

## Road To Zero - The Microgrid Management Game

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# Chapter 1

## Hierarchical Index

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## Chapter 4

# Class Documentation

### 4.1 AssetsManager Class Reference

A class which manages visual and sound assets.

```
#include <AssetsManager.h>
```

#### Public Member Functions

- [AssetsManager](#) (void)  
*Constructor for the [AssetsManager](#) class.*
- void [loadFont](#) (std::string, std::string)  
*Method to load a font and insert it into the font map.*
- void [loadTexture](#) (std::string, std::string)  
*Method to load a texture and insert it into the texture map.*
- void [loadSound](#) (std::string, std::string)  
*Method to load a sound and insert it into the sound map. Automatically creates a corresponding sf::SoundBuffer.*
- void [loadTrack](#) (std::string, std::string)  
*Method to load a track (sf::Music) and insert it into the track map.*
- sf::Font \* [getFont](#) (std::string)  
*Method to get font associated with given font key.*
- sf::Texture \* [getTexture](#) (std::string)  
*Method to get texture associated with given texture key.*
- sf::SoundBuffer \* [getSoundBuffer](#) (std::string)  
*Method to get soundbuffer associated with given sound key.*
- sf::Sound \* [getSound](#) (std::string)  
*Method to get sound associated with given sound key.*
- void [playTrack](#) (void)  
*Method to play the current track.*
- void [pauseTrack](#) (void)  
*Method to pause the current track.*
- void [stopTrack](#) (void)  
*Method to stop the current track.*
- void [nextTrack](#) (void)  
*Method to advance to the next track. Wraps around if the end of the track map is reached.*

- void [previousTrack](#) (void)  
*Method to return to the previous track. Wraps around if the beginning of the track map is reached.*
- std::string [getCurrentTrackKey](#) (void)  
*Method to get track key for current track.*
- sf::SoundSource::Status [getTrackStatus](#) (void)  
*Method to get the status of the current track.*
- void [clear](#) (void)  
*Method to clear all loaded assets.*
- [~AssetsManager](#) (void)  
*Destructor for the [AssetsManager](#) class.*

## Public Attributes

- std::map< std::string, sf::Font \* > [font\\_map](#)  
*A map of pointers to loaded fonts.*
- std::map< std::string, sf::Texture \* > [texture\\_map](#)  
*A map of pointers to loaded textures.*
- std::map< std::string, sf::SoundBuffer \* > [soundbuffer\\_map](#)  
*A map of pointers to sound buffers.*
- std::map< std::string, sf::Sound \* > [sound\\_map](#)  
*A map of pointers to loaded sounds.*
- std::map< std::string, sf::Music \* >::iterator [current\\_track](#)  
*A map iterator which corresponds to the current track (i.e., the track currently being played).*
- std::map< std::string, sf::Music \* > [track\\_map](#)  
*A map of pointers to opened tracks (i.e. sf::Music).*

## Private Member Functions

- void [\\_\\_loadSoundBuffer](#) (std::string, std::string)  
*Helper method to load a soundbuffer and insert it into the soundbuffer map. Should only be called by [loadSound\(\)](#), to create an sf::SoundBuffer corresponding to the loaded sf::Sound.*

### 4.1.1 Detailed Description

A class which manages visual and sound assets.

### 4.1.2 Constructor & Destructor Documentation

#### 4.1.2.1 AssetsManager()

```
AssetsManager::AssetsManager (
    void )
```

Constructor for the [AssetsManager](#) class.

```
142 {
143     //...
144
145     std::cout << "AssetsManager constructed at " << this << std::endl;
146
147     return;
148 } /* AssetsManager() */
```

### 4.1.2.2 ~AssetsManager()

```
AssetsManager::~AssetsManager (
    void )
```

Destructor for the [AssetsManager](#) class.

```
771 {
772     this->clear();
773
774     std::cout << "AssetsManager at " << this << " destroyed" << std::endl;
775
776     return;
777 } /* ~AssetsManager() */
```

## 4.1.3 Member Function Documentation

### 4.1.3.1 \_\_loadSoundBuffer()

```
void AssetsManager::__loadSoundBuffer (
    std::string path_2_sound,
    std::string sound_key ) [private]
```

Helper method to load a soundbuffer and insert it into the soundbuffer map. Should only be called by [loadSound\(\)](#), to create an `sf::SoundBuffer` corresponding to the loaded `sf::Sound`.

#### Parameters

<i>path_2_sound</i>	A path (either relative or absolute) to the sound file.
<i>sound_key</i>	A key associated with the sound (for indexing into the soundbuffer map).

```
79 {
80     // 1. check key, throw error if already in use
81     if (this->soundbuffer_map.count(sound_key) > 0) {
82         std::string error_str = "ERROR AssetsManager::__loadSoundBuffer() sound key ";
83         error_str += sound_key;
84         error_str += " is already in use";
85
86         this->clear();
87
88         #ifdef _WIN32
89             std::cout << error_str << std::endl;
90         #endif /* _WIN32 */
91
92         throw std::runtime_error(error_str);
93     }
94
95
96     // 2. load from file, throw error on fail
97     sf::SoundBuffer* soundbuffer_ptr = new sf::SoundBuffer();
98
99     if (not soundbuffer_ptr->loadFromFile(path_2_sound)) {
100         std::string error_str = "ERROR AssetsManager::__loadSoundBuffer() could not load ";
101         error_str += "soundbuffer at ";
102         error_str += path_2_sound;
103
104         this->clear();
105
106         #ifdef _WIN32
107             std::cout << error_str << std::endl;
108         #endif /* _WIN32 */
109
110         throw std::runtime_error(error_str);
111     }
112
113 }
```

```

114 // 3. insert into soundbuffer map
115 this->soundbuffer_map.insert(
116     std::pair<std::string, sf::SoundBuffer*>(sound_key, soundbuffer_ptr)
117 );
118
119 std::cout << "SoundBuffer " << sound_key << " inserted into soundbuffer map" <<
120     std::endl;
121
122 return;
123 } /* __loadSoundBuffer() */

```

#### 4.1.3.2 clear()

```

void AssetsManager::clear (
    void )

```

Method to clear all loaded assets.

```

678 {
679     // 1. clear fonts
680     std::map<std::string, sf::Font*>::iterator font_iter;
681     for (
682         font_iter = this->font_map.begin();
683         font_iter != this->font_map.end();
684         font_iter++
685     ) {
686         delete font_iter->second;
687
688         std::cout << "Font " << font_iter->first << " deleted from font map" <<
689             std::endl;
690     }
691     this->font_map.clear();
692
693     // 2. clear textures
694     std::map<std::string, sf::Texture*>::iterator texture_iter;
695     for (
696         texture_iter = this->texture_map.begin();
697         texture_iter != this->texture_map.end();
698         texture_iter++
699     ) {
700         delete texture_iter->second;
701
702         std::cout << "Texture " << texture_iter->first << " deleted from texture map" <<
703             std::endl;
704     }
705     this->texture_map.clear();
706
707     // 3. clear sound buffers
708     std::map<std::string, sf::SoundBuffer*>::iterator soundbuffer_iter;
709     for (
710         soundbuffer_iter = this->soundbuffer_map.begin();
711         soundbuffer_iter != this->soundbuffer_map.end();
712         soundbuffer_iter++
713     ) {
714         delete soundbuffer_iter->second;
715
716         std::cout << "SoundBuffer " << soundbuffer_iter->first <<
717             " deleted from soundbuffer map" << std::endl;
718     }
719     this->soundbuffer_map.clear();
720
721     // 4. clear sounds
722     std::map<std::string, sf::Sound*>::iterator sound_iter;
723     for (
724         sound_iter = this->sound_map.begin();
725         sound_iter != this->sound_map.end();
726         sound_iter++
727     ) {
728         sound_iter->second->stop();
729         delete sound_iter->second;
730
731         std::cout << "Sound " << sound_iter->first << " deleted from sound map" <<
732             std::endl;
733     }
734     this->sound_map.clear();
735
736 }
737
738

```

```

739
740 // 5. clear tracks
741 std::map<std::string, sf::Music*>::iterator track_iter;
742 for (
743     track_iter = this->track_map.begin();
744     track_iter != this->track_map.end();
745     track_iter++)
746 {
747     track_iter->second->stop();
748     delete track_iter->second;
749
750     std::cout << "Track " << track_iter->first << " deleted from track map" <<
751         std::endl;
752 }
753 this->track_map.clear();
754
755 return;
756 } /* clear() */

```

#### 4.1.3.3 getCurrentTrackKey()

```

std::string AssetsManager::getCurrentTrackKey (
    void )

```

Method to get track key for current track.

##### Returns

The track key for the current track.

```

642 {
643     return this->current_track->first;
644 } /* getCurrentTrackKey() */

```

#### 4.1.3.4 getFont()

```

sf::Font * AssetsManager::getFont (
    std::string font_key )

```

Method to get font associated with given font key.

##### Parameters

<i>font_key</i>	A key associated with the font (for indexing into the font map).
-----------------	--

##### Returns

A pointer to the corresponding font.

```

383 {
384     // 1. check key, throw error if not found
385     if (this->font_map.count(font_key) <= 0) {
386         std::string error_str = "ERROR AssetsManager::getFont() font key ";
387         error_str += font_key;
388         error_str += " is not contained in font map";
389
390         this->clear();
391
392         #ifdef _WIN32

```

```

393         std::cout << error_str << std::endl;
394     #endif /* _WIN32 */
395
396     throw std::runtime_error(error_str);
397 }
398
399 return this->font_map[font_key];
400 } /* getFont() */

```

#### 4.1.3.5 getSound()

```

sf::Sound * AssetsManager::getSound (
    std::string sound_key )

```

Method to get sound associated with given sound key.

##### Parameters

<i>sound_key</i>	A key associated with the sound (for indexing into the sound map).
------------------	--

##### Returns

A pointer to the corresponding sound.

```

493 {
494     // 1. check key, throw error if not found
495     if (this->sound_map.count(sound_key) <= 0) {
496         std::string error_str = "ERROR AssetsManager::getSound() sound key ";
497         error_str += sound_key;
498         error_str += " is not contained in sound map";
499
500         this->clear();
501
502         #ifdef _WIN32
503             std::cout << error_str << std::endl;
504         #endif /* _WIN32 */
505
506         throw std::runtime_error(error_str);
507     }
508
509     return this->sound_map[sound_key];
510 } /* getSound() */

```

#### 4.1.3.6 getSoundBuffer()

```

sf::SoundBuffer * AssetsManager::getSoundBuffer (
    std::string sound_key )

```

Method to get soundbuffer associated with given sound key.

##### Parameters

<i>sound_key</i>	A key associated with the soundbuffer (for indexing into the soundbuffer map).
------------------	--

**Returns**

A pointer to the corresponding soundbuffer.

```

457 {
458     // 1. check key, throw error if not found
459     if (this->soundbuffer_map.count(sound_key) <= 0) {
460         std::string error_str = "ERROR AssetsManager::getSoundBuffer() sound key ";
461         error_str += sound_key;
462         error_str += " is not contained in soundbuffer map";
463
464         this->clear();
465
466         #ifdef _WIN32
467             std::cout << error_str << std::endl;
468         #endif /* _WIN32 */
469
470         throw std::runtime_error(error_str);
471     }
472
473     return this->soundbuffer_map[sound_key];
474 } /* getSoundBuffer() */

```

**4.1.3.7 getTexture()**

```

sf::Texture * AssetsManager::getTexture (
    std::string texture_key )

```

Method to get texture associated with given texture key.

**Parameters**

<i>texture_key</i>	A key associated with the texture (for indexing into the texture map).
--------------------	--

**Returns**

A pointer to the corresponding texture.

```

420 {
421     // 1. check key, throw error if not found
422     if (this->texture_map.count(texture_key) <= 0) {
423         std::string error_str = "ERROR AssetsManager::getTexture() texture key ";
424         error_str += texture_key;
425         error_str += " is not contained in texture map";
426
427         this->clear();
428
429         #ifdef _WIN32
430             std::cout << error_str << std::endl;
431         #endif /* _WIN32 */
432
433         throw std::runtime_error(error_str);
434     }
435
436     return this->texture_map[texture_key];
437 } /* getTexture() */

```

**4.1.3.8 getTrackStatus()**

```

sf::SoundSource::Status AssetsManager::getTrackStatus (
    void )

```

Method to get the status of the current track.

**Returns**

The status of the current track.

```
661 {
662     return this->current_track->second->getStatus();
663 } /* getTrackStatus */
```

**4.1.3.9 loadFont()**

```
void AssetsManager::loadFont (
    std::string path_2_font,
    std::string font_key )
```

Method to load a font and insert it into the font map.

**Parameters**

<i>path_2_font</i>	A path (either relative or absolute) to the font file.
<i>font_key</i>	A key associated with the font (for indexing into the font map).

```
167 {
168     // 1. check key, throw error if already in use
169     if (this->font_map.count(font_key) > 0) {
170         std::string error_str = "ERROR AssetsManager::loadFont() font key ";
171         error_str += font_key;
172         error_str += " is already in use";
173
174         this->clear();
175
176         #ifdef _WIN32
177             std::cout << error_str << std::endl;
178         #endif /* _WIN32 */
179
180         throw std::runtime_error(error_str);
181     }
182
183
184     // 2. load from file, throw error on fail
185     sf::Font* font_ptr = new sf::Font();
186
187     if (not font_ptr->loadFromFile(path_2_font)) {
188         std::string error_str = "ERROR AssetsManager::loadFont() could not load ";
189         error_str += "font at ";
190         error_str += path_2_font;
191
192         this->clear();
193
194         #ifdef _WIN32
195             std::cout << error_str << std::endl;
196         #endif /* _WIN32 */
197
198         throw std::runtime_error(error_str);
199     }
200
201
202     // 3. insert into font map
203     this->font_map.insert(std::pair<std::string, sf::Font*>(font_key, font_ptr));
204
205     std::cout << "Font " << font_key << " inserted into font map" << std::endl;
206
207     return;
208 } /* loadFont() */
```

**4.1.3.10 loadSound()**

```
void AssetsManager::loadSound (
```



```
std::string path_2_sound,
std::string sound_key )
```

Method to load a sound and insert it into the sound map. Automatically creates a corresponding sf::SoundBuffer.

#### Parameters

<i>path_2_sound</i>	A path (either relative or absolute) to the sound file.
<i>sound_key</i>	A key associated with the sound (for indexing into the sound map).

```
291 {
292     // 1. create an associated sf::SoundBuffer
293     this->__loadSoundBuffer(path_2_sound, sound_key);
294
295     // 2. associate sf::Sound with sf::SoundBuffer
296     sf::Sound* sound_ptr = new sf::Sound();
297     sound_ptr->setBuffer(*(this->soundbuffer_map[sound_key]));
298
299     // 3. insert into sound map
300     this->sound_map.insert(std::pair<std::string, sf::Sound*>(sound_key, sound_ptr));
301
302     std::cout << "Sound " << sound_key << " inserted into sound map" << std::endl;
303
304     return;
305 } /* loadSound() */
```

#### 4.1.3.11 loadTexture()

```
void AssetsManager::loadTexture (
    std::string path_2_texture,
    std::string texture_key )
```

Method to load a texture and insert it into the texture map.

#### Parameters

<i>path_2_texture</i>	A path (either relative or absolute) to the texture file.
<i>texture_key</i>	A key associated with the texture (for indexing into the texture map).

```
228 {
229     // 1. check key, throw error if already in use
230     if (this->texture_map.count(texture_key) > 0) {
231         std::string error_str = "ERROR AssetsManager::loadTexture() texture key ";
232         error_str += texture_key;
233         error_str += " is already in use";
234
235         this->clear();
236
237         #ifdef _WIN32
238             std::cout << error_str << std::endl;
239         #endif /* _WIN32 */
240
241         throw std::runtime_error(error_str);
242     }
243
244     // 2. load from file, throw error on fail
245     sf::Texture* texture_ptr = new sf::Texture();
246
247     if (not texture_ptr->loadFromFile(path_2_texture)) {
248         std::string error_str = "ERROR AssetsManager::loadTexture() could not load ";
249         error_str += "texture at ";
250         error_str += path_2_texture;
251
252         this->clear();
253
254         #ifdef _WIN32
255             std::cout << error_str << std::endl;
256         #endif
```

```

257         #endif /* _WIN32 */
258
259         throw std::runtime_error(error_str);
260     }
261
262
263     // 3. insert into texture map
264     this->texture_map.insert(
265         std::pair<std::string, sf::Texture*>(texture_key, texture_ptr)
266     );
267
268     std::cout << "Texture " << texture_key << " inserted into texture map" << std::endl;
269
270     return;
271 } /* loadTexture() */

```

#### 4.1.3.12 loadTrack()

```

void AssetsManager::loadTrack (
    std::string path_2_track,
    std::string track_key )

```

Method to load a track (sf::Music) and insert it into the track map.

##### Parameters

<i>path_2_track</i>	A path (either relative or absolute) to the track file.
<i>track_key</i>	A key associated with the track (for indexing into the track map).

```

324 {
325     // 1. check key, throw error if already in use
326     if (this->track_map.count(track_key) > 0) {
327         std::string error_str = "ERROR AssetsManager::loadTrack() track key ";
328         error_str += track_key;
329         error_str += " is already in use";
330
331         this->clear();
332
333         #ifdef _WIN32
334             std::cout << error_str << std::endl;
335         #endif /* _WIN32 */
336
337         throw std::runtime_error(error_str);
338     }
339
340     // 2. open from file, throw error on fail
341     sf::Music* track_ptr = new sf::Music();
342
343     if (not track_ptr->openFromFile(path_2_track)) {
344         std::string error_str = "ERROR AssetsManager::loadTrack() could not open ";
345         error_str += "track at ";
346         error_str += path_2_track;
347
348         this->clear();
349
350         #ifdef _WIN32
351             std::cout << error_str << std::endl;
352         #endif /* _WIN32 */
353
354         throw std::runtime_error(error_str);
355     }
356
357     // 3. insert into track map
358     this->track_map.insert(std::pair<std::string, sf::Music*>(track_key, track_ptr));
359     this->current_track = this->track_map.begin();
360
361     std::cout << "Track " << track_key << " inserted into track map" << std::endl;
362
363     return;
364 } /* loadTrack() */

```

#### 4.1.3.13 nextTrack()

```
void AssetsManager::nextTrack (
    void )
```

Method to advance to the next track. Wraps around if the end of the track map is reached.

```
583 {
584     // 1. stop current track
585     this->stopTrack();
586
587     // 2. increment current track
588     this->current_track++;
589
590     // 3. handle wrap around
591     if (this->current_track == this->track_map.end()) {
592         this->current_track = this->track_map.begin();
593     }
594
595     return;
596 } /* nextTrack() */
```

#### 4.1.3.14 pauseTrack()

```
void AssetsManager::pauseTrack (
    void )
```

Method to pause the current track.

```
544 {
545     this->current_track->second->pause();
546
547     return;
548 } /* pauseTrack() */
```

#### 4.1.3.15 playTrack()

```
void AssetsManager::playTrack (
    void )
```

Method to play the current track.

```
525 {
526     this->current_track->second->play();
527
528     return;
529 } /* playTrack() */
```

#### 4.1.3.16 previousTrack()

```
void AssetsManager::previousTrack (
    void )
```

Method to return to the previous track. Wraps around if the beginning of the track map is reached.

```
612 {
613     // 1. stop current track
614     this->stopTrack();
615
616     // 2. handle wrap around
617     if (this->current_track == this->track_map.begin()) {
618         this->current_track = this->track_map.end();
619     }
620
621     // 3. decrement current track
622     this->current_track--;
623
624     return;
625 } /* previousTrack() */
```

#### 4.1.3.17 stopTrack()

```
void AssetsManager::stopTrack (
    void )
```

Method to stop the current track.

```
563 {
564     this->current_track->second->stop();
565
566     return;
567 } /* stopTrack() */
```

### 4.1.4 Member Data Documentation

#### 4.1.4.1 current\_track

```
std::map<std::string, sf::Music*>::iterator AssetsManager::current_track
```

A map iterator which corresponds to the current track (i.e., the track currently being played).

#### 4.1.4.2 font\_map

```
std::map<std::string, sf::Font*> AssetsManager::font_map
```

A map of pointers to loaded fonts.

#### 4.1.4.3 sound\_map

```
std::map<std::string, sf::Sound*> AssetsManager::sound_map
```

A map of pointers to loaded sounds.

#### 4.1.4.4 soundbuffer\_map

```
std::map<std::string, sf::SoundBuffer*> AssetsManager::soundbuffer_map
```

A map of pointers to sound buffers.

#### 4.1.4.5 texture\_map

```
std::map<std::string, sf::Texture*> AssetsManager::texture_map
```

A map of pointers to loaded textures.

#### 4.1.4.6 track\_map

```
std::map<std::string, sf::Music*> AssetsManager::track_map
```

A map of pointers to opened tracks (i.e. sf::Music).

The documentation for this class was generated from the following files:

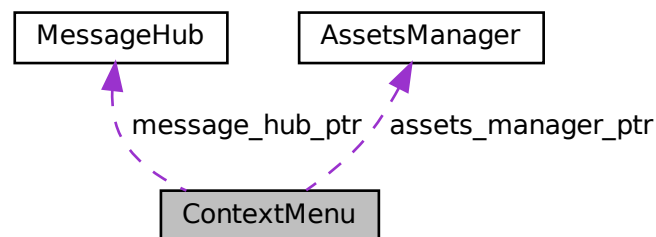
- header/ESC\_core/[AssetsManager.h](#)
- source/ESC\_core/[AssetsManager.cpp](#)

## 4.2 ContextMenu Class Reference

A class which defines a context menu for the game.

```
#include <ContextMenu.h>
```

Collaboration diagram for ContextMenu:



### Public Member Functions

- [ContextMenu](#) (sf::Event \*, sf::RenderWindow \*, [AssetsManager](#) \*, [MessageHub](#) \*)  
*Constructor for the [ContextMenu](#) class.*
- void [processEvent](#) (void)  
*Method to processEvent [ContextMenu](#). To be called once per event.*
- void [processMessage](#) (void)  
*Method to processMessage [ContextMenu](#). To be called once per message.*
- void [draw](#) (void)  
*Method to draw the hex tile to the render window. To be called once per frame.*
- [~ContextMenu](#) (void)  
*Destructor for the [ContextMenu](#) class.*

## Public Attributes

- [ConsoleState console\\_state](#)  
*The current state of the console screen.*
- bool [console\\_string\\_changed](#)  
*Boolean which indicates if console string just changed.*
- bool [game\\_menu\\_up](#)  
*Indicates whether or not the game menu is up.*
- size\_t [console\\_substring\\_idx](#)  
*The current final index of the console string draw.*
- unsigned long long int [frame](#)  
*The current frame of this object.*
- double [position\\_x](#)  
*The position of the object.*
- double [position\\_y](#)  
*The position of the object.*
- std::string [console\\_string](#)  
*The string to be printed to the console screen.*
- sf::RectangleShape [menu\\_frame](#)  
*The frame of the context menu.*
- sf::RectangleShape [visual\\_screen](#)  
*The context menu screen for visuals.*
- sf::ConvexShape [visual\\_screen\\_frame\\_top](#)  
*The top framing of the visual screen.*
- sf::ConvexShape [visual\\_screen\\_frame\\_left](#)  
*The left framing of the visual screen.*
- sf::ConvexShape [visual\\_screen\\_frame\\_bottom](#)  
*The bottom framing of the visual screen.*
- sf::ConvexShape [visual\\_screen\\_frame\\_right](#)  
*The right framing of the visual screen.*
- sf::RectangleShape [console\\_screen](#)  
*The context menu console screen (for animated text output).*
- sf::ConvexShape [console\\_screen\\_frame\\_top](#)  
*The top framing of the console screen.*
- sf::ConvexShape [console\\_screen\\_frame\\_left](#)  
*The left framing of the console screen.*
- sf::ConvexShape [console\\_screen\\_frame\\_bottom](#)  
*The bottom framing of the console screen.*
- sf::ConvexShape [console\\_screen\\_frame\\_right](#)  
*The right framing of the console screen.*

## Private Member Functions

- void [\\_\\_setUpMenuFrame](#) (void)  
*Helper method to set up context menu frame (drawable).*
- void [\\_\\_setUpVisualScreen](#) (void)  
*Helper method to set up context menu visual screen (drawable).*
- void [\\_\\_setUpVisualScreenFrame](#) (void)  
*Helper method to set up framing for context menu visual screen (drawable).*
- void [\\_\\_drawVisualScreenFrame](#) (void)

- Helper method to draw visual screen frame.*
- void [\\_\\_setUpConsoleScreen](#) (void)
- Helper method to set up context menu console screen (drawable).*
- void [\\_\\_setUpConsoleScreenFrame](#) (void)
- Helper method to set up framing for context menu console screen (drawable).*
- void [\\_\\_drawConsoleScreenFrame](#) (void)
- Helper method to draw console screen frame.*
- void [\\_\\_setConsoleState](#) (ConsoleState)
- Helper method to set state of console screen and update string if necessary.*
- void [\\_\\_setConsoleString](#) (void)
- Helper method to set console string depending on console state.*
- void [\\_\\_drawConsoleText](#) (void)
- Helper method to draw animated text to context menu console screen.*
- void [\\_\\_handleKeyPressEvents](#) (void)
- Helper method to handle key press events.*
- void [\\_\\_handleMouseButtonEvents](#) (void)
- Helper method to handle mouse button events.*
- void [\\_\\_sendQuitGameMessage](#) (void)
- Helper method to format and send a quit game message.*
- void [\\_\\_sendRestartGameMessage](#) (void)
- Helper method to format and send a restart game message.*

## Private Attributes

- sf::Event \* [event\\_ptr](#)
- A pointer to the event class.*
- sf::RenderWindow \* [render\\_window\\_ptr](#)
- A pointer to the render window.*
- [AssetsManager](#) \* [assets\\_manager\\_ptr](#)
- A pointer to the assets manager.*
- [MessageHub](#) \* [message\\_hub\\_ptr](#)
- A pointer to the message hub.*

### 4.2.1 Detailed Description

A class which defines a context menu for the game.

### 4.2.2 Constructor & Destructor Documentation

#### 4.2.2.1 ContextMenu()

```
ContextMenu::ContextMenu (
    sf::Event * event_ptr,
    sf::RenderWindow * render_window_ptr,
    AssetsManager * assets_manager_ptr,
    MessageHub * message_hub_ptr )
```

Constructor for the [ContextMenu](#) class.

## Parameters

<i>event_ptr</i>	Pointer to the event class.
<i>render_window_ptr</i>	Pointer to the render window.
<i>assets_manager_ptr</i>	Pointer to the assets manager.
<i>message_hub_ptr</i>	Pointer to the message hub.

```

849 {
850     // 1. set attributes
851
852     // 1.1. private
853     this->event_ptr = event_ptr;
854     this->render_window_ptr = render_window_ptr;
855
856     this->assets_manager_ptr = assets_manager_ptr;
857     this->message_hub_ptr = message_hub_ptr;
858
859     // 1.2. public
860     this->console_state = ConsoleState :: NONE_STATE;
861     this->__setConsoleState(ConsoleState :: READY);
862
863     this->console_string_changed = true;
864     this->game_menu_up = false;
865
866     this->frame = 0;
867
868     this->position_x = GAME_WIDTH;
869     this->position_y = 0;
870
871     // 2. set up and position drawable attributes
872     this->__setUpMenuFrame();
873     this->__setUpVisualScreen();
874     this->__setUpVisualScreenFrame();
875     this->__setUpConsoleScreen();
876     this->__setUpConsoleScreenFrame();
877
878     std::cout << "ContextMenu constructed at " << this << std::endl;
879
880     return;
881 } /* ContextMenu() */

```

## 4.2.2.2 ~ContextMenu()

```

ContextMenu::~ContextMenu (
    void )

```

Destructor for the [ContextMenu](#) class.

```

1031 {
1032     std::cout << "ContextMenu at " << this << " destroyed" << std::endl;
1033
1034     return;
1035 } /* ~ContextMenu() */

```

## 4.2.3 Member Function Documentation

## 4.2.3.1 \_\_drawConsoleScreenFrame()

```

void ContextMenu::__drawConsoleScreenFrame (
    void ) [private]

```

Helper method to draw console screen frame.



```

467 {
468     this->render_window_ptr->draw(this->console_screen_frame_top);
469     this->render_window_ptr->draw(this->console_screen_frame_left);
470     this->render_window_ptr->draw(this->console_screen_frame_bottom);
471     this->render_window_ptr->draw(this->console_screen_frame_right);
472
473     return;
474 } /* __drawContextScreenFrame() */

```

#### 4.2.3.2 \_\_drawConsoleText()

```

void ContextMenu::__drawConsoleText (
    void ) [private]

```

Helper method to draw animated text to context menu console screen.

```

590 {
591     // 1. set up console text (drawable)
592     sf::Text console_text;
593
594     if (this->console_string_changed) {
595         this->assets_manager_ptr->getSound("console string print")->play();
596
597         console_text.setString(this->console_string.substr(0, this->console_substring_idx));
598
599         this->console_substring_idx++;
600
601         while (
602             (this->console_string.substr(0, this->console_substring_idx).back() == ' ') or
603             (this->console_string.substr(0, this->console_substring_idx).back() == '\n')
604         ) {
605             this->console_substring_idx++;
606
607             if (this->console_substring_idx >= this->console_string.size()) {
608                 break;
609             }
610         }
611
612         if (this->console_substring_idx >= this->console_string.size()) {
613             this->console_string_changed = false;
614         }
615     }
616
617     else {
618         console_text.setString(this->console_string);
619     }
620
621     console_text.setFont(*(this->assets_manager_ptr->getFont("Glass_TTY_VT220")));
622     console_text.setCharacterSize(16);
623     console_text.setFillColor(MONOCROME_TEXT_GREEN);
624
625     console_text.setPosition(
626         this->position_x - 50 - 300 + 16,
627         this->position_y + GAME_HEIGHT - 50 - 340 + 16
628     );
629
630
631     // 2. draw console text
632     this->render_window_ptr->draw(console_text);
633
634
635     // 3. assemble and draw blinking console cursor
636     if ((this->frame % FRAMES_PER_SECOND) > FRAMES_PER_SECOND / 2) {
637         sf::RectangleShape console_cursor(sf::Vector2f(10, 16));
638
639         console_cursor.setFillColor(MONOCROME_TEXT_GREEN);
640
641         console_cursor.setPosition(
642             console_text.getPosition().x,
643             console_text.getPosition().y + console_text.getLocalBounds().height + 10
644         );
645
646         this->render_window_ptr->draw(console_cursor);
647     }
648
649     // 4. updating frame count if console is in menu state
650     if (this->console_state == ConsoleState::MENU) {
651         std::string frame_count_string = "FRAME: ";
652         frame_count_string += std::to_string(this->frame);

```

```

653
654     sf::Text frame_count_text(
655         frame_count_string,
656         *(this->assets_manager_ptr->getFont("Glass_TTY_VT220")),
657         16
658     );
659
660     frame_count_text.setFillColor(MONOCROME_TEXT_GREEN);
661
662     frame_count_text.setPosition(
663         console_text.getPosition().x,
664         console_text.getPosition().y + console_text.getLocalBounds().height - 10
665     );
666
667     this->render_window_ptr->draw(frame_count_text);
668 }
669
670 return;
671 } /* __drawConsoleText() */

```

#### 4.2.3.3 \_\_drawVisualScreenFrame()

```

void ContextMenu::__drawVisualScreenFrame (
    void ) [private]

```

Helper method to draw visual screen frame.

```

242 {
243     this->render_window_ptr->draw(this->visual_screen_frame_top);
244     this->render_window_ptr->draw(this->visual_screen_frame_left);
245     this->render_window_ptr->draw(this->visual_screen_frame_bottom);
246     this->render_window_ptr->draw(this->visual_screen_frame_right);
247
248     return;
249 } /* __drawVisualScreenFrame() */

```

#### 4.2.3.4 \_\_handleKeyPressEvents()

```

void ContextMenu::__handleKeyPressEvents (
    void ) [private]

```

Helper method to handle key press events.

```

686 {
687     switch (this->event_ptr->key.code) {
688         case (sf::Keyboard::Escape): {
689             if (this->console_state == ConsoleState :: MENU) {
690                 this->__setConsoleState(ConsoleState :: READY);
691             }
692
693             else {
694                 this->__setConsoleState(ConsoleState :: MENU);
695             }
696
697             break;
698         }
699
700         case (sf::Keyboard::Q): {
701             if (this->console_state == ConsoleState :: MENU) {
702                 this->__sendQuitGameMessage();
703             }
704         }
705
706         case (sf::Keyboard::R): {
707             if (this->console_state == ConsoleState :: MENU) {
708                 this->__sendRestartGameMessage();
709             }
710         }
711     }
712 }
713

```

```

714
715         default: {
716             // do nothing!
717
718             break;
719         }
720     }
721
722     return;
723 } /* __handleKeyPressEvents() */

```

#### 4.2.3.5 \_\_handleMouseButtonEvents()

```

void ContextMenu::__handleMouseButtonEvents (
    void ) [private]

```

Helper method to handle mouse button events.

```

738 {
739     switch (this->event_ptr->mouseButton.button) {
740         case (sf::Mouse::Left): {
741             //...
742
743             break;
744         }
745
746         case (sf::Mouse::Right): {
747             //...
748
749             break;
750         }
751     }
752
753     default: {
754         // do nothing!
755
756         break;
757     }
758 }
759
760
761 return;
762 } /* __handleMouseButtonEvents() */

```

#### 4.2.3.6 \_\_sendQuitGameMessage()

```

void ContextMenu::__sendQuitGameMessage (
    void ) [private]

```

Helper method to format and send a quit game message.

```

777 {
778     Message quit_game_message;
779
780     quit_game_message.channel = GAME_CHANNEL;
781     quit_game_message.subject = "quit game";
782
783     this->message_hub_ptr->sendMessage(quit_game_message);
784
785     std::cout << "Quit game message sent by " << this << std::endl;
786     return;
787 } /* __sendQuitGameMessage() */

```

#### 4.2.3.7 \_\_sendRestartGameMessage()

```
void ContextMenu::__sendRestartGameMessage (
    void ) [private]
```

Helper method to format and send a restart game message.

```
802 {
803     Message restart_game_message;
804
805     restart_game_message.channel = GAME_CHANNEL;
806     restart_game_message.subject = "restart game";
807
808     this->message_hub_ptr->sendMessage(restart_game_message);
809
810     std::cout << "Restart game message sent by " << this << std::endl;
811     return;
812 } /* __sendRestartGameMessage() */
```

#### 4.2.3.8 \_\_setConsoleState()

```
void ContextMenu::__setConsoleState (
    ConsoleState console_state ) [private]
```

Helper method to set state of console screen and update string if necessary.

##### Parameters

<i>console_state</i>	The state (ConsoleState) to set the console to.
----------------------	---

```
491 {
492     // 1. if no change, do nothing
493     if (this->console_state == console_state) {
494         return;
495     }
496
497     // 2. update console state, set console string accordingly
498     this->console_state = console_state;
499     this->__setConsoleString();
500
501     return;
502 } /* __setConsoleState() */
```

#### 4.2.3.9 \_\_setConsoleString()

```
void ContextMenu::__setConsoleString (
    void ) [private]
```

Helper method to set console string depending on console state.

```
517 {
518     this->console_string_changed = true;
519     this->console_substring_idx = 0;
520
521     this->console_string.clear();
522
523     switch (this->console_state) {
524     case (ConsoleState :: MENU): {
525         // 32 char x 17 line console "-----\n";
526         this->console_string = "          **** MENU ****          \n";
527         this->console_string += "          \n";
528         this->console_string += "[R]:  RESTART          \n";
529         this->console_string += "          \n";
530         this->console_string += "[TAB]: TOGGLE RESOURCE OVERLAY \n";
531     }
```

```

531         this->console_string += "[T]:  TUTORIAL          \n";
532         this->console_string += "                  \n";
533         this->console_string += "                  \n";
534         this->console_string += "                  \n";
535         this->console_string += "                  \n";
536         this->console_string += "                  \n";
537         this->console_string += "                  \n";
538         this->console_string += "                  \n";
539         this->console_string += "[Q]:    QUIT          \n";
540         this->console_string += "[ESC]:  CLOSE MENU    \n";
541         this->console_string += "                  \n";
542
543         break;
544     }
545
546     case (ConsoleState :: TILE): {
547         // take console string from tile state message
548
549         break;
550     }
551
552
553
554     default: {
555         //          32 char x 17 line console "-----\n";
556         this->console_string = "    **** RTZ 64 CONTEXT V12 **** \n";
557         this->console_string += "                  \n";
558         this->console_string += "64K RAM SYSTEM  38911 BYTES FREE\n";
559         this->console_string += "                  \n";
560         this->console_string += "[TAB]:  TOGGLE RESOURCE OVERLAY \n";
561         this->console_string += "                  \n";
562         this->console_string += "[ESC]:           MENU          \n";
563         this->console_string += "[LEFT CLICK]:  TILE INFO/OPTIONS\n";
564         this->console_string += "[RIGHT CLICK]: CLEAR SELECTION  \n";
565         this->console_string += "                  \n";
566         this->console_string += "[ENTER]:  END TURN            \n";
567         this->console_string += "                  \n";
568         this->console_string += "READY.                        ";
569
570         break;
571     }
572 }
573
574 return;
575 } /* __setConsoleString() */

```

#### 4.2.3.10 \_\_setUpConsoleScreen()

```

void ContextMenu::__setUpConsoleScreen (
    void ) [private]

```

Helper method to set up context menu console screen (drawable).

```

264 {
265     this->console_screen.setSize(sf::Vector2f(300, 340));
266     this->console_screen.setOrigin(300, 340);
267     this->console_screen.setPosition(
268         this->position_x - 50,
269         this->position_y + GAME_HEIGHT - 50
270     );
271     this->console_screen.setFillColor(MONOCHROME_SCREEN_BACKGROUND);
272
273     return;
274 } /* __setUpConsoleScreen() */

```

#### 4.2.3.11 \_\_setUpConsoleScreenFrame()

```

void ContextMenu::__setUpConsoleScreenFrame (
    void ) [private]

```

Helper method to set up framing for context menu console screen (drawable).

```

289 {
290     int n_points = 4;
291
292     // 1. top framing
293     this->console_screen_frame_top.setPointCount(n_points);
294
295     this->console_screen_frame_top.setPoint(
296         0,
297         sf::Vector2f(
298             this->position_x - 50,
299             this->position_y + GAME_HEIGHT - 50 - 340
300         )
301     );
302     this->console_screen_frame_top.setPoint(
303         1,
304         sf::Vector2f(
305             this->position_x - 50 + 16,
306             this->position_y + GAME_HEIGHT - 50 - 340 - 16
307         )
308     );
309     this->console_screen_frame_top.setPoint(
310         2,
311         sf::Vector2f(
312             this->position_x - 350 - 16,
313             this->position_y + GAME_HEIGHT - 50 - 340 - 16
314         )
315     );
316     this->console_screen_frame_top.setPoint(
317         3,
318         sf::Vector2f(
319             this->position_x - 350,
320             this->position_y + GAME_HEIGHT - 50 - 340
321         )
322     );
323
324     this->console_screen_frame_top.setFill_color(VISUAL_SCREEN_FRAME_GREY);
325
326     this->console_screen_frame_top.setOutlineThickness(2);
327     this->console_screen_frame_top.setOutlineColor(sf::Color(0, 0, 0, 255));
328
329     this->console_screen_frame_top.move(0, -2);
330
331
332     // 2. left framing
333     this->console_screen_frame_left.setPointCount(n_points);
334
335     this->console_screen_frame_left.setPoint(
336         0,
337         sf::Vector2f(
338             this->position_x - 350,
339             this->position_y + GAME_HEIGHT - 50 - 340
340         )
341     );
342     this->console_screen_frame_left.setPoint(
343         1,
344         sf::Vector2f(
345             this->position_x - 350 - 16,
346             this->position_y + GAME_HEIGHT - 50 - 340 - 16
347         )
348     );
349     this->console_screen_frame_left.setPoint(
350         2,
351         sf::Vector2f(
352             this->position_x - 350 - 16,
353             this->position_y + GAME_HEIGHT - 50 + 16
354         )
355     );
356     this->console_screen_frame_left.setPoint(
357         3,
358         sf::Vector2f(
359             this->position_x - 350,
360             this->position_y + GAME_HEIGHT - 50
361         )
362     );
363
364     this->console_screen_frame_left.setFill_color(VISUAL_SCREEN_FRAME_GREY);
365
366     this->console_screen_frame_left.setOutlineThickness(2);
367     this->console_screen_frame_left.setOutlineColor(sf::Color(0, 0, 0, 255));
368
369     this->console_screen_frame_left.move(-2, 0);
370
371
372     // 3. bottom framing
373     this->console_screen_frame_bottom.setPointCount(n_points);
374

```

```

375     this->console_screen_frame_bottom.setPoint(
376         0,
377         sf::Vector2f(
378             this->position_x - 350,
379             this->position_y + GAME_HEIGHT - 50
380         )
381     );
382     this->console_screen_frame_bottom.setPoint(
383         1,
384         sf::Vector2f(
385             this->position_x - 350 - 16,
386             this->position_y + GAME_HEIGHT - 50 + 16
387         )
388     );
389     this->console_screen_frame_bottom.setPoint(
390         2,
391         sf::Vector2f(
392             this->position_x - 50 + 16,
393             this->position_y + GAME_HEIGHT - 50 + 16
394         )
395     );
396     this->console_screen_frame_bottom.setPoint(
397         3,
398         sf::Vector2f(
399             this->position_x - 50,
400             this->position_y + GAME_HEIGHT - 50
401         )
402     );
403
404     this->console_screen_frame_bottom.setFillColor(VISUAL_SCREEN_FRAME_GREY);
405
406     this->console_screen_frame_bottom.setOutlineThickness(2);
407     this->console_screen_frame_bottom.setOutlineColor(sf::Color(0, 0, 0, 255));
408
409     this->console_screen_frame_bottom.move(0, 2);
410
411     // 4. right framing
412     this->console_screen_frame_right.setPointCount(n_points);
413
414     this->console_screen_frame_right.setPoint(
415         0,
416         sf::Vector2f(
417             this->position_x - 50,
418             this->position_y + GAME_HEIGHT - 50
419         )
420     );
421
422     this->console_screen_frame_right.setPoint(
423         1,
424         sf::Vector2f(
425             this->position_x - 50 + 16,
426             this->position_y + GAME_HEIGHT - 50 + 16
427         )
428     );
429     this->console_screen_frame_right.setPoint(
430         2,
431         sf::Vector2f(
432             this->position_x - 50 + 16,
433             this->position_y + GAME_HEIGHT - 50 - 340 - 16
434         )
435     );
436     this->console_screen_frame_right.setPoint(
437         3,
438         sf::Vector2f(
439             this->position_x - 50,
440             this->position_y + GAME_HEIGHT - 50 - 340
441         )
442     );
443
444     this->console_screen_frame_right.setFillColor(VISUAL_SCREEN_FRAME_GREY);
445
446     this->console_screen_frame_right.setOutlineThickness(2);
447     this->console_screen_frame_right.setOutlineColor(sf::Color(0, 0, 0, 255));
448
449     this->console_screen_frame_right.move(2, 0);
450
451     return;
452 } /* __setUpConsoleScreenFrame() */

```

#### 4.2.3.12 \_\_setUpMenuFrame()

```
void ContextMenu::__setUpMenuFrame (
```

```
void ) [private]
```

Helper method to set up context menu frame (drawable).

```
68 {
69     this->menu_frame.setSize(sf::Vector2f(400, GAME_HEIGHT));
70     this->menu_frame.setOrigin(400, 0);
71     this->menu_frame.setPosition(this->position_x, this->position_y);
72     this->menu_frame.setFillColor(MENU_FRAME_GREY);
73
74     return;
75 } /* __setUpMenuFrame() */
```

#### 4.2.3.13 \_\_setUpVisualScreen()

```
void ContextMenu::__setUpVisualScreen (
    void ) [private]
```

Helper method to set up context menu visual screen (drawable).

```
90 {
91     this->visual_screen.setSize(sf::Vector2f(300, 300));
92     this->visual_screen.setOrigin(300, 0);
93     this->visual_screen.setPosition(this->position_x - 50, this->position_y + 50);
94     this->visual_screen.setFillColor(MONochrome_SCREEN_BACKGROUND);
95
96     return;
97 } /* __setUpVisualScreen() */
```

#### 4.2.3.14 \_\_setUpVisualScreenFrame()

```
void ContextMenu::__setUpVisualScreenFrame (
    void ) [private]
```

Helper method to set up framing for context menu visual screen (drawable).

```
112 {
113     int n_points = 4;
114
115     // 1. top framing
116     this->visual_screen_frame_top.setPointCount(n_points);
117
118     this->visual_screen_frame_top.setPoint(
119         0,
120         sf::Vector2f(this->position_x - 50, this->position_y + 50)
121     );
122     this->visual_screen_frame_top.setPoint(
123         1,
124         sf::Vector2f(this->position_x - 50 + 16, this->position_y + 50 - 16)
125     );
126     this->visual_screen_frame_top.setPoint(
127         2,
128         sf::Vector2f(this->position_x - 350 - 16, this->position_y + 50 - 16)
129     );
130     this->visual_screen_frame_top.setPoint(
131         3,
132         sf::Vector2f(this->position_x - 350, this->position_y + 50)
133     );
134
135     this->visual_screen_frame_top.setFillColor(VISUAL_SCREEN_FRAME_GREY);
136
137     this->visual_screen_frame_top.setOutlineThickness(2);
138     this->visual_screen_frame_top.setOutlineColor(sf::Color(0, 0, 0, 255));
139
140     this->visual_screen_frame_top.move(0, -2);
141
142
143     // 2. left framing
144     this->visual_screen_frame_left.setPointCount(n_points);
145
146     this->visual_screen_frame_left.setPoint(
```



```

147         0,
148         sf::Vector2f(this->position_x - 350, this->position_y + 50)
149     );
150     this->visual_screen_frame_left.setPoint(
151         1,
152         sf::Vector2f(this->position_x - 350 - 16, this->position_y + 50 - 16)
153     );
154     this->visual_screen_frame_left.setPoint(
155         2,
156         sf::Vector2f(this->position_x - 350 - 16, this->position_y + 350 + 16)
157     );
158     this->visual_screen_frame_left.setPoint(
159         3,
160         sf::Vector2f(this->position_x - 350, this->position_y + 350)
161     );
162
163     this->visual_screen_frame_left.setFillColor(VISUAL_SCREEN_FRAME_GREY);
164
165     this->visual_screen_frame_left.setOutlineThickness(2);
166     this->visual_screen_frame_left.setOutlineColor(sf::Color(0, 0, 0, 255));
167
168     this->visual_screen_frame_left.move(-2, 0);
169
170
171     // 3. bottom framing
172     this->visual_screen_frame_bottom.setPointCount(n_points);
173
174     this->visual_screen_frame_bottom.setPoint(
175         0,
176         sf::Vector2f(this->position_x - 350, this->position_y + 350)
177     );
178     this->visual_screen_frame_bottom.setPoint(
179         1,
180         sf::Vector2f(this->position_x - 350 - 16, this->position_y + 350 + 16)
181     );
182     this->visual_screen_frame_bottom.setPoint(
183         2,
184         sf::Vector2f(this->position_x - 50 + 16, this->position_y + 350 + 16)
185     );
186     this->visual_screen_frame_bottom.setPoint(
187         3,
188         sf::Vector2f(this->position_x - 50, this->position_y + 350)
189     );
190
191     this->visual_screen_frame_bottom.setFillColor(VISUAL_SCREEN_FRAME_GREY);
192
193     this->visual_screen_frame_bottom.setOutlineThickness(2);
194     this->visual_screen_frame_bottom.setOutlineColor(sf::Color(0, 0, 0, 255));
195
196     this->visual_screen_frame_bottom.move(0, 2);
197
198
199     // 4. right framing
200     this->visual_screen_frame_right.setPointCount(n_points);
201
202     this->visual_screen_frame_right.setPoint(
203         0,
204         sf::Vector2f(this->position_x - 50, this->position_y + 350)
205     );
206     this->visual_screen_frame_right.setPoint(
207         1,
208         sf::Vector2f(this->position_x - 50 + 16, this->position_y + 350 + 16)
209     );
210     this->visual_screen_frame_right.setPoint(
211         2,
212         sf::Vector2f(this->position_x - 50 + 16, this->position_y + 50 - 16)
213     );
214     this->visual_screen_frame_right.setPoint(
215         3,
216         sf::Vector2f(this->position_x - 50, this->position_y + 50)
217     );
218
219     this->visual_screen_frame_right.setFillColor(VISUAL_SCREEN_FRAME_GREY);
220
221     this->visual_screen_frame_right.setOutlineThickness(2);
222     this->visual_screen_frame_right.setOutlineColor(sf::Color(0, 0, 0, 255));
223
224     this->visual_screen_frame_right.move(2, 0);
225
226     return;
227 } /* __setUpVisualScreenFrame() */

```

#### 4.2.3.15 draw()

```
void ContextMenu::draw (
    void )
```

Method to draw the hex tile to the render window. To be called once per frame.

```
1001 {
1002     // 1. menu frame
1003     this->render_window_ptr->draw(this->menu_frame);
1004
1005     // 2. visual screen
1006     this->render_window_ptr->draw(this->visual_screen);
1007     this->__drawVisualScreenFrame();
1008
1009     // 3. console screen
1010     this->render_window_ptr->draw(this->console_screen);
1011     this->__drawConsoleScreenFrame();
1012     this->__drawConsoleText();
1013
1014     this->frame++;
1015     return;
1016 } /* draw() */
```

#### 4.2.3.16 processEvent()

```
void ContextMenu::processEvent (
    void )
```

Method to processEvent [ContextMenu](#). To be called once per event.

```
896 {
897     if (this->event_ptr->type == sf::Event::KeyPressed) {
898         this->__handleKeyPressEvents();
899     }
900
901     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
902         this->__handleMouseButtonEvents();
903     }
904
905     return;
906 } /* processEvent() */
```

#### 4.2.3.17 processMessage()

```
void ContextMenu::processMessage (
    void )
```

Method to processMessage [ContextMenu](#). To be called once per message.

```
921 {
922     switch (this->console_state) {
923         case (ConsoleState :: TILE): {
924             // process no tile selected
925             if (not this->message_hub_ptr->isEmpty(NO_TILE_SELECTED_CHANNEL)) {
926                 Message no_tile_selected_message = this->message_hub_ptr->receiveMessage(
927                     NO_TILE_SELECTED_CHANNEL
928                 );
929
930                 if (no_tile_selected_message.subject == "no tile selected") {
931                     this->__setConsoleState(ConsoleState :: READY);
932
933                     std::cout << "No tile selected message received by " << this <<
934                         std::endl;
935                     this->message_hub_ptr->popMessage(NO_TILE_SELECTED_CHANNEL);
936                 }
937             }
938
939             // process tile state
```

```

940         if (not this->message_hub_ptr->isEmpty(TILE_STATE_CHANNEL)) {
941             Message tile_state_message = this->message_hub_ptr->receiveMessage(
942                 TILE_STATE_CHANNEL
943             );
944
945             if (tile_state_message.subject == "tile state") {
946                 this->console_string = tile_state_message.string_payload["console string"];
947
948                 this->console_string_changed = true;
949                 this->console_substring_idx = 0;
950
951                 std::cout << "Tile state message received by " << this << std::endl;
952                 this->message_hub_ptr->popMessage(TILE_STATE_CHANNEL);
953             }
954         }
955
956         // process tile selected (subsequent left clicks causing program to hang)
957         if (not this->message_hub_ptr->isEmpty(TILE_SELECTED_CHANNEL)) {
958             this->message_hub_ptr->popMessage(TILE_SELECTED_CHANNEL);
959         }
960
961         break;
962     }
963
964     default: {
965         // process tile selected
966         if (not this->message_hub_ptr->isEmpty(TILE_SELECTED_CHANNEL)) {
967             Message tile_selected_message = this->message_hub_ptr->receiveMessage(
968                 TILE_SELECTED_CHANNEL
969             );
970
971             if (tile_selected_message.subject == "tile selected") {
972                 this->__setConsoleState(ConsoleState :: TILE);
973
974                 std::cout << "Tile selected message received by " << this <<
975                     std::endl;
976                 this->message_hub_ptr->popMessage(TILE_SELECTED_CHANNEL);
977             }
978         }
979
980         break;
981     }
982 }
983
984 return;
985 } /* processMessage() */

```

## 4.2.4 Member Data Documentation

### 4.2.4.1 assets\_manager\_ptr

`AssetsManager*` ContextMenu::assets\_manager\_ptr [private]

A pointer to the assets manager.

### 4.2.4.2 console\_screen

`sf::RectangleShape` ContextMenu::console\_screen

The context menu console screen (for animated text output).

#### 4.2.4.3 console\_screen\_frame\_bottom

```
sf::ConvexShape ContextMenu::console_screen_frame_bottom
```

The bottom framing of the console screen.

#### 4.2.4.4 console\_screen\_frame\_left

```
sf::ConvexShape ContextMenu::console_screen_frame_left
```

The left framing of the console screen.

#### 4.2.4.5 console\_screen\_frame\_right

```
sf::ConvexShape ContextMenu::console_screen_frame_right
```

The right framing of the console screen.

#### 4.2.4.6 console\_screen\_frame\_top

```
sf::ConvexShape ContextMenu::console_screen_frame_top
```

The top framing of the console screen.

#### 4.2.4.7 console\_state

```
ConsoleState ContextMenu::console_state
```

The current state of the console screen.

#### 4.2.4.8 console\_string

```
std::string ContextMenu::console_string
```

The string to be printed to the console screen.

#### 4.2.4.9 console\_string\_changed

```
bool ContextMenu::console_string_changed
```

Boolean which indicates if console string just changed.

#### 4.2.4.10 console\_substring\_idx

```
size_t ContextMenu::console_substring_idx
```

The current final index of the console string draw.

#### 4.2.4.11 event\_ptr

```
sf::Event* ContextMenu::event_ptr [private]
```

A pointer to the event class.

#### 4.2.4.12 frame

```
unsigned long long int ContextMenu::frame
```

The current frame of this object.

#### 4.2.4.13 game\_menu\_up

```
bool ContextMenu::game_menu_up
```

Indicates whether or not the game menu is up.

#### 4.2.4.14 menu\_frame

```
sf::RectangleShape ContextMenu::menu_frame
```

The frame of the context menu.

#### 4.2.4.15 message\_hub\_ptr

```
MessageHub* ContextMenu::message_hub_ptr [private]
```

A pointer to the message hub.

#### 4.2.4.16 position\_x

```
double ContextMenu::position_x
```

The position of the object.

#### 4.2.4.17 position\_y

```
double ContextMenu::position_y
```

The position of the object.

#### 4.2.4.18 render\_window\_ptr

```
sf::RenderWindow* ContextMenu::render_window_ptr [private]
```

A pointer to the render window.

#### 4.2.4.19 visual\_screen

```
sf::RectangleShape ContextMenu::visual_screen
```

The context menu screen for visuals.

#### 4.2.4.20 visual\_screen\_frame\_bottom

```
sf::ConvexShape ContextMenu::visual_screen_frame_bottom
```

The bottom framing of the visual screen.

#### 4.2.4.21 visual\_screen\_frame\_left

```
sf::ConvexShape ContextMenu::visual_screen_frame_left
```

The left framing of the visual screen.

#### 4.2.4.22 visual\_screen\_frame\_right

```
sf::ConvexShape ContextMenu::visual_screen_frame_right
```

The right framing of the visual screen.

#### 4.2.4.23 visual\_screen\_frame\_top

```
sf::ConvexShape ContextMenu::visual_screen_frame_top
```

The top framing of the visual screen.

The documentation for this class was generated from the following files:

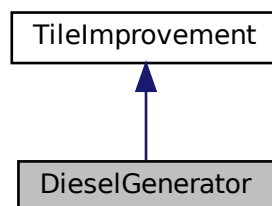
- header/[ContextMenu.h](#)
- source/[ContextMenu.cpp](#)

## 4.3 DieselGenerator Class Reference

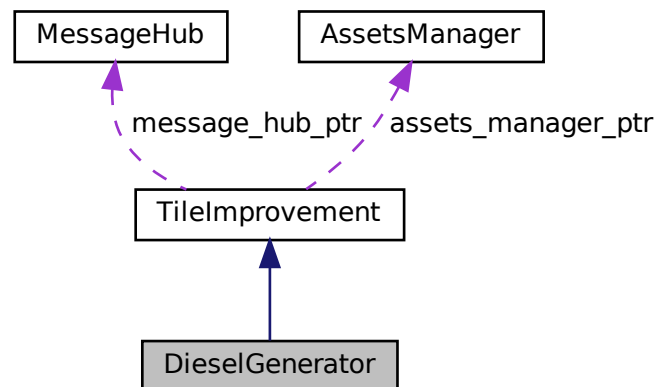
A settlement class (child class of [TileImprovement](#)).

```
#include <DieselGenerator.h>
```

Inheritance diagram for DieselGenerator:



Collaboration diagram for DieselGenerator:



## Public Member Functions

- [DieselGenerator](#) (double, double, sf::Event \*, sf::RenderWindow \*, [AssetsManager](#) \*, [MessageHub](#) \*)  
*Constructor for the [DieselGenerator](#) class.*
- [std::string getTileOptionsSubstring](#) (void)  
*Helper method to assemble and return tile options substring.*
- void [processEvent](#) (void)  
*Method to process [DieselGenerator](#). To be called once per event.*
- void [processMessage](#) (void)  
*Method to process [DieselGenerator](#). To be called once per message.*
- void [draw](#) (void)  
*Method to draw the hex tile to the render window. To be called once per frame.*
- virtual [~DieselGenerator](#) (void)  
*Destructor for the [DieselGenerator](#) class.*

## Public Attributes

- int [capacity\\_kW](#)  
*The rated production capacity [kW] of the diesel generator.*
- int [production\\_MWh](#)  
*The current production [MWh] of the diesel generator.*
- int [max\\_production\\_MWh](#)  
*The maximum production [MWh] for this turn.*
- double [smoke\\_da](#)  
*The per frame delta in smoke particle alpha value.*
- double [smoke\\_dx](#)  
*The per frame delta in smoke particle x position.*
- double [smoke\\_dy](#)  
*The per frame delta in smoke particle y position.*
- double [smoke\\_prob](#)  
*The probability of spawning a new smoke prob in any given frame.*
- [std::list< sf::Sprite >](#) [smoke\\_sprite\\_list](#)  
*A list of smoke sprite (for chimney animation).*



## Private Member Functions

- void [\\_\\_setUpTileImprovementSpriteAnimated](#) (void)  
*Helper method to set up tile improvement sprite (static).*
- void [\\_\\_upgrade](#) (void)  
*Helper method to upgrade the diesel generator.*
- void [\\_\\_handleKeyPressEvents](#) (void)  
*Helper method to handle key press events.*
- void [\\_\\_handleMouseButtonEvents](#) (void)  
*Helper method to handle mouse button events.*

## Additional Inherited Members

### 4.3.1 Detailed Description

A settlement class (child class of [TileImprovement](#)).

### 4.3.2 Constructor & Destructor Documentation

#### 4.3.2.1 DieselGenerator()

```
DieselGenerator::DieselGenerator (
    double position_x,
    double position_y,
    sf::Event * event_ptr,
    sf::RenderWindow * render_window_ptr,
    AssetsManager * assets_manager_ptr,
    MessageHub * message_hub_ptr )
```

Constructor for the [DieselGenerator](#) class.

Ref: [Wikipedia](#) [2023]

#### Parameters

<i>position_x</i>	The x position of the tile.
<i>position_y</i>	The y position of the tile.
<i>event_ptr</i>	Pointer to the event class.
<i>render_window_ptr</i>	Pointer to the render window.
<i>assets_manager_ptr</i>	Pointer to the assets manager.
<i>message_hub_ptr</i>	Pointer to the message hub.

```
275 :
276 TileImprovement (
277     position_x,
278     position_y,
279     event_ptr,
280     render_window_ptr,
```

```

281     assets_manager_ptr,
282     message_hub_ptr
283 )
284 {
285     // 1. set attributes
286
287     // 1.1. private
288     //...
289
290     // 1.2. public
291     this->tile_improvement_type = TileImprovementType :: DIESEL_GENERATOR;
292
293     this->is_running = false;
294
295     this->health = 100;
296
297     this->capacity_kW = 100;
298     this->upgrade_level = 1;
299
300     this->production_MWh = 0;
301     this->max_production_MWh = 72;
302
303     this->smoke_da = 1e-8 * SECONDS_PER_FRAME;
304     this->smoke_dx = 5 * SECONDS_PER_FRAME;
305     this->smoke_dy = -10 * SECONDS_PER_FRAME;
306     this->smoke_prob = 8 * SECONDS_PER_FRAME;
307
308     this->smoke_sprite_list = {};
309
310     this->tile_improvement_string = "DIESEL GEN";
311
312     this->__setUpTileImprovementSpriteAnimated();
313
314     std::cout << "DieselGenerator constructed at " << this << std::endl;
315
316     return;
317 } /* DieselGenerator() */

```

#### 4.3.2.2 ~DieselGenerator()

```

DieselGenerator::~~DieselGenerator (
    void ) [virtual]

```

Destructor for the [DieselGenerator](#) class.

```

526 {
527     std::cout << "DieselGenerator at " << this << " destroyed" << std::endl;
528
529     return;
530 } /* ~DieselGenerator() */

```

### 4.3.3 Member Function Documentation

#### 4.3.3.1 \_\_handleKeyPressEvents()

```

void DieselGenerator::__handleKeyPressEvents (
    void ) [private]

```

Helper method to handle key press events.

```

161 {
162     if (this->just_built) {
163         return;
164     }
165
166
167     switch (this->event_ptr->key.code) {

```

```

168         case (sf::Keyboard::U): {
169             this->__upgrade();
170
171             break;
172         }
173
174         default: {
175             // do nothing!
176
177             break;
178         }
179     }
180 }
181
182
183 return;
184 } /* __handleKeyPressEvents() */

```

#### 4.3.3.2 \_\_handleMouseButtonEvents()

```

void DieselGenerator::__handleMouseButtonEvents (
    void ) [private]

```

Helper method to handle mouse button events.

```

199 {
200     if (this->just_built) {
201         return;
202     }
203
204     switch (this->event_ptr->mouseButton.button) {
205         case (sf::Mouse::Left): {
206             //...
207
208             break;
209         }
210
211         case (sf::Mouse::Right): {
212             //...
213
214             break;
215         }
216
217         default: {
218             // do nothing!
219
220             break;
221         }
222     }
223 }
224
225
226 return;
227 } /* __handleMouseButtonEvents() */

```

#### 4.3.3.3 \_\_setUpTileImprovementSpriteAnimated()

```

void DieselGenerator::__setUpTileImprovementSpriteAnimated (
    void ) [private]

```

Helper method to set up tile improvement sprite (static).

```

68 {
69     sf::Sprite diesel_generator_sheet(
70         *(this->assets_manager_ptr->getTexture("diesel generator"))
71     );
72
73     int n_elements = diesel_generator_sheet.getLocalBounds().height / 64;
74
75     for (int i = 0; i < n_elements; i++) {
76         this->tile_improvement_sprite_animated.push_back(

```

```

77         sf::Sprite(
78             *(this->assets_manager_ptr->getTexture("diesel generator")),
79             sf::IntRect(0, i * 64, 64, 64)
80         )
81     );
82
83     this->tile_improvement_sprite_animated.back().setOrigin(
84         this->tile_improvement_sprite_animated.back().getLocalBounds().width / 2,
85         this->tile_improvement_sprite_animated.back().getLocalBounds().height
86     );
87
88     this->tile_improvement_sprite_animated.back().setPosition(
89         this->position_x,
90         this->position_y - 32
91     );
92
93     this->tile_improvement_sprite_animated.back().setColor(
94         sf::Color(255, 255, 255, 0)
95     );
96 }
97
98 return;
99 } /* __setUpTileImprovementSpriteAnimated() */

```

#### 4.3.3.4 \_\_upgrade()

```

void DieselGenerator::__upgrade (
    void ) [private]

```

Helper method to upgrade the diesel generator.

```

114 {
115     if (this->credits < DIESEL_GENERATOR_BUILD_COST) {
116         std::cout << "Cannot upgrade diesel generator: insufficient credits (need "
117             << DIESEL_GENERATOR_BUILD_COST << " K)" << std::endl;
118
119         this->__sendInsufficientCreditsMessage();
120         return;
121     }
122
123     if (this->upgrade_level >= MAX_UPGRADE_LEVELS) {
124         return;
125     }
126
127     this->is_running = false;
128
129     this->health = 100;
130
131     this->capacity_kW += 100;
132     this->upgrade_level++;
133
134     this->production_MWh = 0;
135     this->max_production_MWh += 72;
136
137     this->just_upgraded = true;
138
139     this->assets_manager_ptr->getSound("upgrade")->play();
140
141     this->__sendCreditsSpentMessage(DIESEL_GENERATOR_BUILD_COST);
142     this->__sendTileStateRequest();
143     this->__sendGameStateRequest();
144
145     return;
146 } /* __upgrade() */

```

#### 4.3.3.5 draw()

```

void DieselGenerator::draw (
    void ) [virtual]

```

Method to draw the hex tile to the render window. To be called once per frame.

Reimplemented from [TileImprovement](#).

```

434 {
435     // 1. if just built, call base method and return
436     if (this->just_built) {
437         TileImprovement::draw();
438
439         return;
440     }
441
442     // 2. handle upgrade effects
443     if (this->just_upgraded) {
444         for (size_t i = 0; i < this->tile_improvement_sprite_animated.size(); i++) {
445             this->tile_improvement_sprite_animated[i].setColor(
446                 sf::Color(
447                     255 * pow(cos((M_PI * this->upgrade_frame) / FRAMES_PER_SECOND), 2),
448                     255,
449                     255 * pow(cos((M_PI * this->upgrade_frame) / FRAMES_PER_SECOND), 2),
450                     255
451                 )
452             );
453
454             this->tile_improvement_sprite_animated[i].setScale(
455                 sf::Vector2f(
456                     1 + 0.2 * pow(cos((M_PI * this->upgrade_frame) / FRAMES_PER_SECOND), 2),
457                     1 + 0.2 * pow(cos((M_PI * this->upgrade_frame) / FRAMES_PER_SECOND), 2)
458                 )
459             );
460         }
461
462         this->upgrade_frame++;
463     }
464
465     if (this->upgrade_frame >= 2 * FRAMES_PER_SECOND) {
466         for (size_t i = 0; i < this->tile_improvement_sprite_animated.size(); i++) {
467             this->tile_improvement_sprite_animated[i].setColor(
468                 sf::Color(255,255,255,255)
469             );
470
471             this->tile_improvement_sprite_animated[i].setScale(sf::Vector2f(1,1));
472         }
473
474         this->just_upgraded = false;
475         this->upgrade_frame = 0;
476     }
477
478     // 3. draw first element of animated sprite
479     this->render_window_ptr->draw(this->tile_improvement_sprite_animated[0]);
480
481     // 4. draw second element of animated sprite
482     if (this->is_running) {
483         //...
484     }
485
486     else {
487         //...
488     }
489
490     this->render_window_ptr->draw(this->tile_improvement_sprite_animated[1]);
491
492     // 5. draw smoke effects
493     if (this->is_running) {
494         //...
495     }
496
497     // 6. draw production menu
498     if (this->production_menu_open) {
499         this->render_window_ptr->draw(this->production_menu_backing);
500         this->render_window_ptr->draw(this->production_menu_backing_text);
501
502         //...
503     }
504
505     this->frame++;
506     return;
507 }
508
509 /* draw() */
510 }

```

#### 4.3.3.6 getFileOptionsSubstring()

```
std::string DieselGenerator::getFileOptionsSubstring (
    void ) [virtual]
```

Helper method to assemble and return tile options substring.

##### Returns

Tile options substring.

Reimplemented from [TileImprovement](#).

```
334 {
335     int upgrade_cost = DIESEL_GENERATOR_BUILD_COST;
336
337     //          32 char x 17 line console "-----\n";
338     std::string options_substring = "CAPACITY: ";
339     options_substring += std::to_string(this->capacity_kW);
340     options_substring += " kW (level ";
341     options_substring += std::to_string(this->upgrade_level);
342     options_substring += ") \n";
343
344     options_substring += "PRODUCTION: ";
345     options_substring += std::to_string(this->production_MWh);
346     options_substring += " MWh (MAX ";
347     options_substring += std::to_string(this->max_production_MWh);
348     options_substring += ") \n";
349
350     options_substring += "HEALTH: ";
351     options_substring += std::to_string(this->health);
352     options_substring += "/100 \n";
353
354     options_substring += " \n";
355     options_substring += " **** DIESEL GEN OPTIONS **** \n";
356     options_substring += " \n";
357     options_substring += " [E]: OPEN PRODUCTION MENU \n";
358
359     if (this->upgrade_level < MAX_UPGRADE_LEVELS) {
360         options_substring += " [U]: + 100 kW (";
361         options_substring += std::to_string(upgrade_cost);
362         options_substring += " K) \n";
363     }
364
365     options_substring += "HOLD [P]: SCRAP (";
366     options_substring += std::to_string(SCRAP_COST);
367     options_substring += " K)";
368
369     return options_substring;
370 } /* getFileOptionsSubstring() */
```

#### 4.3.3.7 processEvent()

```
void DieselGenerator::processEvent (
    void ) [virtual]
```

Method to process [DieselGenerator](#). To be called once per event.

Reimplemented from [TileImprovement](#).

```
385 {
386     TileImprovement :: processEvent ();
387
388     if (this->event_ptr->type == sf::Event::KeyPressed) {
389         this->__handleKeyPressEvents ();
390     }
391
392     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
393         this->__handleMouseButtonEvents ();
394     }
395
396     return;
397 } /* processEvent() */
```

#### 4.3.3.8 processMessage()

```
void DieselGenerator::processMessage (
    void ) [virtual]
```

Method to process [DieselGenerator](#). To be called once per message.

Reimplemented from [TileImprovement](#).

```
412 {
413     TileImprovement :: processMessage ();
414
415     //...
416
417     return;
418 } /* processMessage() */
```

### 4.3.4 Member Data Documentation

#### 4.3.4.1 capacity\_kW

```
int DieselGenerator::capacity_kW
```

The rated production capacity [kW] of the diesel generator.

#### 4.3.4.2 max\_production\_MWh

```
int DieselGenerator::max_production_MWh
```

The maximum production [MWh] for this turn.

#### 4.3.4.3 production\_MWh

```
int DieselGenerator::production_MWh
```

The current production [MWh] of the diesel generator.

#### 4.3.4.4 smoke\_da

```
double DieselGenerator::smoke_da
```

The per frame delta in smoke particle alpha value.

#### 4.3.4.5 smoke\_dx

```
double DieselGenerator::smoke_dx
```

The per frame delta in smoke particle x position.

#### 4.3.4.6 smoke\_dy

```
double DieselGenerator::smoke_dy
```

The per frame delta in smoke particle y position.

#### 4.3.4.7 smoke\_prob

```
double DieselGenerator::smoke_prob
```

The probability of spawning a new smoke prob in any given frame.

#### 4.3.4.8 smoke\_sprite\_list

```
std::list<sf::Sprite> DieselGenerator::smoke_sprite_list
```

A list of smoke sprite (for chimney animation).

The documentation for this class was generated from the following files:

- header/[DieselGenerator.h](#)
- source/[DieselGenerator.cpp](#)

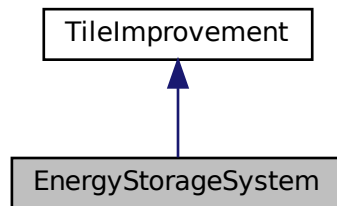


## 4.4 EnergyStorageSystem Class Reference

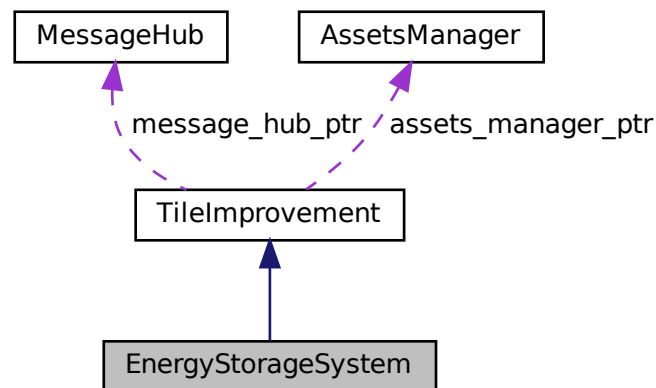
A settlement class (child class of [TileImprovement](#)).

```
#include <EnergyStorageSystem.h>
```

Inheritance diagram for EnergyStorageSystem:



Collaboration diagram for EnergyStorageSystem:



### Public Member Functions

- [EnergyStorageSystem](#) (double, double, sf::Event \*, sf::RenderWindow \*, [AssetsManager](#) \*, [MessageHub](#) \*)  
*Constructor for the [EnergyStorageSystem](#) class.*
- void [setIsSelected](#) (bool)  
*Method to set the is selected attribute.*
- std::string [getTileOptionsSubstring](#) (void)  
*Helper method to assemble and return tile options substring.*
- void [processEvent](#) (void)

- *Method to process [EnergyStorageSystem](#). To be called once per event.*
- void [processMessage](#) (void)  
*Method to process [EnergyStorageSystem](#). To be called once per message.*
- void [draw](#) (void)  
*Method to draw the hex tile to the render window. To be called once per frame.*
- virtual [~EnergyStorageSystem](#) (void)  
*Destructor for the [EnergyStorageSystem](#) class.*

## Public Attributes

- int [capacity\\_MWh](#)  
*The rated energy capacity [MWh] of the energy storage system.*
- int [charge\\_MWh](#)  
*The charge [MWh] in the energy storage system.*

## Private Member Functions

- void [\\_\\_setUpTileImprovementSpriteStatic](#) (void)  
*Helper method to set up tile improvement sprite (static).*
- void [\\_\\_setUpProductionMenu](#) (void)  
*Helper method to set up and position production menu assets (drawable).*
- void [\\_\\_upgrade](#) (void)  
*Helper method to upgrade the diesel generator.*
- void [\\_\\_handleKeyPressEvents](#) (void)  
*Helper method to handle key press events.*
- void [\\_\\_handleMouseButtonEvents](#) (void)  
*Helper method to handle mouse button events.*

## Additional Inherited Members

### 4.4.1 Detailed Description

A settlement class (child class of [TileImprovement](#)).

### 4.4.2 Constructor & Destructor Documentation

#### 4.4.2.1 EnergyStorageSystem()

```
EnergyStorageSystem::EnergyStorageSystem (
    double position_x,
    double position_y,
    sf::Event * event_ptr,
    sf::RenderWindow * render_window_ptr,
    AssetsManager * assets_manager_ptr,
    MessageHub * message_hub_ptr )
```

Constructor for the [EnergyStorageSystem](#) class.

Ref: [Wikipedia \[2023\]](#)

## Parameters

<i>position_x</i>	The x position of the tile.
<i>position_y</i>	The y position of the tile.
<i>event_ptr</i>	Pointer to the event class.
<i>render_window_ptr</i>	Pointer to the render window.
<i>assets_manager_ptr</i>	Pointer to the assets manager.
<i>message_hub_ptr</i>	Pointer to the message hub.

```

291 :
292 TileImprovement (
293     position_x,
294     position_y,
295     event_ptr,
296     render_window_ptr,
297     assets_manager_ptr,
298     message_hub_ptr
299 )
300 {
301     // 1. set attributes
302
303     // 1.1. private
304     //...
305
306     // 1.2. public
307     this->tile_improvement_type = TileImprovementType :: ENERGY_STORAGE_SYSTEM;
308
309     this->is_running = false;
310
311     this->health = 100;
312
313     this->capacity_MWh = 1;
314     this->upgrade_level = 1;
315
316     this->charge_MWh = 0;
317
318     this->tile_improvement_string = "ENERGY STORAGE";
319
320     this->__setUpTileImprovementSpriteStatic();
321     this->__setUpProductionMenu();
322
323     std::cout << "EnergyStorageSystem constructed at " << this << std::endl;
324
325     return;
326 } /* EnergyStorageSystem() */

```

## 4.4.2.2 ~EnergyStorageSystem()

```

EnergyStorageSystem::~EnergyStorageSystem (
    void ) [virtual]

```

Destructor for the [EnergyStorageSystem](#) class.

```

504 {
505     std::cout << "EnergyStorageSystem at " << this << " destroyed" << std::endl;
506
507     return;
508 } /* ~EnergyStorageSystem() */

```

## 4.4.3 Member Function Documentation

#### 4.4.3.1 \_\_handleKeyPressEvents()

```
void EnergyStorageSystem::__handleKeyPressEvents (
    void ) [private]
```

Helper method to handle key press events.

```
179 {
180     if (this->just_built) {
181         return;
182     }
183
184     switch (this->event_ptr->key.code) {
185         case (sf::Keyboard::U): {
186             if (this->upgrade_level < MAX_UPGRADE_LEVELS) {
187                 this->__upgrade();
188             }
189
190             break;
191         }
192
193         default: {
194             // do nothing!
195
196             break;
197         }
198     }
199 }
200
201 return;
202 } /* __handleKeyPressEvents() */
```

#### 4.4.3.2 \_\_handleMouseButtonEvents()

```
void EnergyStorageSystem::__handleMouseButtonEvents (
    void ) [private]
```

Helper method to handle mouse button events.

```
217 {
218     if (this->just_built) {
219         return;
220     }
221
222     switch (this->event_ptr->mouseButton.button) {
223         case (sf::Mouse::Left): {
224             //...
225
226             break;
227         }
228
229         case (sf::Mouse::Right): {
230             //...
231
232             break;
233         }
234     }
235
236     default: {
237         // do nothing!
238
239         break;
240     }
241 }
242
243 return;
244 } /* __handleMouseButtonEvents() */
```

#### 4.4.3.3 \_\_setUpProductionMenu()

```
void EnergyStorageSystem::__setUpProductionMenu (
    void ) [private]
```

Helper method to set up and position production menu assets (drawable).

```
103 {
104     // 1. modify production menu text
105     this->production_menu_backing_text.setString("**** DISCHARGE MENU ****");
106     this->production_menu_backing_text.setFont (
107         *(this->assets_manager_ptr->getFont ("Glass_TTY_VT220"))
108     );
109     this->production_menu_backing_text.setCharacterSize(16);
110     this->production_menu_backing_text.setFill-color(MONOCROME_TEXT_GREEN);
111     this->production_menu_backing_text.setOrigin(
112         this->production_menu_backing_text.getLocalBounds().width / 2, 0
113     );
114     this->production_menu_backing_text.setPosition(400, 400 - 128 + 4);
115
116     return;
117 } /* __setUpProductionMenu() */
```

#### 4.4.3.4 \_\_setUpTileImprovementSpriteStatic()

```
void EnergyStorageSystem::__setUpTileImprovementSpriteStatic (
    void ) [private]
```

Helper method to set up tile improvement sprite (static).

```
68 {
69     this->tile_improvement_sprite_static.setTexture(
70         *(this->assets_manager_ptr->getTexture("energy storage system"))
71     );
72
73     this->tile_improvement_sprite_static.setOrigin(
74         this->tile_improvement_sprite_static.getLocalBounds().width / 2,
75         this->tile_improvement_sprite_static.getLocalBounds().height
76     );
77
78     this->tile_improvement_sprite_static.setPosition(
79         this->position_x,
80         this->position_y - 32
81     );
82
83     this->tile_improvement_sprite_static.setColor(
84         sf::Color(255, 255, 255, 0)
85     );
86
87     return;
88 } /* __setUpTileImprovementSpriteStatic() */
```

#### 4.4.3.5 \_\_upgrade()

```
void EnergyStorageSystem::__upgrade (
    void ) [private]
```

Helper method to upgrade the diesel generator.

```
132 {
133     /*
134     int upgrade_cost = DIESEL_GENERATOR_BUILD_COST;
135
136     if (this->credits < upgrade_cost) {
137         std::cout << "Cannot upgrade diesel generator: insufficient credits (need "
138             << upgrade_cost << " K)" << std::endl;
139
140         this->__sendInsufficientCreditsMessage();
141         return;
142     }
143     */
144 }
```

```

142     }
143
144     this->is_running = false;
145
146     this->health = 100;
147
148     this->capacity_kW += 100;
149     this->upgrade_level++;
150
151     this->production_MWh = 0;
152     this->max_production_MWh += 72;
153
154     this->just_upgraded = true;
155
156     this->assets_manager_ptr->getSound("upgrade")->play();
157
158     this->__sendCreditsSpentMessage(upgrade_cost);
159     this->__sendTileStateRequest();
160     this->__sendGameStateRequest();
161     */
162
163     return;
164 } /* __upgrade() */

```

#### 4.4.3.6 draw()

```

void EnergyStorageSystem::draw (
    void ) [virtual]

```

Method to draw the hex tile to the render window. To be called once per frame.

Reimplemented from [TileImprovement](#).

```

466 {
467     // 1. if just built, call base method and return
468     if (this->just_built) {
469         TileImprovement::draw();
470
471         return;
472     }
473
474
475     // 2. draw static sprite
476     this->render_window_ptr->draw(this->tile_improvement_sprite_static);
477
478
479     // 3. draw production menu
480     if (this->production_menu_open) {
481         this->render_window_ptr->draw(this->production_menu_backing);
482         this->render_window_ptr->draw(this->production_menu_backing_text);
483
484         //...
485     }
486
487     this->frame++;
488     return;
489 } /* draw() */

```

#### 4.4.3.7 getTileOptionsSubstring()

```

std::string EnergyStorageSystem::getTileOptionsSubstring (
    void ) [virtual]

```

Helper method to assemble and return tile options substring.

## Returns

Tile options substring.

Reimplemented from [TileImprovement](#).

```

368 {
369     int upgrade_cost = ENERGY_STORAGE_SYSTEM_BUILD_COST;
370
371     // 32 char x 17 line console "-----\n";
372     std::string options_substring = "CAPACITY: ";
373     options_substring += std::to_string(this->capacity_MWh);
374     options_substring += " MWh (level ";
375     options_substring += std::to_string(this->upgrade_level);
376     options_substring += ") \n";
377
378     options_substring += "CHARGE: ";
379     options_substring += std::to_string(this->charge_MWh);
380     options_substring += " MWh \n";
381
382     options_substring += "HEALTH: ";
383     options_substring += std::to_string(this->health);
384     options_substring += "/100 \n";
385
386     options_substring += " \n";
387     options_substring += "**** ENERGY STORAGE OPTIONS **** \n";
388     options_substring += " \n";
389     options_substring += " [E]: OPEN DISCHARGE MENU \n";
390
391     if (this->upgrade_level < MAX_UPGRADE_LEVELS) {
392         options_substring += " [U]: UPGRADE (";
393         options_substring += std::to_string(upgrade_cost);
394         options_substring += " K) \n";
395     }
396
397     options_substring += "HOLD [P]: SCRAP (";
398     options_substring += std::to_string(SCRAP_COST);
399     options_substring += " K)";
400
401     return options_substring;
402 } /* getTileOptionsSubstring() */

```

## 4.4.3.8 processEvent()

```

void EnergyStorageSystem::processEvent (
    void ) [virtual]

```

Method to process [EnergyStorageSystem](#). To be called once per event.

Reimplemented from [TileImprovement](#).

```

417 {
418     TileImprovement :: processEvent();
419
420     if (this->event_ptr->type == sf::Event::KeyPressed) {
421         this->__handleKeyPressEvents();
422     }
423
424     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
425         this->__handleMouseButtonEvents();
426     }
427
428     return;
429 } /* processEvent() */

```

#### 4.4.3.9 processMessage()

```
void EnergyStorageSystem::processMessage (
    void ) [virtual]
```

Method to process [EnergyStorageSystem](#). To be called once per message.

Reimplemented from [TileImprovement](#).

```
444 {
445     TileImprovement :: processMessage();
446
447     //...
448
449     return;
450 } /* processMessage() */
```

#### 4.4.3.10 setIsSelected()

```
void EnergyStorageSystem::setIsSelected (
    bool is_selected ) [virtual]
```

Method to set the is selected attribute.

##### Parameters

<i>is_selected</i>	The value to set the is selected attribute to.
--------------------	--

Reimplemented from [TileImprovement](#).

```
343 {
344     TileImprovement :: setIsSelected(is_selected);
345
346     if (this->is_selected) {
347         this->assets_manager_ptr->getSound("energy storage system")->play();
348     }
349
350     return;
351 } /* setIsSelected() */
```

### 4.4.4 Member Data Documentation

#### 4.4.4.1 capacity\_MWh

```
int EnergyStorageSystem::capacity_MWh
```

The rated energy capacity [MWh] of the energy storage system.



#### 4.4.4.2 charge\_MWh

```
int EnergyStorageSystem::charge_MWh
```

The charge [MWh] in the energy storage system.

The documentation for this class was generated from the following files:

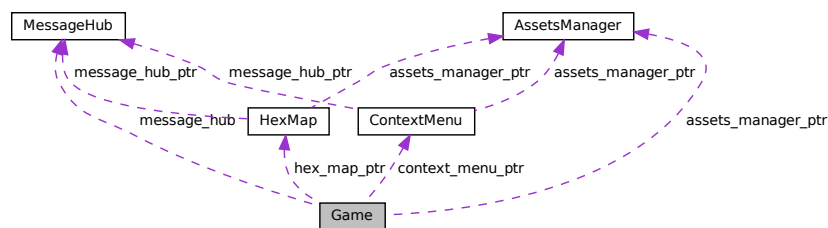
- header/[EnergyStorageSystem.h](#)
- source/[EnergyStorageSystem.cpp](#)

## 4.5 Game Class Reference

A class which acts as the central class for the game, by containing all other classes and implementing the game loop.

```
#include <Game.h>
```

Collaboration diagram for Game:



### Public Member Functions

- [Game](#) (sf::RenderWindow \*, [AssetsManager](#) \*)  
Constructor for the [Game](#) class.
- bool [run](#) (void)  
Method to run game (defines game loop).
- [~Game](#) (void)  
Destructor for the [Game](#) class.

## Public Attributes

- [GamePhase](#) `game_phase`  
*The current phase of the game.*
- `bool` [quit\\_game](#)  
*Boolean indicating whether to quit (true) or create a new [Game](#) instance (false).*
- `bool` [game\\_loop\\_broken](#)  
*Boolean indicating whether or not the game loop is broken.*
- `bool` [show\\_frame\\_clock\\_overlay](#)  
*Boolean indicating whether or not to show frame and clock overlay.*
- `unsigned long long int` [frame](#)  
*The current frame of the game.*
- `double` [time\\_since\\_start\\_s](#)  
*The time elapsed [s] since the start of the game.*
- `int` [year](#)  
*Current game year.*
- `int` [month](#)  
*Current game month.*
- `int` [population](#)  
*Current population.*
- `int` [credits](#)  
*Current balance of credits.*
- `int` [demand\\_MWh](#)  
*Current energy demand [MWh].*
- `int` [cumulative\\_emissions\\_tonnes](#)  
*Cumulative emissions [tonnes] (1 tonne = 1000 kg).*
- `int` [turn](#) = 0  
*The current game turn.*
- `sf::Clock` [clock](#)  
*The game clock.*
- `sf::Event` [event](#)  
*The game events class.*
- [MessageHub](#) [message\\_hub](#)  
*The message hub (for inter-object message traffic).*
- [HexMap](#) \* [hex\\_map\\_ptr](#)  
*Pointer to the hex map (defines game world).*
- [ContextMenu](#) \* [context\\_menu\\_ptr](#)  
*Pointer to the context menu.*

## Private Member Functions

- `void` [\\_\\_toggleFrameClockOverlay](#) (void)  
*Helper method to toggle frame clock overlay.*
- `void` [\\_\\_handleKeyPressEvents](#) (void)  
*Helper method to handle key press events.*
- `void` [\\_\\_handleMouseButtonEvents](#) (void)  
*Helper method to handle mouse button events.*
- `void` [\\_\\_processEvent](#) (void)  
*Helper method to process [Game](#). To be called once per event.*
- `void` [\\_\\_processMessage](#) (void)

Helper method to process [Game](#). To be called once per message.

- void [\\_\\_sendGameStateMessage](#) (void)

Helper method to format and send a game state message.

- void [\\_\\_insufficientCreditsAlarm](#) (void)

Helper method to sound and display and insufficient credits alarm.

- void [\\_\\_drawFrameClockOverlay](#) (void)

Helper method to draw frame clock overlay.

- void [\\_\\_drawHUD](#) (void)

Helper method to heads-up display (HUD).

- void [\\_\\_draw](#) (void)

Helper method to draw game to the render window. To be called once per frame.

## Private Attributes

- sf::RenderWindow \* [render\\_window\\_ptr](#)

A pointer to the render window.

- [AssetsManager](#) \* [assets\\_manager\\_ptr](#)

A pointer to the assets manager.

### 4.5.1 Detailed Description

A class which acts as the central class for the game, by containing all other classes and implementing the game loop.

### 4.5.2 Constructor & Destructor Documentation

#### 4.5.2.1 Game()

```
Game::Game (
    sf::RenderWindow * render_window_ptr,
    AssetsManager * assets_manager_ptr )
```

Constructor for the [Game](#) class.

```
702 {
703     // 1. set attributes
704
705     // 1.1. private
706     this->render_window_ptr = render_window_ptr;
707
708     this->assets_manager_ptr = assets_manager_ptr;
709
710     // 1.2. public
711     this->game_phase = GamePhase :: BUILD_SETTLEMENT;
712
713     this->quit_game = false;
714     this->game_loop_broken = false;
715     this->show_frame_clock_overlay = false;
716
717     this->frame = 0;
718     this->time_since_start_s = 0;
719
720     double seconds_since_epoch = time(NULL);
721     double years_since_epoch = seconds_since_epoch / SECONDS_PER_YEAR;
722
723     this->year = 1970 + (int)years_since_epoch;
```

```

724     this->month = (years_since_epoch - (int)years_since_epoch) * 12 + 1;
725
726     this->population = 0;
727     this->credits = STARTING_CREDITS;
728     this->demand_MWh = 0;
729     this->cumulative_emissions_tonnes = 0;
730
731     this->hex_map_ptr = new HexMap(
732         6,
733         &(this->event),
734         this->render_window_ptr,
735         this->assets_manager_ptr,
736         &(this->message_hub)
737     );
738
739     this->context_menu_ptr = new ContextMenu(
740         &(this->event),
741         this->render_window_ptr,
742         this->assets_manager_ptr,
743         &(this->message_hub)
744     );
745
746     // 2. add message channel(s)
747     this->message_hub.addChannel(GAME_CHANNEL);
748     this->message_hub.addChannel(GAME_STATE_CHANNEL);
749
750     std::cout << "Game constructed at " << this << std::endl;
751
752     return;
753 } /* Game() */

```

#### 4.5.2.2 ~Game()

```

Game::~Game (
    void )

```

Destructor for the [Game](#) class.

```

837 {
838     // 1. clean up attributes
839     delete this->hex_map_ptr;
840     delete this->context_menu_ptr;
841
842     std::cout << "Game at " << this << " destroyed" << std::endl;
843
844     return;
845 } /* ~Game() */

```

### 4.5.3 Member Function Documentation

#### 4.5.3.1 \_\_draw()

```

void Game::__draw (
    void ) [private]

```

Helper method to draw game to the render window. To be called once per frame.

```

669 {
670     this->__drawHUD();
671
672     if (this->show_frame_clock_overlay) {
673         this->__drawFrameClockOverlay();
674     }
675
676     return;
677 } /* draw() */

```

4.5.3.2 `__drawFrameClockOverlay()`

```
void Game::__drawFrameClockOverlay (
    void ) [private]
```

Helper method to draw frame clock overlay.

```
495 {
496     std::string frame_clock_string = "FRAME: ";
497     frame_clock_string += std::to_string(this->frame);
498     frame_clock_string += "\nTIME SINCE START [s]: ";
499     frame_clock_string += std::to_string(this->time_since_start_s);
500
501     sf::Text frame_clock_text(
502         frame_clock_string,
503         *(this->assets_manager_ptr->getFont("DroidSansMono")),
504         16
505     );
506
507     sf::RectangleShape frame_clock_backing(
508         sf::Vector2f(
509             1.02 * frame_clock_text.getLocalBounds().width,
510             1.20 * frame_clock_text.getLocalBounds().height
511         )
512     );
513     frame_clock_backing.setFillColor(sf::Color(0, 0, 0, 255));
514
515     this->render_window_ptr->draw(frame_clock_backing);
516     this->render_window_ptr->draw(frame_clock_text);
517
518     return;
519 } /* __drawFrameClockOverlay() */
```

4.5.3.3 `__drawHUD()`

```
void Game::__drawHUD (
    void ) [private]
```

Helper method to heads-up display (HUD).

```
534 {
535     // 1. first line (top)
536     std::string HUD_string = "YEAR: ";
537     HUD_string += std::to_string(this->year);
538
539     HUD_string += "    MONTH: ";
540     HUD_string += std::to_string(this->month);
541
542     HUD_string += "    POPULATION: ";
543     HUD_string += std::to_string(this->population);
544
545     HUD_string += "    CREDITS: ";
546     HUD_string += std::to_string(this->credits);
547     HUD_string += " K";
548
549     HUD_string += "    CURRENT DEMAND: ";
550     HUD_string += std::to_string(this->demand_MWh);
551     HUD_string += " MWh";
552
553     sf::Text HUD_text(
554         HUD_string,
555         *(this->assets_manager_ptr->getFont("Glass_TTY_VT220")),
556         16
557     );
558
559     HUD_text.setPosition(
560         (800 - HUD_text.getLocalBounds().width) / 2,
561         8
562     );
563
564     HUD_text.setFillColor(MONOCROME_TEXT_GREEN);
565
566     this->render_window_ptr->draw(HUD_text);
567
568
569     // 2. second line (top)
570     HUD_string = "CUMULATIVE EMISSIONS: ";
```

```

571 HUD_string += std::to_string(this->cumulative_emissions_tonnes);
572 HUD_string += " tonnes (CO2e)";
573
574 HUD_string += "    LIFETIME LIMIT: ";
575 HUD_string += std::to_string(EMISSIONS_LIFETIME_LIMIT_TONNES);
576 HUD_string += " tonnes (CO2e)";
577
578 HUD_text.setString(HUD_string);
579
580 HUD_text.setPosition(
581     (800 - HUD_text.getLocalBounds().width) / 2,
582     35
583 );
584
585 this->render_window_ptr->draw(HUD_text);
586
587
588 // 3. third line (bottom)
589 HUD_string = "GAME PHASE: ";
590
591 switch (this->game_phase) {
592     case (GamePhase :: BUILD_SETTLEMENT): {
593         HUD_string += "BUILD SETTLEMENT";
594
595         break;
596     }
597
598     case (GamePhase :: SYSTEM_MANAGEMENT): {
599         HUD_string += "SYSTEM MANAGEMENT";
600
601         break;
602     }
603
604     case (GamePhase :: LOSS_EMISSIONS): {
605         HUD_string += "LOSS (EMISSIONS)";
606
607         break;
608     }
609
610     case (GamePhase :: LOSS_DEMAND): {
611         HUD_string += "LOSS (DEMAND)";
612
613         break;
614     }
615
616     case (GamePhase :: LOSS_CREDITS): {
617         HUD_string += "LOSS (CREDITS)";
618
619         break;
620     }
621
622     case (GamePhase :: VICTORY): {
623         HUD_string += "VICTORY";
624
625         break;
626     }
627
628     default: {
629         HUD_string += "???";
630
631         break;
632     }
633 }
634
635 HUD_string += "    TURN: ";
636 HUD_string += std::to_string(this->turn);
637
638 HUD_text.setString(HUD_string);
639
640 HUD_text.setPosition(
641     (800 - HUD_text.getLocalBounds().width) / 2,
642     GAME_HEIGHT - 35
643 );
644
645 this->render_window_ptr->draw(HUD_text);
646
647 return;
648 } /* __drawHUD() */

```

#### 4.5.3.4 \_\_handleKeyPressEvents()

```
void Game::__handleKeyPressEvents (
    void ) [private]
```

Helper method to handle key press events.

```
93 {
94     switch (this->event.key.code) {
95         case (sf::Keyboard::Tilde): {
96             this->__toggleFrameClockOverlay();
97
98             break;
99         }
100
101
102         case (sf::Keyboard::Tab): {
103             this->hex_map_ptr->toggleResourceOverlay();
104
105             break;
106         }
107
108
109         default: {
110             // do nothing!
111
112             break;
113         }
114     }
115
116     return;
117 } /* __handleKeyPressEvents() */
```

#### 4.5.3.5 \_\_handleMouseButtonEvents()

```
void Game::__handleMouseButtonEvents (
    void ) [private]
```

Helper method to handle mouse button events.

```
132 {
133     switch (this->event.mouseButton.button) {
134         case (sf::Mouse::Left): {
135             //...
136
137             break;
138         }
139
140
141         case (sf::Mouse::Right): {
142             //...
143
144             break;
145         }
146
147
148         default: {
149             // do nothing!
150
151             break;
152         }
153     }
154
155     return;
156 } /* __handleMouseButtonEvents() */
```

#### 4.5.3.6 \_\_insufficientCreditsAlarm()

```
void Game::__insufficientCreditsAlarm (
    void ) [private]
```

Helper method to sound and display and insufficient credits alarm.

```
388 {
389     // 1. sound buzzer
390     this->assets_manager_ptr->getSound("insufficient credits")->play();
391
392     // 2. construct alarm text and backing rectangle
393     sf::Text insufficient_credits_text(
394         "INSUFFICIENT CREDITS",
395         (*(this->assets_manager_ptr->getFont("DroidSansMono"))),
396         32
397     );
398
399     insufficient_credits_text.setOrigin(
400         insufficient_credits_text.getLocalBounds().width / 2,
401         insufficient_credits_text.getLocalBounds().height / 2
402     );
403
404     insufficient_credits_text.setPosition(400, GAME_HEIGHT / 2);
405
406     sf::RectangleShape backing_rectangle(
407         sf::Vector2f(
408             1.1 * insufficient_credits_text.getLocalBounds().width,
409             1.5 * insufficient_credits_text.getLocalBounds().height
410         )
411     );
412
413     backing_rectangle.setFillColor(RESOURCE_CHIP_GREY);
414
415     backing_rectangle.setOrigin(
416         backing_rectangle.getLocalBounds().width / 2,
417         backing_rectangle.getLocalBounds().height / 2
418     );
419
420     backing_rectangle.setPosition(400, (GAME_HEIGHT / 2) + 8);
421
422     // 3. display loop (blocking ~3 seconds)
423     bool red_flag = true;
424     int alarm_frame = 0;
425     double time_since_alarm_s = 0;
426
427     sf::Clock alarm_clock;
428
429     while (alarm_frame < 2.5 * FRAMES_PER_SECOND) {
430
431         time_since_alarm_s = alarm_clock.getElapsedTime().asSeconds();
432
433         if (time_since_alarm_s >= (alarm_frame + 1) * SECONDS_PER_FRAME) {
434             while (this->render_window_ptr->pollEvent(this->event)) {
435                 // do nothing!
436             }
437
438             this->render_window_ptr->clear();
439
440             this->hex_map_ptr->draw();
441             this->context_menu_ptr->draw();
442             this->__draw();
443
444             if (alarm_frame % (FRAMES_PER_SECOND / 3) == 0) {
445                 if (red_flag) {
446                     red_flag = false;
447                 }
448
449                 else {
450                     red_flag = true;
451                 }
452             }
453
454             if (red_flag) {
455                 insufficient_credits_text.setFillColor(MONOCHROME_TEXT_RED);
456             }
457
458             else {
459                 insufficient_credits_text.setFillColor(sf::Color(255, 255, 255));
460             }
461
462             this->render_window_ptr->draw(backing_rectangle);
463             this->render_window_ptr->draw(insufficient_credits_text);
464
465 }
```



```

466         this->render_window_ptr->display();
467
468         alarm_frame++;
469         this->frame++;
470     }
471
472     // check track status, move to next if stopped
473     if (this->assets_manager_ptr->getTrackStatus() == sf::SoundSource::Stopped) {
474         this->assets_manager_ptr->nextTrack();
475         this->assets_manager_ptr->playTrack();
476     }
477 }
478
479 return;
480 } /* __insufficientCreditsAlarm( */

```

#### 4.5.3.7 \_\_processEvent()

```

void Game::__processEvent (
    void ) [private]

```

Helper method to process [Game](#). To be called once per event.

```

172 {
173     if (this->event.type == sf::Event::Closed) {
174         this->quit_game = true;
175         this->game_loop_broken = true;
176     }
177
178     if (this->event.type == sf::Event::KeyPressed) {
179         this->__handleKeyPressEvents();
180     }
181
182     if (this->event.type == sf::Event::MouseButtonPressed) {
183         this->__handleMouseButtonEvents();
184     }
185
186     return;
187 } /* __processEvent() */

```

#### 4.5.3.8 \_\_processMessage()

```

void Game::__processMessage (
    void ) [private]

```

Helper method to process [Game](#). To be called once per message.

```

285 {
286     if (not this->message_hub.isEmpty(GAME_CHANNEL)) {
287         Message game_channel_message = this->message_hub.receiveMessage(GAME_CHANNEL);
288
289         if (game_channel_message.subject == "quit game") {
290             this->quit_game = true;
291             this->game_loop_broken = true;
292
293             std::cout << "Quit game message received by " << this << std::endl;
294             this->message_hub.popMessage(GAME_CHANNEL);
295         }
296
297         if (game_channel_message.subject == "restart game") {
298             this->game_loop_broken = true;
299
300             std::cout << "Restart game message received by " << this << std::endl;
301             this->message_hub.popMessage(GAME_CHANNEL);
302         }
303
304         if (game_channel_message.subject == "state request") {
305             std::cout << "Game state request message received by " << this << std::endl;
306
307             this->__sendGameStateMessage();
308             this->message_hub.popMessage(GAME_CHANNEL);

```

```

309     }
310
311     if (game_channel_message.subject == "credits spent") {
312         this->credits -= game_channel_message.int_payload["credits spent"];
313
314         std::cout << "Credits spent message (" <<
315             game_channel_message.int_payload["credits spent"] << ") received by "
316             << this << std::endl;
317
318         std::cout << "Current credits (Game): " << this->credits << " K" <<
319             std::endl;
320
321         this->message_hub.popMessage(GAME_CHANNEL);
322     }
323
324     if (game_channel_message.subject == "insufficient credits") {
325         std::cout << "Insufficient credits message received by " << this <<
326             std::endl;
327
328         this->__insufficientCreditsAlarm();
329
330         this->message_hub.popMessage(GAME_CHANNEL);
331     }
332
333     if (game_channel_message.subject == "update game phase") {
334         std::cout << "Update game phase message received by " << this << std::endl;
335
336         if (
337             game_channel_message.string_payload["game phase"] == "system management"
338         ) {
339             this->game_phase = GamePhase :: SYSTEM_MANAGEMENT;
340             this->population = STARTING_POPULATION;
341             this->turn++;
342         }
343
344         else if (
345             game_channel_message.string_payload["game phase"] == "loss emissions"
346         ) {
347             this->game_phase = GamePhase :: LOSS_EMISSIONS;
348         }
349
350         else if (
351             game_channel_message.string_payload["game phase"] == "loss demand"
352         ) {
353             this->game_phase = GamePhase :: LOSS_DEMAND;
354         }
355
356         else if (
357             game_channel_message.string_payload["game phase"] == "loss credits"
358         ) {
359             this->game_phase = GamePhase :: LOSS_CREDITS;
360         }
361
362         else if (
363             game_channel_message.string_payload["game phase"] == "victory"
364         ) {
365             this->game_phase = GamePhase :: VICTORY;
366         }
367
368         this->message_hub.popMessage(GAME_CHANNEL);
369     }
370 }
371
372 return;
373 } /* __processMessage() */

```

#### 4.5.3.9 \_\_sendGameStateMessage()

```

void Game::__sendGameStateMessage (
    void ) [private]

```

Helper method to format and send a game state message.

```

202 {
203     Message game_state_message;
204
205     game_state_message.channel = GAME_STATE_CHANNEL;
206     game_state_message.subject = "game state";
207

```

```

208     game_state_message.int_payload["year"] = this->year;
209     game_state_message.int_payload["month"] = this->month;
210     game_state_message.int_payload["population"] = this->population;
211     game_state_message.int_payload["credits"] = this->credits;
212     game_state_message.int_payload["demand_MWh"] = this->demand_MWh;
213     game_state_message.int_payload["cumulative_emissions_tonnes"] =
214         this->cumulative_emissions_tonnes;
215
216     switch (this->game_phase) {
217         case (GamePhase :: BUILD_SETTLEMENT): {
218             game_state_message.string_payload["game phase"] = "build settlement";
219
220             break;
221         }
222
223         case (GamePhase :: SYSTEM_MANAGEMENT): {
224             game_state_message.string_payload["game phase"] = "system management";
225
226             break;
227         }
228
229         case (GamePhase :: LOSS_EMISSIONS): {
230             game_state_message.string_payload["game phase"] = "loss emissions";
231
232             break;
233         }
234
235         case (GamePhase :: LOSS_DEMAND): {
236             game_state_message.string_payload["game phase"] = "loss demand";
237
238             break;
239         }
240
241         case (GamePhase :: LOSS_CREDITS): {
242             game_state_message.string_payload["game phase"] = "loss credits";
243
244             break;
245         }
246
247         case (GamePhase :: VICTORY): {
248             game_state_message.string_payload["game phase"] = "victory";
249
250             break;
251         }
252
253         default: {
254             // do nothing!
255
256             break;
257         }
258     }
259
260     this->message_hub.sendMessage(game_state_message);
261
262     std::cout << "Game state message sent by " << this << std::endl;
263     return;
264 } /* __sendGameStateMessage() */

```

#### 4.5.3.10 \_\_toggleFrameClockOverlay()

```

void Game::__toggleFrameClockOverlay (
    void ) [private]

```

Helper method to toggle frame clock overlay.

```

68 {
69     if (this->show_frame_clock_overlay) {
70         this->show_frame_clock_overlay = false;
71     }
72
73     else {
74         this->show_frame_clock_overlay = true;
75     }

```

```

76
77     return;
78 } /* __toggleFrameClockOverlay() */

```

#### 4.5.3.11 run()

```

bool Game::run (
    void )

```

Method to run game (defines game loop).

#### Returns

Boolean indicating whether to quit (true) or create a new [Game](#) instance (false).

```

771 {
772     // 1. play brand animation
773     //...
774
775     // 2. show splash screen
776     //...
777
778     // 3. start game loop
779     while (not this->game_loop_broken) {
780         this->time_since_start_s = this->clock.getElapsedTime().asSeconds();
781
782         if (this->time_since_start_s >= (this->frame + 1) * SECONDS_PER_FRAME) {
783             // 6.1. process events
784             while (this->render_window_ptr->pollEvent(this->event)) {
785                 this->hex_map_ptr->processEvent();
786                 this->context_menu_ptr->processEvent();
787                 this->__processEvent();
788             }
789
790             // 6.2. process messages
791             while (this->message_hub.hasTraffic()) {
792                 this->hex_map_ptr->processMessage();
793                 this->context_menu_ptr->processMessage();
794                 this->__processMessage();
795             }
796
797             // 6.3. draw frame
798             this->render_window_ptr->clear();
799
800             this->hex_map_ptr->draw();
801             this->context_menu_ptr->draw();
802             this->__draw();
803
804             this->render_window_ptr->display();
805
806             // 6.4. increment frame
807             this->frame++;
808         }
809
810         // check track status, move to next if stopped
811         if (this->assets_manager_ptr->getTrackStatus() == sf::SoundSource::Stopped) {
812             this->assets_manager_ptr->nextTrack();
813             this->assets_manager_ptr->playTrack();
814         }
815     }
816
817     return this->quit_game;
818 } /* run() */

```

## 4.5.4 Member Data Documentation

#### 4.5.4.1 assets\_manager\_ptr

```
AssetsManager* Game::assets_manager_ptr [private]
```

A pointer to the assets manager.

#### 4.5.4.2 clock

```
sf::Clock Game::clock
```

The game clock.

#### 4.5.4.3 context\_menu\_ptr

```
ContextMenu* Game::context_menu_ptr
```

Pointer to the context menu.

#### 4.5.4.4 credits

```
int Game::credits
```

Current balance of credits.

#### 4.5.4.5 cumulative\_emissions\_tonnes

```
int Game::cumulative_emissions_tonnes
```

Cumulative emissions [tonnes] (1 tonne = 1000 kg).

#### 4.5.4.6 demand\_MWh

```
int Game::demand_MWh
```

Current energy demand [MWh].

#### 4.5.4.7 event

```
sf::Event Game::event
```

The game events class.

#### 4.5.4.8 frame

```
unsigned long long int Game::frame
```

The current frame of the game.

#### 4.5.4.9 game\_loop\_broken

```
bool Game::game_loop_broken
```

Boolean indicating whether or not the game loop is broken.

#### 4.5.4.10 game\_phase

```
GamePhase Game::game_phase
```

The current phase of the game.

#### 4.5.4.11 hex\_map\_ptr

```
HexMap* Game::hex_map_ptr
```

Pointer to the hex map (defines game world).

#### 4.5.4.12 message\_hub

```
MessageHub Game::message_hub
```

The message hub (for inter-object message traffic).

#### 4.5.4.13 month

```
int Game::month
```

Current game month.

#### 4.5.4.14 population

```
int Game::population
```

Current population.

#### 4.5.4.15 quit\_game

```
bool Game::quit_game
```

Boolean indicating whether to quit (true) or create a new [Game](#) instance (false).

#### 4.5.4.16 render\_window\_ptr

```
sf::RenderWindow* Game::render_window_ptr [private]
```

A pointer to the render window.

#### 4.5.4.17 show\_frame\_clock\_overlay

```
bool Game::show_frame_clock_overlay
```

Boolean indicating whether or not to show frame and clock overlay.

#### 4.5.4.18 time\_since\_start\_s

```
double Game::time_since_start_s
```

The time elapsed [s] since the start of the game.

#### 4.5.4.19 turn

```
int Game::turn = 0
```

The current game turn.

#### 4.5.4.20 year

```
int Game::year
```

Current game year.

The documentation for this class was generated from the following files:

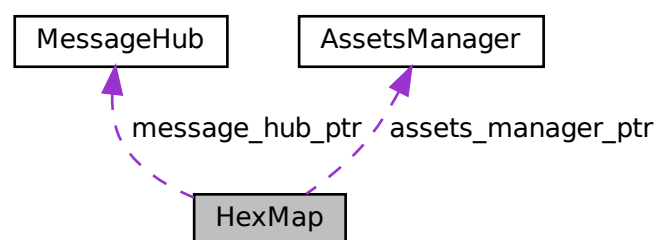
- [header/Game.h](#)
- [source/Game.cpp](#)

## 4.6 HexMap Class Reference

A class which defines a hex map of hex tiles.

```
#include <HexMap.h>
```

Collaboration diagram for HexMap:





## Public Member Functions

- [HexMap](#) (int, sf::Event \*, sf::RenderWindow \*, [AssetsManager](#) \*, [MessageHub](#) \*)  
*Constructor (intended) for the [HexMap](#) class.*
- void [assess](#) (void)  
*Method to assess the resource of the selected tile.*
- void [reroll](#) (void)  
*Method to re-roll the hex map.*
- void [toggleResourceOverlay](#) (void)  
*Method to toggle the hex map resource overlay.*
- void [processEvent](#) (void)  
*Method to process [HexMap](#). To be called once per event.*
- void [processMessage](#) (void)  
*Method to process [HexMap](#). To be called once per message.*
- void [draw](#) (void)  
*Method to draw the hex map to the render window. To be called once per frame.*
- void [clear](#) (void)  
*Method to clear the hex map.*
- [~HexMap](#) (void)  
*Destructor for the [HexMap](#) class.*

## Public Attributes

- bool [show\\_resource](#)  
*A boolean which indicates whether or not to show resource value.*
- bool [tile\\_selected](#)  
*A boolean which indicates if a tile is currently selected.*
- int [n\\_layers](#)  
*The number of layers in the hex map.*
- int [n\\_tiles](#)  
*The number of tiles in the hex map.*
- unsigned long long int [frame](#)  
*The current frame of this object.*
- double [position\\_x](#)  
*The x position of the hex map's origin (i.e. central) tile.*
- double [position\\_y](#)  
*The y position of the hex map's origin (i.e. central) tile.*
- sf::RectangleShape [glass\\_screen](#)  
*To give the effect of an old glass screen over the hex map.*
- std::vector< double > [tile\\_position\\_x\\_vec](#)  
*A vector of tile x positions.*
- std::vector< double > [tile\\_position\\_y\\_vec](#)  
*A vector of tile y position.*
- std::vector< [HexTile](#) \* > [border\\_tiles\\_vec](#)  
*A vector of pointers to the border tiles.*
- std::map< double, std::map< double, [HexTile](#) \* > > [hex\\_map](#)  
*A position-indexed, nested map of hex tiles.*
- std::vector< [HexTile](#) \* > [hex\\_draw\\_order\\_vec](#)  
*A vector of hex tiles, in drawing order.*

## Private Member Functions

- void [\\_\\_setUpGlassScreen](#) (void)  
*Helper method to set up glass screen effect (drawable).*
- void [\\_\\_layTiles](#) (void)  
*Helper method to lay the hex tiles down to generate the game world.*
- void [\\_\\_buildDrawOrderVector](#) (void)  
*Helper method to build tile drawing order vector.*
- std::vector< double > [\\_\\_getNoise](#) (int, int=128)  
*Helper method to generate a vector of noise, with values mapped to the closed interval [0, 1]. Applies a random cosine series approach.*
- void [\\_\\_procedurallyGenerateTileTypes](#) (void)  
*Helper method to procedurally generate tile types and set tiles accordingly.*
- std::vector< double > [\\_\\_getValidMapIndexPositions](#) (double, double)  
*Helper method to translate given position into valid index position for a.*
- std::vector< [HexTile](#) \* > [\\_\\_getNeighboursVector](#) ([HexTile](#) \*)  
*Helper method to assemble a vector pointers to all neighbours of the given tile.*
- [TileType](#) [\\_\\_getMajorityTileType](#) ([HexTile](#) \*)  
*Function to return majority tile type of a tile and its neighbours. If no clear majority, simply returns the type of the given tile.*
- void [\\_\\_smoothTileTypes](#) (void)  
*Helper method to smooth tile types using a majority rules approach.*
- bool [\\_\\_isLakeTouchingOcean](#) ([HexTile](#) \*)
- void [\\_\\_enforceOceanContinuity](#) (void)  
*Helper method to scan tiles and enforce ocean continuity. That is to say, if a lake tile is found to be in contact with an ocean tile, then it becomes ocean.*
- void [\\_\\_procedurallyGenerateTileResources](#) (void)  
*Helper method to procedurally generate tile resources and set tiles accordingly.*
- void [\\_\\_assembleHexMap](#) (void)  
*Helper method to assemble the hex map.*
- [HexTile](#) \* [\\_\\_getSelectedTile](#) (void)  
*Helper method to get pointer to selected tile.*
- void [\\_\\_handleKeyPressEvents](#) (void)  
*Helper method to handle key press events.*
- void [\\_\\_handleMouseButtonEvents](#) (void)  
*Helper method to handle mouse button events.*
- void [\\_\\_sendNoTileSelectedMessage](#) (void)  
*Helper method to format and send message on no tile selected.*
- void [\\_\\_assessNeighbours](#) ([HexTile](#) \*)  
*Helper method to assess all neighbours of the given tile.*

## Private Attributes

- sf::Event \* [event\\_ptr](#)  
*A pointer to the event class.*
- sf::RenderWindow \* [render\\_window\\_ptr](#)  
*A pointer to the render window.*
- [AssetsManager](#) \* [assets\\_manager\\_ptr](#)  
*A pointer to the assets manager.*
- [MessageHub](#) \* [message\\_hub\\_ptr](#)  
*A pointer to the message hub.*

### 4.6.1 Detailed Description

A class which defines a hex map of hex tiles.

### 4.6.2 Constructor & Destructor Documentation

#### 4.6.2.1 HexMap()

```
HexMap::HexMap (
    int n_layers,
    sf::Event * event_ptr,
    sf::RenderWindow * render_window_ptr,
    AssetsManager * assets_manager_ptr,
    MessageHub * message_hub_ptr )
```

Constructor (intended) for the [HexMap](#) class.

##### Parameters

<i>n_layers</i>	The number of layers in the <a href="#">HexMap</a> .
<i>event_ptr</i>	Pointer to the event class.
<i>render_window_ptr</i>	Pointer to the render window.
<i>assets_manager_ptr</i>	Pointer to the assets manager.
<i>message_hub_ptr</i>	Pointer to the message hub.

```
1116 {
1117     // 1. set attributes
1118
1119     // 1.1. private
1120     this->event_ptr = event_ptr;
1121     this->render_window_ptr = render_window_ptr;
1122
1123     this->assets_manager_ptr = assets_manager_ptr;
1124     this->message_hub_ptr = message_hub_ptr;
1125
1126     // 1.2. public
1127     this->show_resource = false;
1128     this->tile_selected = false;
1129
1130     this->frame = 0;
1131
1132     this->n_layers = n_layers;
1133     if (this->n_layers < 0) {
1134         this->n_layers = 0;
1135     }
1136
1137     this->position_x = 400;
1138     this->position_y = 400;
1139
1140     // 2. assemble n layer hex map
1141     this->__assembleHexMap();
1142
1143     // 3. set up and position drawable attributes
1144     this->__setUpGlassScreen();
1145
1146     // 4. add message channel(s)
1147     this->message_hub_ptr->addChannel(TILE_SELECTED_CHANNEL);
1148     this->message_hub_ptr->addChannel(NO_TILE_SELECTED_CHANNEL);
1149     this->message_hub_ptr->addChannel(TILE_STATE_CHANNEL);
1150     this->message_hub_ptr->addChannel(HEX_MAP_CHANNEL);
1151
1152     std::cout << "HexMap constructed at " << this << std::endl;
1153 }
```

```

1154     return;
1155 }    /* HexMap(), intended */

```

#### 4.6.2.2 ~HexMap()

```

HexMap::~~HexMap (
    void )

```

Destructor for the [HexMap](#) class.

```

1449 {
1450     this->clear();
1451
1452     std::cout << "HexMap at " << this << " destroyed" << std::endl;
1453
1454     return;
1455 }    /* ~HexMap() */

```

### 4.6.3 Member Function Documentation

#### 4.6.3.1 \_\_assembleHexMap()

```

void HexMap::__assembleHexMap (
    void ) [private]

```

Helper method to assemble the hex map.

```

875 {
876     // 1. seed RNG (using milliseconds since 1 Jan 1970)
877     unsigned long long int milliseconds_since_epoch =
878         std::chrono::duration_cast<std::chrono::milliseconds>(
879             std::chrono::system_clock::now().time_since_epoch()
880         ).count();
881     srand(milliseconds_since_epoch);
882
883     // 2. lay tiles
884     this->__layTiles();
885     this->__buildDrawOrderVector();
886
887     // 3. procedurally generate types
888     this->__procedurallyGenerateTileTypes();
889
890     // 4. procedurally generate resources
891     this->__procedurallyGenerateTileResources();
892
893     return;
894 }    /* __assembleHexMap() */

```

#### 4.6.3.2 \_\_assessNeighbours()

```

void HexMap::__assessNeighbours (
    HexTile * hex_ptr ) [private]

```

Helper method to assess all neighbours of the given tile.

## Parameters

<i>Pointer</i>	to the tile whose neighbours are to be assessed.
----------------	--

```

1067 {
1068     std::vector<HexTile*> neighbours_vec = this->__getNeighboursVector(hex_ptr);
1069
1070     for (size_t i = 0; i < neighbours_vec.size(); i++) {
1071         neighbours_vec[i]->assess();
1072     }
1073
1074     return;
1075 } /* __assessNeighbours() */

```

## 4.6.3.3 \_\_buildDrawOrderVector()

```

void HexMap::__buildDrawOrderVector (
    void ) [private]

```

Helper method to build tile drawing order vector.

```

273 {
274     // 1. build temp list of tiles
275     std::list<HexTile*> temp_list;
276
277     std::map<double, std::map<double, HexTile*>>::iterator hex_map_iter_x;
278     std::map<double, HexTile*>::iterator hex_map_iter_y;
279     for (
280         hex_map_iter_x = this->hex_map.begin();
281         hex_map_iter_x != this->hex_map.end();
282         hex_map_iter_x++
283     ) {
284         for (
285             hex_map_iter_y = hex_map_iter_x->second.begin();
286             hex_map_iter_y != hex_map_iter_x->second.end();
287             hex_map_iter_y++
288         ) {
289             temp_list.push_back(hex_map_iter_y->second);
290         }
291     }
292
293     // 2. move elements from temp list to drawing order vector
294     double min_position_y = 0;
295     std::list<HexTile*>::iterator list_iter;
296
297     while (not temp_list.empty()) {
298         // 2.1. determine min y position
299         min_position_y = std::numeric_limits<double>::infinity();
300
301         for (
302             list_iter = temp_list.begin();
303             list_iter != temp_list.end();
304             list_iter++
305         ) {
306             if ((*list_iter)->position_y < min_position_y) {
307                 min_position_y = (*list_iter)->position_y;
308             }
309         }
310
311         // 2.2 move min y list elements to drawing order vec
312         list_iter = temp_list.begin();
313         while (list_iter != temp_list.end()) {
314             if ((*list_iter)->position_y == min_position_y) {
315                 this->hex_draw_order_vec.push_back((*list_iter));
316                 list_iter = temp_list.erase(list_iter);
317             }
318             else {
319                 list_iter++;
320             }
321         }
322     }
323
324     return;
325 } /* __buildDrawOrderVector() */

```

#### 4.6.3.4 \_\_enforceOceanContinuity()

```
void HexMap::__enforceOceanContinuity (
    void ) [private]
```

Helper method to scan tiles and enforce ocean continuity. That is to say, if a lake tile is found to be in contact with an ocean tile, then it becomes ocean.

```
786 {
787     std::cout << "enforcing ocean continuity ..." << std::endl;
788
789     bool tile_changed = false;
790
791     // 1. scan tiles and enforce (where appropriate)
792     std::map<double, std::map<double, HexTile*>::iterator hex_map_iter_x;
793     std::map<double, HexTile*>::iterator hex_map_iter_y;
794     HexTile* hex_ptr;
795     for (
796         hex_map_iter_x = this->hex_map.begin();
797         hex_map_iter_x != this->hex_map.end();
798         hex_map_iter_x++
799     ) {
800         for (
801             hex_map_iter_y = hex_map_iter_x->second.begin();
802             hex_map_iter_y != hex_map_iter_x->second.end();
803             hex_map_iter_y++
804         ) {
805             hex_ptr = hex_map_iter_y->second;
806
807             if (this->__isLakeTouchingOcean(hex_ptr)) {
808                 hex_ptr->setTileType(TileType :: OCEAN);
809                 tile_changed = true;
810             }
811         }
812     }
813
814     if (tile_changed) {
815         this->__enforceOceanContinuity();
816     }
817     else {
818         return;
819     }
820 } /* __enforceOceanContinuity() */
```

#### 4.6.3.5 \_\_getMajorityTileType()

```
TileType HexMap::__getMajorityTileType (
    HexTile * hex_ptr ) [private]
```

Function to return majority tile type of a tile and its neighbours. If no clear majority, simply returns the type of the given tile.

##### Parameters

<i>hex_ptr</i>	Pointer to the given tile.
----------------	----------------------------

##### Returns

The majority tile type of the tile and its neighbours. If no clear majority type, then the type of the given tile is simply returned.

```
642 {
643     // 1. init type count map
644     std::map<TileType, int> type_count_map;
645     type_count_map[hex_ptr->tile_type] = 1;
646
647     // 2. survey neighbours, count type instances
```

```

648     std::vector<HexTile*> neighbours_vec = this->__getNeighboursVector(hex_ptr);
649
650     for (size_t i = 0; i < neighbours_vec.size(); i++) {
651         if (type_count_map.count(neighbours_vec[i]->tile_type) <= 0) {
652             type_count_map[neighbours_vec[i]->tile_type] = 1;
653         }
654         else {
655             type_count_map[neighbours_vec[i]->tile_type] += 1;
656         }
657     }
658
659     // 3. find majority tile type
660     int max_count = -1 * std::numeric_limits<int>::infinity();
661     TileType majority_tile_type = hex_ptr->tile_type;
662
663     std::map<TileType, int>::iterator map_iter;
664     for (
665         map_iter = type_count_map.begin();
666         map_iter != type_count_map.end();
667         map_iter++
668     ){
669         if (map_iter->second > max_count) {
670             max_count = map_iter->second;
671             majority_tile_type = map_iter->first;
672         }
673     }
674
675     // 4. detect ties
676     for (
677         map_iter = type_count_map.begin();
678         map_iter != type_count_map.end();
679         map_iter++
680     ){
681         if (
682             map_iter->second == max_count and
683             map_iter->first != majority_tile_type
684         ) {
685             majority_tile_type = hex_ptr->tile_type;
686             break;
687         }
688     }
689
690     return majority_tile_type;
691 } /* __getMajorityTileType() */

```

#### 4.6.3.6 \_\_getNeighboursVector()

```

std::vector< HexTile * > HexMap::__getNeighboursVector (
    HexTile * hex_ptr ) [private]

```

Helper method to assemble a vector pointers to all neighbours of the given tile.

##### Parameters

<i>hex_ptr</i>	A pointer to the given tile.
----------------	------------------------------

##### Returns

A vector of pointers to all neighbours of the given tile.

```

584 {
585     std::vector<HexTile*> neighbours_vec;
586
587     // 1. build potential neighbour positions
588     std::vector<double> potential_neighbour_x_vec(6, 0);
589     std::vector<double> potential_neighbour_y_vec(6, 0);
590
591     for (int i = 0; i < 6; i++) {
592         potential_neighbour_x_vec[i] = hex_ptr->position_x +
593             2 * hex_ptr->minor_radius * cos((60 * i) * (M_PI / 180));
594
595         potential_neighbour_y_vec[i] = hex_ptr->position_y +

```

```

596         2 * hex_ptr->minor_radius * sin((60 * i) * (M_PI / 180));
597     }
598
599     // 2. populate neighbours vector
600     std::vector<double> map_index_positions;
601     double potential_x = 0;
602     double potential_y = 0;
603
604     for (int i = 0; i < 6; i++) {
605         potential_x = potential_neighbour_x_vec[i];
606         potential_y = potential_neighbour_y_vec[i];
607
608         map_index_positions = this->__getValidMapIndexPositions(
609             potential_x,
610             potential_y
611         );
612
613         if (not (map_index_positions[0] == -1)) {
614             neighbours_vec.push_back(
615                 this->hex_map[map_index_positions[0]][map_index_positions[1]]
616             );
617         }
618     }
619
620     return neighbours_vec;
621 } /* __getNeighbourVector() */

```

#### 4.6.3.7 \_\_getNoise()

```

std::vector< double > HexMap::__getNoise (
    int n_elements,
    int n_components = 128 ) [private]

```

Helper method to generate a vector of noise, with values mapped to the closed interval [0, 1]. Applies a random cosine series approach.

##### Parameters

<i>n_elements</i>	The number of elements in the generated noise vector.
<i>n_components</i>	The number of components to use in the random cosine series. Defaults to 64.

##### Returns

A vector of noise, with values mapped to the closed interval [0, 1].

```

349 {
350     // 1. generate random amplitude, wave number, direction, and phase vectors
351     std::vector<double> random_amplitude_vec(n_components, 0);
352     std::vector<double> random_wave_number_vec(n_components, 0);
353     std::vector<double> random_frequency_vec(n_components, 0);
354     std::vector<double> random_direction_vec(n_components, 0);
355     std::vector<double> random_phase_vec(n_components, 0);
356
357     for (int i = 0; i < n_components; i++) {
358         random_amplitude_vec[i] = 10 * ((double)rand() / RAND_MAX);
359
360         random_wave_number_vec[i] = 2 * M_PI * ((double)rand() / RAND_MAX);
361
362         random_frequency_vec[i] = ((double)rand() / RAND_MAX);
363
364         random_direction_vec[i] = 2 * M_PI * ((double)rand() / RAND_MAX);
365
366         random_phase_vec[i] = 2 * M_PI * ((double)rand() / RAND_MAX);
367     }
368
369     // 2. generate noise vec
370     double amp = 0;
371     double wave_no = 0;
372     double freq = 0;
373     double dir = 0;

```



```

374     double phase = 0;
375
376     double x = 0;
377     double y = 0;
378     double t = time(NULL);
379
380     double max_noise = -1 * std::numeric_limits<double>::infinity();
381     double min_noise = std::numeric_limits<double>::infinity();
382
383     double noise = 0;
384     std::vector<double> noise_vec(n_elements, 0);
385
386     for (int i = 0; i < n_elements; i++) {
387         x = this->tile_position_x_vec[i] - this->position_x;
388         y = this->tile_position_y_vec[i] - this->position_y;
389
390         for (int j = 0; j < n_components; j++) {
391             amp = random_amplitude_vec[j];
392             wave_no = random_wave_number_vec[j];
393             freq = random_frequency_vec[j];
394             dir = random_direction_vec[j];
395             phase = random_phase_vec[j];
396
397             noise += (amp / (j + 1)) * cos(
398                 wave_no * (j + 1) * (x * sin(dir) + y * cos(dir)) +
399                 2 * M_PI * (j + 1) * freq * t +
400                 phase
401             );
402         }
403
404         noise_vec[i] = noise;
405
406         if (noise > max_noise) {
407             max_noise = noise;
408         }
409
410         else if (noise < min_noise) {
411             min_noise = noise;
412         }
413
414         noise = 0;
415     }
416
417     // 3. normalize noise vec
418     for (int i = 0; i < n_elements; i++) {
419         noise_vec[i] = (noise_vec[i] - min_noise) / (max_noise - min_noise);
420
421         if (noise_vec[i] < 0) {
422             noise_vec[i] = 0;
423         }
424         else if (noise_vec[i] > 1) {
425             noise_vec[i] = 1;
426         }
427     }
428
429     return noise_vec;
430 } /* __getNoise() */

```

#### 4.6.3.8 \_\_getSelectedTile()

```

HexTile * HexMap::__getSelectedTile (
    void ) [private]

```

Helper method to get pointer to selected tile.

#### Returns

Pointer to selected tile (or NULL if no tile selected).

```

911 {
912     HexTile* selected_tile_ptr = NULL;
913
914     bool break_flag = false;
915     std::map<double, std::map<double, HexTile*>::iterator hex_map_iter_x;
916     std::map<double, HexTile*>::iterator hex_map_iter_y;
917

```

```

918     for (
919         hex_map_iter_x = this->hex_map.begin();
920         hex_map_iter_x != this->hex_map.end();
921         hex_map_iter_x++
922     ) {
923         for (
924             hex_map_iter_y = hex_map_iter_x->second.begin();
925             hex_map_iter_y != hex_map_iter_x->second.end();
926             hex_map_iter_y++
927         ) {
928             if (hex_map_iter_y->second->is_selected) {
929                 selected_tile_ptr = hex_map_iter_y->second;
930                 break_flag = true;
931             }
932
933             if (break_flag) {
934                 break;
935             }
936         }
937
938         if (break_flag) {
939             break;
940         }
941     }
942
943     return selected_tile_ptr;
944 } /* __getSelectedTile() */

```

#### 4.6.3.9 \_\_getValidMapIndexPositions()

```

std::vector< double > HexMap::__getValidMapIndexPositions (
    double potential_x,
    double potential_y ) [private]

```

Helper method to translate given position into valid index position for a.

##### Parameters

<i>potential_x</i>	The potential x position of the tile.
<i>potential_y</i>	The potential y position of the tile.

##### Returns

A vector of positions, either valid for indexing into the hex map, or sentinel values (-1) if invalid.

```

530 {
531     std::vector<double> map_index_positions = {-1, -1};
532
533     std::map<double, std::map<double, HexTile*>::iterator hex_map_iter_x;
534     std::map<double, HexTile*>::iterator hex_map_iter_y;
535     HexTile* hex_ptr;
536
537     double distance = 0;
538
539     for (
540         hex_map_iter_x = this->hex_map.begin();
541         hex_map_iter_x != this->hex_map.end();
542         hex_map_iter_x++
543     ) {
544         for (
545             hex_map_iter_y = hex_map_iter_x->second.begin();
546             hex_map_iter_y != hex_map_iter_x->second.end();
547             hex_map_iter_y++
548         ) {
549             hex_ptr = hex_map_iter_y->second;
550
551             distance = sqrt(

```

```

552             pow(hex_ptr->position_x - potential_x, 2) +
553             pow(hex_ptr->position_y - potential_y, 2)
554         );
555
556         if (distance <= hex_ptr->minor_radius / 4) {
557             map_index_positions = {hex_ptr->position_x, hex_ptr->position_y};
558             return map_index_positions;
559         }
560     }
561 }
562
563 return map_index_positions;
564 } /* __isInHexMap() */

```

#### 4.6.3.10 \_\_handleKeyPressEvents()

```

void HexMap::__handleKeyPressEvents (
    void ) [private]

```

Helper method to handle key press events.

```

959 {
960     switch (this->event_ptr->key.code) {
961         case (sf::Keyboard::Escape): {
962             this->tile_selected = false;
963         }
964
965
966         default: {
967             // do nothing!
968
969             break;
970         }
971     }
972
973     return;
974 } /* __handleKeyPressEvents() */

```

#### 4.6.3.11 \_\_handleMouseButtonEvents()

```

void HexMap::__handleMouseButtonEvents (
    void ) [private]

```

Helper method to handle mouse button events.

```

989 {
990     switch (this->event_ptr->mouseButton.button) {
991         case (sf::Mouse::Left): {
992             HexTile* hex_ptr = this->__getSelectedTile();
993
994             if (hex_ptr != NULL) {
995                 this->tile_selected = true;
996             }
997
998             else if (this->tile_selected) {
999                 this->tile_selected = false;
1000                 this->__sendNoTileSelectedMessage();
1001             }
1002
1003             break;
1004         }
1005
1006
1007         case (sf::Mouse::Right): {
1008             if (this->tile_selected) {
1009                 this->tile_selected = false;
1010                 this->__sendNoTileSelectedMessage();
1011             }
1012
1013             break;
1014         }

```

```

1015
1016
1017         default: {
1018             // do nothing!
1019
1020             break;
1021         }
1022     }
1023
1024     return;
1025 } /* __handleMouseButtonEvents() */

```

#### 4.6.3.12 \_\_isLakeTouchingOcean()

```

bool HexMap::__isLakeTouchingOcean (
    HexTile * hex_ptr ) [private]
753 {
754     // 1. if not lake tile, return
755     if (not (hex_ptr->tile_type == TileType :: LAKE)) {
756         return false;
757     }
758
759     // 2. scan neighbours for ocean tiles
760     std::vector<HexTile*> neighbours_vec = this->__getNeighboursVector(hex_ptr);
761
762     for (size_t i = 0; i < neighbours_vec.size(); i++) {
763         if (neighbours_vec[i]->tile_type == TileType :: OCEAN) {
764             return true;
765         }
766     }
767
768     return false;
769 } /* __isLakeTouchingOcean() */

```

#### 4.6.3.13 \_\_layTiles()

```

void HexMap::__layTiles (
    void ) [private]

```

Helper method to lay the hex tiles down to generate the game world.

```

88 {
89     this->n_tiles = 0;
90
91     // 1. add origin tile
92     HexTile* hex_ptr = new HexTile(
93         this->position_x,
94         this->position_y,
95         this->event_ptr,
96         this->render_window_ptr,
97         this->assets_manager_ptr,
98         this->message_hub_ptr
99     );
100
101     this->hex_map[hex_ptr->position_x][hex_ptr->position_y] = hex_ptr;
102     this->tile_position_x_vec.push_back(hex_ptr->position_x);
103     this->tile_position_y_vec.push_back(hex_ptr->position_y);
104     this->n_tiles++;
105
106
107     // 2. fill out first row (reflect across origin tile)
108     for (int i = 0; i < this->n_layers; i++) {
109         hex_ptr = new HexTile(
110             this->position_x + 2 * (i + 1) * hex_ptr->minor_radius,
111             this->position_y,
112             this->event_ptr,
113             this->render_window_ptr,
114             this->assets_manager_ptr,
115             this->message_hub_ptr
116         );
117

```

```

118     this->hex_map[hex_ptr->position_x][hex_ptr->position_y] = hex_ptr;
119     this->tile_position_x_vec.push_back(hex_ptr->position_x);
120     this->tile_position_y_vec.push_back(hex_ptr->position_y);
121     this->n_tiles++;
122
123     if (i == this->n_layers - 1) {
124         this->border_tiles_vec.push_back(hex_ptr);
125     }
126
127     hex_ptr = new HexTile(
128         this->position_x - 2 * (i + 1) * hex_ptr->minor_radius,
129         this->position_y,
130         this->event_ptr,
131         this->render_window_ptr,
132         this->assets_manager_ptr,
133         this->message_hub_ptr
134     );
135
136     this->hex_map[hex_ptr->position_x][hex_ptr->position_y] = hex_ptr;
137     this->tile_position_x_vec.push_back(hex_ptr->position_x);
138     this->tile_position_y_vec.push_back(hex_ptr->position_y);
139     this->n_tiles++;
140
141     if (i == this->n_layers - 1) {
142         this->border_tiles_vec.push_back(hex_ptr);
143     }
144 }
145
146 // 3. fill out subsequent rows (reflect across first row)
147 HexTile* first_row_left_tile = hex_ptr;
148
149 int offset_count = 1;
150
151 double x_offset = 0;
152 double y_offset = 0;
153
154 for (
155     int row_width = 2 * this->n_layers;
156     row_width > this->n_layers;
157     row_width--
158 ) {
159     // 3.1. upper row
160     x_offset = first_row_left_tile->position_x +
161         2 * offset_count * first_row_left_tile->minor_radius *
162         cos(60 * (M_PI / 180));
163
164     y_offset = first_row_left_tile->position_y -
165         2 * offset_count * first_row_left_tile->minor_radius *
166         sin(60 * (M_PI / 180));
167
168     hex_ptr = new HexTile(
169         x_offset,
170         y_offset,
171         this->event_ptr,
172         this->render_window_ptr,
173         this->assets_manager_ptr,
174         this->message_hub_ptr
175     );
176
177     this->hex_map[hex_ptr->position_x][hex_ptr->position_y] = hex_ptr;
178     this->tile_position_x_vec.push_back(hex_ptr->position_x);
179     this->tile_position_y_vec.push_back(hex_ptr->position_y);
180     this->n_tiles++;
181
182     this->border_tiles_vec.push_back(hex_ptr);
183
184     for (int i = 1; i < row_width; i++) {
185         x_offset += 2 * first_row_left_tile->minor_radius;
186
187         hex_ptr = new HexTile(
188             x_offset,
189             y_offset,
190             this->event_ptr,
191             this->render_window_ptr,
192             this->assets_manager_ptr,
193             this->message_hub_ptr
194         );
195
196         this->hex_map[hex_ptr->position_x][hex_ptr->position_y] = hex_ptr;
197         this->tile_position_x_vec.push_back(hex_ptr->position_x);
198         this->tile_position_y_vec.push_back(hex_ptr->position_y);
199         this->n_tiles++;
200
201         if (row_width == this->n_layers + 1 or i == row_width - 1) {
202             this->border_tiles_vec.push_back(hex_ptr);
203         }
204     }

```

```

205     }
206
207     // 3.2. lower row
208     x_offset = first_row_left_tile->position_x +
209         2 * offset_count * first_row_left_tile->minor_radius *
210         cos(60 * (M_PI / 180));
211
212     y_offset = first_row_left_tile->position_y +
213         2 * offset_count * first_row_left_tile->minor_radius *
214         sin(60 * (M_PI / 180));
215
216     hex_ptr = new HexTile(
217         x_offset,
218         y_offset,
219         this->event_ptr,
220         this->render_window_ptr,
221         this->assets_manager_ptr,
222         this->message_hub_ptr
223     );
224
225     this->hex_map[hex_ptr->position_x][hex_ptr->position_y] = hex_ptr;
226     this->tile_position_x_vec.push_back(hex_ptr->position_x);
227     this->tile_position_y_vec.push_back(hex_ptr->position_y);
228     this->n_tiles++;
229
230     this->border_tiles_vec.push_back(hex_ptr);
231
232     for (int i = 1; i < row_width; i++) {
233         x_offset += 2 * first_row_left_tile->minor_radius;
234
235         hex_ptr = new HexTile(
236             x_offset,
237             y_offset,
238             this->event_ptr,
239             this->render_window_ptr,
240             this->assets_manager_ptr,
241             this->message_hub_ptr
242         );
243
244         this->hex_map[hex_ptr->position_x][hex_ptr->position_y] = hex_ptr;
245         this->tile_position_x_vec.push_back(hex_ptr->position_x);
246         this->tile_position_y_vec.push_back(hex_ptr->position_y);
247         this->n_tiles++;
248
249         if (row_width == this->n_layers + 1 or i == row_width - 1) {
250             this->border_tiles_vec.push_back(hex_ptr);
251         }
252     }
253
254     offset_count++;
255 }
256
257 return;
258 } /* __layTiles() */

```

#### 4.6.3.14 \_\_procedurallyGenerateTileResources()

```

void HexMap::__procedurallyGenerateTileResources (
    void ) [private]

```

Helper method to procedurally generate tile resources and set tiles accordingly.

```

835 {
836     // 1. get random cosine series noise vec
837     std::vector<double> noise_vec = this->__getNoise(this->n_tiles);
838
839     // 2. set tile resources based on random cosine series noise
840     int noise_idx = 0;
841
842     std::map<double, std::map<double, HexTile*>::iterator hex_map_iter_x;
843     std::map<double, HexTile*>::iterator hex_map_iter_y;
844     for (
845         hex_map_iter_x = this->hex_map.begin();
846         hex_map_iter_x != this->hex_map.end();
847         hex_map_iter_x++
848     ) {
849         for (
850             hex_map_iter_y = hex_map_iter_x->second.begin();
851             hex_map_iter_y != hex_map_iter_x->second.end();

```

```

852         hex_map_iter_y++
853     ) {
854         hex_map_iter_y->second->setTileResource(noise_vec[noise_idx]);
855         noise_idx++;
856     }
857 }
858
859 return;
860 } /* __procedurallyGenerateTileResources() */

```

#### 4.6.3.15 \_\_procedurallyGenerateTileTypes()

```

void HexMap::__procedurallyGenerateTileTypes (
    void ) [private]

```

Helper method to procedurally generate tile types and set tiles accordingly.

```

445 {
446     // 1. get random cosine series noise vec
447     std::vector<double> noise_vec = this->__getNoise(this->n_tiles);
448
449     // 2. set initial tile types based on either random cosine series noise or white
450     //     noise (decided by coin toss)
451     int noise_idx = 0;
452
453     std::map<double, std::map<double, HexTile*>::iterator hex_map_iter_x;
454     std::map<double, HexTile*>::iterator hex_map_iter_y;
455     for (
456         hex_map_iter_x = this->hex_map.begin();
457         hex_map_iter_x != this->hex_map.end();
458         hex_map_iter_x++
459     ) {
460         for (
461             hex_map_iter_y = hex_map_iter_x->second.begin();
462             hex_map_iter_y != hex_map_iter_x->second.end();
463             hex_map_iter_y++
464         ) {
465             if ((double)rand() / RAND_MAX > 0.5) {
466                 hex_map_iter_y->second->setTileType(noise_vec[noise_idx]);
467             }
468             else {
469                 hex_map_iter_y->second->setTileType((double)rand() / RAND_MAX);
470             }
471             noise_idx++;
472         }
473     }
474
475     // 3. smooth tile types (majority rules)
476     this->__smoothTileTypes();
477
478     // 4. set border tile type to ocean
479     for (size_t i = 0; i < this->border_tiles_vec.size(); i++) {
480         this->border_tiles_vec[i]->setTileType(TileType :: OCEAN);
481     }
482
483     // 5. enforce ocean continuity (i.e. all lake tiles touching ocean become ocean)
484     this->__enforceOceanContinuity();
485
486     // 6. decorate tiles
487     for (
488         hex_map_iter_x = this->hex_map.begin();
489         hex_map_iter_x != this->hex_map.end();
490         hex_map_iter_x++
491     ) {
492         for (
493             hex_map_iter_y = hex_map_iter_x->second.begin();
494             hex_map_iter_y != hex_map_iter_x->second.end();
495             hex_map_iter_y++
496         ) {
497             hex_map_iter_y->second->decorateTile();
498         }
499     }
500
501     return;
502 } /* __procedurallyGenerateTileTypes() */

```

#### 4.6.3.16 \_\_sendNoTileSelectedMessage()

```
void HexMap::__sendNoTileSelectedMessage (
    void ) [private]
```

Helper method to format and send message on no tile selected.

```
1040 {
1041     Message no_tile_selected_message;
1042
1043     no_tile_selected_message.channel = NO_TILE_SELECTED_CHANNEL;
1044     no_tile_selected_message.subject = "no tile selected";
1045
1046     this->message_hub_ptr->sendMessage(no_tile_selected_message);
1047
1048     std::cout << "No tile selected message sent by " << this << std::endl;
1049     return;
1050 } /* __sendNoTileSelectedMessage() */
```

#### 4.6.3.17 \_\_setUpGlassScreen()

```
void HexMap::__setUpGlassScreen (
    void ) [private]
```

Helper method to set up glass screen effect (drawable).

```
68 {
69     this->glass_screen.setSize(sf::Vector2f(GAME_WIDTH, GAME_HEIGHT));
70     this->glass_screen.setFillColor(sf::Color(MONOCROME_SCREEN_BACKGROUND));
71
72     return;
73 } /* __setUpGlassScreen() */
```

#### 4.6.3.18 \_\_smoothTileTypes()

```
void HexMap::__smoothTileTypes (
    void ) [private]
```

Helper method to smooth tile types using a majority rules approach.

```
706 {
707     std::cout << "smoothing ..." << std::endl;
708
709     std::map<double, std::map<double, HexTile*>::iterator hex_map_iter_x;
710     std::map<double, HexTile*>::iterator hex_map_iter_y;
711     HexTile* hex_ptr;
712     TileType majority_tile_type;
713
714     for (
715         hex_map_iter_x = this->hex_map.begin();
716         hex_map_iter_x != this->hex_map.end();
717         hex_map_iter_x++
718     ) {
719         for (
720             hex_map_iter_y = hex_map_iter_x->second.begin();
721             hex_map_iter_y != hex_map_iter_x->second.end();
722             hex_map_iter_y++
723         ) {
724             hex_ptr = hex_map_iter_y->second;
725             majority_tile_type = this->__getMajorityTileType(hex_ptr);
726
727             if (majority_tile_type != hex_ptr->tile_type) {
728                 hex_ptr->setTileType(majority_tile_type);
729             }
730         }
731     }
732
733     return;
734 } /* __smoothTileTypes() */
```



#### 4.6.3.19 assess()

```
void HexMap::assess (
    void )
```

Method to assess the resource of the selected tile.

```
1170 {
1171     HexTile* selected_tile_ptr = this->__getSelectedTile();
1172     if (selected_tile_ptr != NULL) {
1173         selected_tile_ptr->assess();
1174     }
1175
1176     return;
1177 } /* assess() */
```

#### 4.6.3.20 clear()

```
void HexMap::clear (
    void )
```

Method to clear the hex map.

```
1411 {
1412     std::map<double, std::map<double, HexTile*>::iterator hex_map_iter_x;
1413     std::map<double, HexTile*>::iterator hex_map_iter_y;
1414     for (
1415         hex_map_iter_x = this->hex_map.begin();
1416         hex_map_iter_x != this->hex_map.end();
1417         hex_map_iter_x++
1418     ) {
1419         for (
1420             hex_map_iter_y = hex_map_iter_x->second.begin();
1421             hex_map_iter_y != hex_map_iter_x->second.end();
1422             hex_map_iter_y++
1423         ) {
1424             delete hex_map_iter_y->second;
1425         }
1426     }
1427     this->hex_map.clear();
1428
1429     this->tile_position_x_vec.clear();
1430     this->tile_position_y_vec.clear();
1431     this->border_tiles_vec.clear();
1432
1433     return;
1434 } /* clear() */
```

#### 4.6.3.21 draw()

```
void HexMap::draw (
    void )
```

Method to draw the hex map to the render window. To be called once per frame.

```
1348 {
1349     // 1. draw background
1350     sf::Color glass_screen_colour = this->glass_screen.getFillColor();
1351     glass_screen_colour.a = 255;
1352     this->glass_screen.setFillColor(glass_screen_colour);
1353
1354     this->render_window_ptr->draw(this->glass_screen);
1355
1356     // 2. draw tiles (other than the selected tile) in drawing order
1357     for (size_t i = 0; i < this->hex_draw_order_vec.size(); i++) {
1358         if (not this->hex_draw_order_vec[i]->is_selected) {
1359             this->hex_draw_order_vec[i]->draw();
1360         }
1361     }
```

```

1362
1363 // 3. draw selected tile
1364 HexTile* selected_tile_ptr = this->__getSelectedTile();
1365 if (selected_tile_ptr != NULL) {
1366     selected_tile_ptr->draw();
1367 }
1368
1369 // 4. draw resource overlay text indication
1370 if (this->show_resource) {
1371     sf::Text resource_overlay_text(
1372         "**** RENEWABLE RESOURCE OVERLAY ****",
1373         *(this->assets_manager_ptr->getFont("Glass_TTY_VT220")),
1374         16
1375     );
1376
1377     resource_overlay_text.setPosition(
1378         (800 - resource_overlay_text.getLocalBounds().width) / 2,
1379         GAME_HEIGHT - 70
1380     );
1381
1382     resource_overlay_text.setFillColor(MONOCHROME_TEXT_GREEN);
1383
1384     this->render_window_ptr->draw(resource_overlay_text);
1385 }
1386
1387 // 5. draw glass screen
1388 glass_screen_colour = this->glass_screen.getFillColor();
1389 glass_screen_colour.a = 40;
1390 this->glass_screen.setFillColor(glass_screen_colour);
1391
1392 this->render_window_ptr->draw(this->glass_screen);
1393
1394 this->frame++;
1395 return;
1396 } /* draw() */

```

#### 4.6.3.22 processEvent()

```

void HexMap::processEvent (
    void )

```

Method to process [HexMap](#). To be called once per event.

```

1255 {
1256     // 1. process HexTile events
1257     std::map<double, std::map<double, HexTile*>::iterator hex_map_iter_x;
1258     std::map<double, HexTile*>::iterator hex_map_iter_y;
1259     for (
1260         hex_map_iter_x = this->hex_map.begin();
1261         hex_map_iter_x != this->hex_map.end();
1262         hex_map_iter_x++
1263     ) {
1264         for (
1265             hex_map_iter_y = hex_map_iter_x->second.begin();
1266             hex_map_iter_y != hex_map_iter_x->second.end();
1267             hex_map_iter_y++
1268         ) {
1269             hex_map_iter_y->second->processEvent();
1270         }
1271     }
1272
1273     // 2. process HexMap events
1274     if (this->event_ptr->type == sf::Event::KeyPressed) {
1275         this->__handleKeyPressEvents();
1276     }
1277
1278     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
1279         this->__handleMouseButtonEvents();
1280     }
1281
1282     return;
1283 } /* processEvent() */

```

#### 4.6.3.23 processMessage()

```
void HexMap::processMessage (
    void )
```

Method to process [HexMap](#). To be called once per message.

```
1298 {
1299     // 1. process HexTile messages
1300     std::map<double, std::map<double, HexTile*>::iterator hex_map_iter_x;
1301     std::map<double, HexTile*>::iterator hex_map_iter_y;
1302     for (
1303         hex_map_iter_x = this->hex_map.begin();
1304         hex_map_iter_x != this->hex_map.end();
1305         hex_map_iter_x++
1306     ) {
1307         for (
1308             hex_map_iter_y = hex_map_iter_x->second.begin();
1309             hex_map_iter_y != hex_map_iter_x->second.end();
1310             hex_map_iter_y++
1311         ) {
1312             hex_map_iter_y->second->processMessage();
1313         }
1314     }
1315
1316     // 2. process HexMap messages
1317     if (not this->message_hub_ptr->isEmpty(HEX_MAP_CHANNEL)) {
1318         Message hex_map_message = this->message_hub_ptr->receiveMessage(
1319             HEX_MAP_CHANNEL
1320         );
1321
1322         if (hex_map_message.subject == "assess neighbours") {
1323             HexTile* hex_ptr = this->__getSelectedTile();
1324             this->__assessNeighbours(hex_ptr);
1325
1326             std::cout << "Assess neighbours message received by " << this << std::endl;
1327             this->message_hub_ptr->popMessage(HEX_MAP_CHANNEL);
1328         }
1329     }
1330
1331     return;
1332 } /* processMessage() */
```

#### 4.6.3.24 reroll()

```
void HexMap::reroll (
    void )
```

Method to re-roll the hex map.

```
1192 {
1193     this->clear();
1194     this->__assembleHexMap();
1195
1196     return;
1197 } /* reroll() */
```

#### 4.6.3.25 toggleResourceOverlay()

```
void HexMap::toggleResourceOverlay (
    void )
```

Method to toggle the hex map resource overlay.

```
1212 {
1213     std::map<double, std::map<double, HexTile*>::iterator hex_map_iter_x;
1214     std::map<double, HexTile*>::iterator hex_map_iter_y;
1215     for (
1216         hex_map_iter_x = this->hex_map.begin();
```

```

1217         hex_map_iter_x != this->hex_map.end();
1218         hex_map_iter_x++
1219     ) {
1220         for (
1221             hex_map_iter_y = hex_map_iter_x->second.begin();
1222             hex_map_iter_y != hex_map_iter_x->second.end();
1223             hex_map_iter_y++
1224         ) {
1225             hex_map_iter_y->second->toggleResourceOverlay();
1226         }
1227     }
1228
1229     if (this->show_resource) {
1230         this->show_resource = false;
1231         this->assets_manager_ptr->getSound("resource overlay toggle off")->play();
1232     }
1233
1234     else {
1235         this->show_resource = true;
1236         this->assets_manager_ptr->getSound("resource overlay toggle on")->play();
1237     }
1238
1239     return;
1240 } /* toggleResourceOverlay() */

```

## 4.6.4 Member Data Documentation

### 4.6.4.1 assets\_manager\_ptr

`AssetsManager*` HexMap::assets\_manager\_ptr [private]

A pointer to the assets manager.

### 4.6.4.2 border\_tiles\_vec

`std::vector<HexTile*>` HexMap::border\_tiles\_vec

A vector of pointers to the border tiles.

### 4.6.4.3 event\_ptr

`sf::Event*` HexMap::event\_ptr [private]

A pointer to the event class.

### 4.6.4.4 frame

`unsigned long long int` HexMap::frame

The current frame of this object.

#### 4.6.4.5 glass\_screen

```
sf::RectangleShape HexMap::glass_screen
```

To give the effect of an old glass screen over the hex map.

#### 4.6.4.6 hex\_draw\_order\_vec

```
std::vector<HexTile*> HexMap::hex_draw_order_vec
```

A vector of hex tiles, in drawing order.

#### 4.6.4.7 hex\_map

```
std::map<double, std::map<double, HexTile*> > HexMap::hex_map
```

A position-indexed, nested map of hex tiles.

#### 4.6.4.8 message\_hub\_ptr

```
MessageHub* HexMap::message_hub_ptr [private]
```

A pointer to the message hub.

#### 4.6.4.9 n\_layers

```
int HexMap::n_layers
```

The number of layers in the hex map.

#### 4.6.4.10 n\_tiles

```
int HexMap::n_tiles
```

The number of tiles in the hex map.

#### 4.6.4.11 position\_x

```
double HexMap::position_x
```

The x position of the hex map's origin (i.e. central) tile.

#### 4.6.4.12 position\_y

```
double HexMap::position_y
```

The y position of the hex map's origin (i.e. central) tile.

#### 4.6.4.13 render\_window\_ptr

```
sf::RenderWindow* HexMap::render_window_ptr [private]
```

A pointer to the render window.

#### 4.6.4.14 show\_resource

```
bool HexMap::show_resource
```

A boolean which indicates whether or not to show resource value.

#### 4.6.4.15 tile\_position\_x\_vec

```
std::vector<double> HexMap::tile_position_x_vec
```

A vector of tile x positions.

#### 4.6.4.16 tile\_position\_y\_vec

```
std::vector<double> HexMap::tile_position_y_vec
```

A vector of tile y position.

## 4.6.4.17 tile\_selected

```
bool HexMap::tile_selected
```

A boolean which indicates if a tile is currently selected.

The documentation for this class was generated from the following files:

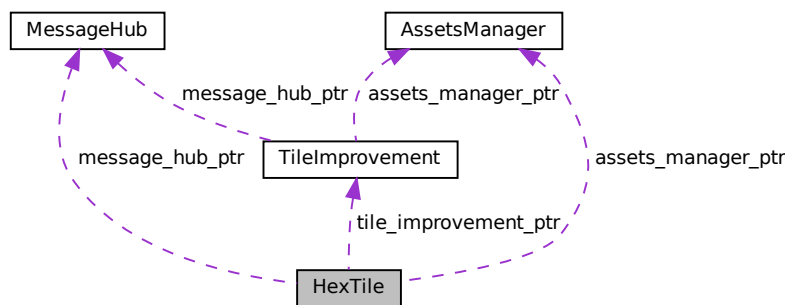
- header/[HexMap.h](#)
- source/[HexMap.cpp](#)

## 4.7 HexTile Class Reference

A class which defines a hex tile of the hex map.

```
#include <HexTile.h>
```

Collaboration diagram for HexTile:



### Public Member Functions

- [HexTile](#) (double, double, sf::Event \*, sf::RenderWindow \*, [AssetsManager](#) \*, [MessageHub](#) \*)  
*Constructor for the [HexTile](#) class.*
- void [setTileType](#) ([TileType](#))  
*Method to set the tile type (by enum value).*
- void [setTileType](#) (double)  
*Method to set the tile type (by numeric input).*
- void [setTileResource](#) ([TileResource](#))  
*Method to set the tile resource (by enum value).*
- void [setTileResource](#) (double)  
*Method to set the tile resource (by numeric input).*
- void [decorateTile](#) (void)  
*Method to decorate tile.*
- void [toggleResourceOverlay](#) (void)  
*Method to toggle the tile resource overlay.*

- void [assess](#) (void)  
*Method to assess the tile's resource.*
- void [processEvent](#) (void)  
*Method to process [HexTile](#). To be called once per event.*
- void [processMessage](#) (void)  
*Method to process [HexTile](#). To be called once per message.*
- void [draw](#) (void)  
*Method to draw the hex tile to the render window. To be called once per frame.*
- [~HexTile](#) (void)  
*Destructor for the [HexTile](#) class.*

## Public Attributes

- [TileType](#) [tile\\_type](#)
- [TileResource](#) [tile\\_resource](#)
- bool [show\\_node](#)  
*A boolean which indicates whether or not to show the tile node.*
- bool [show\\_resource](#)  
*A boolean which indicates whether or not to show resource value.*
- bool [resource\\_assessed](#)  
*A boolean which indicates whether or not the resource has been assessed.*
- bool [resource\\_assessment](#)  
*A boolean which triggers a resource assessment notification.*
- bool [is\\_selected](#)  
*A boolean which indicates whether or not the tile is selected.*
- bool [draw\\_explosion](#)  
*A boolean which indicates whether or not to draw a tile explosion.*
- bool [decoration\\_cleared](#)  
*A boolean which indicates if the tile decoration has been cleared.*
- bool [has\\_improvement](#)  
*A boolean which indicates if tile has improvement or not.*
- [TileImprovement](#) \* [tile\\_improvement\\_ptr](#)  
*A pointer to the improvement for this tile.*
- bool [build\\_menu\\_open](#)  
*A boolean which indicates if the tile build menu is open.*
- size\_t [explosion\\_frame](#)  
*The current frame of the explosion animation.*
- unsigned long long int [frame](#)  
*The current frame of this object.*
- int [credits](#)  
*The current balance of credits.*
- int [scrap\\_improvement\\_frame](#)  
*A frame for key-hold to confirm scrapping.*
- double [position\\_x](#)  
*The x position of the tile.*
- double [position\\_y](#)  
*The y position of the tile.*
- double [major\\_radius](#)  
*The radius of the smallest bounding circle.*
- double [minor\\_radius](#)



- The radius of the largest inscribed circle.*

  - `std::string` [game\\_phase](#)

*The current phase of the game.*
- `sf::CircleShape` [node\\_sprite](#)

*A circle shape to mark the tile node.*
- `sf::ConvexShape` [tile\\_sprite](#)

*A convex shape which represents the tile.*
- `sf::ConvexShape` [select\\_outline\\_sprite](#)

*A convex shape which outlines the tile when selected.*
- `sf::CircleShape` [resource\\_chip\\_sprite](#)

*A circle shape which represents a resource chip.*
- `sf::Text` [resource\\_text](#)

*A text representation of the resource.*
- `sf::Sprite` [tile\\_decoration\\_sprite](#)

*A tile decoration sprite.*
- `sf::Sprite` [magnifying\\_glass\\_sprite](#)

*A magnifying glass sprite.*
- `std::vector< sf::Sprite >` [explosion\\_sprite\\_reel](#)

*A reel of sprites for a tile explosion animation.*
- `sf::RectangleShape` [build\\_menu\\_backing](#)

*A backing for the tile build menu.*
- `sf::Text` [build\\_menu\\_backing\\_text](#)

*A text label for the build menu.*
- `std::vector< std::vector< sf::Sprite > >` [build\\_menu\\_options\\_vec](#)

*A vector of sprites for illustrating the tile build options.*
- `std::vector< sf::Text >` [build\\_menu\\_options\\_text\\_vec](#)

*A vector of text for the tile build options.*

## Private Member Functions

- `void` [\\_\\_setUpNodeSprite](#) (`void`)

*Helper method to set up node sprite.*
- `void` [\\_\\_setUpTileSprite](#) (`void`)

*Helper method to set up tile sprite.*
- `void` [\\_\\_setUpSelectOutlineSprite](#) (`void`)

*Helper method to set up select outline sprite.*
- `void` [\\_\\_setUpResourceChipSprite](#) (`void`)

*Helper method to set up resource chip sprite.*
- `void` [\\_\\_setResourceText](#) (`void`)

*Helper method to set up resource text.*
- `void` [\\_\\_setUpMagnifyingGlassSprite](#) (`void`)

*Helper method to set up and position magnifying glass sprite.*
- `void` [\\_\\_setUpTileExplosionReel](#) (`void`)

*Helper method to set up tile explosion sprite reel.*
- `void` [\\_\\_setUpBuildOption](#) (`std::string`, `std::string`)

*Helper method to set up and position the sprite and text for a build option.*
- `void` [\\_\\_setUpDieselGeneratorBuildOption](#) (`void`)

*Helper method to set up and position the diesel generator build option.*
- `void` [\\_\\_setUpWindTurbineBuildOption](#) (`bool=false`, `bool=false`)

*Helper method to set up and position the wind turbine build option.*

- void [\\_\\_setUpSolarPVBuildOption](#) (bool=false)  
*Helper method to set up and position the solar PV array build option.*
- void [\\_\\_setUpTidalTurbineBuildOption](#) (void)  
*Helper method to set up and position the tidal turbine build option.*
- void [\\_\\_setUpWaveEnergyConverterBuildOption](#) (void)  
*Helper method to set up and position the wave energy converter build option.*
- void [\\_\\_setUpEnergyStorageSystemBuildOption](#) (void)  
*Helper method to set up and position the wave energy converter build option.*
- void [\\_\\_setUpBuildMenu](#) (void)  
*Helper method to set up and place build menu assets (drawable).*
- void [\\_\\_setIsSelected](#) (bool)  
*Helper method to set the is selected attribute (of tile and improvement).*
- void [\\_\\_clearDecoration](#) (void)  
*Helper method to clear tile decoration.*
- bool [\\_\\_isClicked](#) (void)  
*Helper method to determine if tile was clicked on.*
- void [\\_\\_handleKeyPressEvents](#) (void)  
*Helper method to handle key press events.*
- void [\\_\\_handleKeyReleaseEvents](#) (void)
- void [\\_\\_handleMouseButtonEvents](#) (void)  
*Helper method to handle mouse button events.*
- void [\\_\\_openBuildMenu](#) (void)  
*Helper method to open the tile improvement build menu.*
- void [\\_\\_closeBuildMenu](#) (void)  
*Helper method to close the tile improvement build menu.*
- void [\\_\\_buildSettlement](#) (void)  
*Helper method to build a settlement on this tile.*
- void [\\_\\_buildDieselGenerator](#) (void)  
*Helper method to build a diesel generator on this tile.*
- void [\\_\\_buildSolarPV](#) (void)  
*Helper method to build a solar PV array on this tile.*
- void [\\_\\_buildWindTurbine](#) (void)  
*Helper method to build a wind turbine on this tile.*
- void [\\_\\_buildTidalTurbine](#) (void)  
*Helper method to build a tidal turbine on this tile.*
- void [\\_\\_buildWaveEnergyConverter](#) (void)  
*Helper method to build a wave energy converter on this tile.*
- void [\\_\\_buildEnergyStorage](#) (void)  
*Helper method to build an energy storage system on this tile.*
- void [\\_\\_scrapImprovement](#) (void)  
*Helper method to scrap the tile improvement ([Settlement](#) cannot be scrapped). Requires the mapped key to be held continuously to confirm.*
- void [\\_\\_sendTileSelectedMessage](#) (void)  
*Helper method to format and send message on tile selection.*
- std::string [\\_\\_getTileCoordsSubstring](#) (void)  
*Helper method to assemble and return tile coordinates substring.*
- std::string [\\_\\_getTileTypeSubstring](#) (void)  
*Helper method to assemble and return tile type substring.*
- std::string [\\_\\_getTileResourceSubstring](#) (void)  
*Helper method to assemble and return tile resource substring.*
- std::string [\\_\\_getTileImprovementSubstring](#) (void)

- Helper method to assemble and return the tile improvement substring.*
- `std::string __getTileOptionsSubstring` (void)
- Helper method to assemble and return tile options substring.*
- `void __sendTileStateMessage` (void)
- Helper method to format and send tile state message.*
- `void __sendAssessNeighboursMessage` (void)
- Helper method to format and send assess neighbours message.*
- `void __sendGameStateRequest` (void)
- Helper method to format and send a game state request (message).*
- `void __sendUpdateGamePhaseMessage` (std::string)
- Helper method to format and send update game phase message.*
- `void __sendCreditsSpentMessage` (int)
- Helper method to format and send a credits spent message.*
- `void __sendInsufficientCreditsMessage` (void)
- Helper method to format and send an insufficient credits message.*

## Private Attributes

- `sf::Event * event_ptr`  
*A pointer to the event class.*
- `sf::RenderWindow * render_window_ptr`  
*A pointer to the render window.*
- `AssetsManager * assets_manager_ptr`  
*A pointer to the assets manager.*
- `MessageHub * message_hub_ptr`  
*A pointer to the message hub.*

### 4.7.1 Detailed Description

A class which defines a hex tile of the hex map.

### 4.7.2 Constructor & Destructor Documentation

#### 4.7.2.1 HexTile()

```
HexTile::HexTile (
    double position_x,
    double position_y,
    sf::Event * event_ptr,
    sf::RenderWindow * render_window_ptr,
    AssetsManager * assets_manager_ptr,
    MessageHub * message_hub_ptr )
```

Constructor for the [HexTile](#) class.

Ref: [Wikipedia \[2023\]](#)

## Parameters

<i>position_x</i>	The x position of the tile.
<i>position_y</i>	The y position of the tile.
<i>event_ptr</i>	Pointer to the event class.
<i>render_window_ptr</i>	Pointer to the render window.
<i>assets_manager_ptr</i>	Pointer to the assets manager.
<i>message_hub_ptr</i>	Pointer to the message hub.

```

2303 {
2304     // 1. set attributes
2305
2306     // 1.1. private
2307     this->event_ptr = event_ptr;
2308     this->render_window_ptr = render_window_ptr;
2309
2310     this->assets_manager_ptr = assets_manager_ptr;
2311     this->message_hub_ptr = message_hub_ptr;
2312
2313     // 1.2. public
2314     this->show_node = false;
2315     this->show_resource = false;
2316     this->resource_assessed = false;
2317     this->resource_assessment = false;
2318     this->is_selected = false;
2319     this->draw_explosion = false;
2320
2321     this->decoration_cleared = false;
2322     this->has_improvement = false;
2323     this->tile_improvement_ptr = NULL;
2324
2325     this->build_menu_open = false;
2326
2327     this->explosion_frame = 0;
2328
2329     this->frame = 0;
2330     this->credits = 0;
2331
2332     this->scrap_improvement_frame = 0;
2333
2334     this->position_x = position_x;
2335     this->position_y = position_y;
2336
2337     this->major_radius = 32;
2338     this->minor_radius = (sqrt(3) / 2) * this->major_radius;
2339
2340     this->game_phase = "build settlement";
2341
2342     // 2. set up and position drawable attributes
2343     this->__setUpNodeSprite();
2344     this->__setUpTileSprite();
2345     this->__setUpSelectOutlineSprite();
2346     this->__setUpResourceChipSprite();
2347     this->__setUpResourceText();
2348     this->__setUpMagnifyingGlassSprite();
2349     this->__setUpTileExplosionReel();
2350
2351     // 3. set tile type and resource (default to none type and average)
2352     this->setTileType(TileType :: NONE_TYPE);
2353     this->setTileResource(TileResource :: AVERAGE);
2354
2355     std::cout << "HexTile constructed at " << this << std::endl;
2356
2357     return;
2358 } /* HexTile() */

```

## 4.7.2.2 ~HexTile()

```

HexTile::~HexTile (
    void )

```

Destructor for the [HexTile](#) class.

```

2913 {
2914     if (this->tile_improvement_ptr != NULL) {
2915         delete this->tile_improvement_ptr;
2916     }
2917
2918     std::cout << "HexTile at " << this << " destroyed" << std::endl;
2919
2920     return;
2921 } /* ~HexTile() */

```

## 4.7.3 Member Function Documentation

### 4.7.3.1 \_\_buildDieselGenerator()

```

void HexTile::__buildDieselGenerator (
    void ) [private]

```

Helper method to build a diesel generator on this tile.

```

1409 {
1410     int build_cost = DIESEL_GENERATOR_BUILD_COST;
1411
1412     if (this->credits < build_cost) {
1413         std::cout << "Cannot build diesel generator: insufficient credits (need "
1414             << build_cost << " K)" << std::endl;
1415
1416         this->__sendInsufficientCreditsMessage();
1417         return;
1418     }
1419
1420     this->tile_improvement_ptr = new DieselGenerator(
1421         this->position_x,
1422         this->position_y,
1423         this->event_ptr,
1424         this->render_window_ptr,
1425         this->assets_manager_ptr,
1426         this->message_hub_ptr
1427     );
1428
1429     this->has_improvement = true;
1430     this->__closeBuildMenu();
1431
1432     this->__sendCreditsSpentMessage(build_cost);
1433     this->__sendTileStateMessage();
1434     this->__sendGameStateRequest();
1435
1436     return;
1437 } /* __buildDieselGenerator() */

```

### 4.7.3.2 \_\_buildEnergyStorage()

```

void HexTile::__buildEnergyStorage (
    void ) [private]

```

Helper method to build an energy storage system on this tile.

```

1652 {
1653     /*
1654     int build_cost = ENERGY_STORAGE_SYSTEM_BUILD_COST;
1655
1656     if (this->credits < build_cost) {
1657         std::cout << "Cannot build energy storage system: insufficient credits (need "
1658             << build_cost << " K)" << std::endl;
1659
1660         this->__sendInsufficientCreditsMessage();
1661         return;
1662     }

```

```

1663
1664     this->tile_improvement_ptr = new EnergyStorageSystem(
1665         this->position_x,
1666         this->position_y,
1667         this->event_ptr,
1668         this->render_window_ptr,
1669         this->assets_manager_ptr,
1670         this->message_hub_ptr
1671     );
1672
1673     this->has_improvement = true;
1674     this->__closeBuildMenu();
1675
1676     this->__sendCreditsSpentMessage(build_cost);
1677     this->__sendTileStateMessage();
1678     this->__sendGameStateRequest();
1679     */
1680     return;
1681 } /* __buildEnergyStorage() */

```

#### 4.7.3.3 \_\_buildSettlement()

```

void HexTile::__buildSettlement (
    void ) [private]

```

Helper method to build a settlement on this tile.

```

1363 {
1364     if (this->credits < BUILD_SETTLEMENT_COST) {
1365         std::cout << "Cannot build settlement: insufficient credits (need "
1366             << BUILD_SETTLEMENT_COST << " K)" << std::endl;
1367
1368         this->__sendInsufficientCreditsMessage();
1369         return;
1370     }
1371
1372     this->__clearDecoration();
1373
1374     this->tile_improvement_ptr = new Settlement(
1375         this->position_x,
1376         this->position_y,
1377         this->event_ptr,
1378         this->render_window_ptr,
1379         this->assets_manager_ptr,
1380         this->message_hub_ptr
1381     );
1382
1383     this->has_improvement = true;
1384
1385     this->assess();
1386     this->__sendAssessNeighboursMessage();
1387
1388     this->__sendUpdateGamePhaseMessage("system management");
1389     this->__sendCreditsSpentMessage(BUILD_SETTLEMENT_COST);
1390     this->__sendTileStateMessage();
1391     this->__sendGameStateRequest();
1392
1393     return;
1394 } /* __buildSettlement() */

```

#### 4.7.3.4 \_\_buildSolarPV()

```

void HexTile::__buildSolarPV (
    void ) [private]

```

Helper method to build a solar PV array on this tile.

```

1452 {
1453     int build_cost = SOLAR_PV_BUILD_COST;
1454
1455     if (this->tile_type == TileType::LAKE) {

```

```

1456         build_cost *= SOLAR_PV_WATER_BUILD_MULTIPLIER;
1457     }
1458
1459     if (this->credits < build_cost) {
1460         std::cout << "Cannot build solar PV array: insufficient credits (need "
1461             << build_cost << " K)" << std::endl;
1462
1463         this->__sendInsufficientCreditsMessage();
1464         return;
1465     }
1466
1467     this->tile_improvement_ptr = new SolarPV(
1468         this->position_x,
1469         this->position_y,
1470         this->event_ptr,
1471         this->render_window_ptr,
1472         this->assets_manager_ptr,
1473         this->message_hub_ptr
1474     );
1475
1476     this->has_improvement = true;
1477     this->__closeBuildMenu();
1478
1479     if (this->tile_type == TileType::LAKE) {
1480         this->decoration_cleared = true;
1481         this->assets_manager_ptr->getSound("splash")->play();
1482     }
1483
1484     this->__sendCreditsSpentMessage(build_cost);
1485     this->__sendTileStateMessage();
1486     this->__sendGameStateRequest();
1487
1488     return;
1489 } /* __buildSolarPV() */

```

#### 4.7.3.5 \_\_buildTidalTurbine()

```

void HexTile::__buildTidalTurbine (
    void ) [private]

```

Helper method to build a tidal turbine on this tile.

```

1562 {
1563     int build_cost = TIDAL_TURBINE_BUILD_COST;
1564
1565     if (this->credits < build_cost) {
1566         std::cout << "Cannot build tidal turbine: insufficient credits (need "
1567             << build_cost << " K)" << std::endl;
1568
1569         this->__sendInsufficientCreditsMessage();
1570         return;
1571     }
1572
1573     this->tile_improvement_ptr = new TidalTurbine(
1574         this->position_x,
1575         this->position_y,
1576         this->event_ptr,
1577         this->render_window_ptr,
1578         this->assets_manager_ptr,
1579         this->message_hub_ptr
1580     );
1581
1582     this->has_improvement = true;
1583     this->decoration_cleared = true;
1584     this->assets_manager_ptr->getSound("splash")->play();
1585     this->__closeBuildMenu();
1586
1587     this->__sendCreditsSpentMessage(build_cost);
1588     this->__sendTileStateMessage();
1589     this->__sendGameStateRequest();
1590
1591     return;
1592 } /* __buildTidalTurbine() */

```

#### 4.7.3.6 \_\_buildWaveEnergyConverter()

```
void HexTile::__buildWaveEnergyConverter (
    void ) [private]
```

Helper method to build a wave energy converter on this tile.

```
1607 {
1608     int build_cost = WAVE_ENERGY_CONVERTER_BUILD_COST;
1609
1610     if (this->credits < build_cost) {
1611         std::cout << "Cannot build wave energy converter: insufficient credits (need "
1612             << build_cost << " K)" << std::endl;
1613
1614         this->__sendInsufficientCreditsMessage();
1615         return;
1616     }
1617
1618     this->tile_improvement_ptr = new WaveEnergyConverter(
1619         this->position_x,
1620         this->position_y,
1621         this->event_ptr,
1622         this->render_window_ptr,
1623         this->assets_manager_ptr,
1624         this->message_hub_ptr
1625     );
1626
1627     this->has_improvement = true;
1628     this->decoration_cleared = true;
1629     this->assets_manager_ptr->getSound("splash")->play();
1630     this->__closeBuildMenu();
1631
1632     this->__sendCreditsSpentMessage(build_cost);
1633     this->__sendTileStateMessage();
1634     this->__sendGameStateRequest();
1635
1636     return;
1637 } /* __buildWaveEnergyConverter() */
```

#### 4.7.3.7 \_\_buildWindTurbine()

```
void HexTile::__buildWindTurbine (
    void ) [private]
```

Helper method to build a wind turbine on this tile.

```
1504 {
1505     int build_cost = WIND_TURBINE_BUILD_COST;
1506
1507     if (
1508         (this->tile_type == TileType :: LAKE) or
1509         (this->tile_type == TileType :: OCEAN)
1510     ) {
1511         build_cost *= WIND_TURBINE_WATER_BUILD_MULTIPLIER;
1512     }
1513
1514     if (this->credits < build_cost) {
1515         std::cout << "Cannot build wind turbine: insufficient credits (need "
1516             << build_cost << " K)" << std::endl;
1517
1518         this->__sendInsufficientCreditsMessage();
1519         return;
1520     }
1521
1522     this->tile_improvement_ptr = new WindTurbine(
1523         this->position_x,
1524         this->position_y,
1525         this->event_ptr,
1526         this->render_window_ptr,
1527         this->assets_manager_ptr,
1528         this->message_hub_ptr
1529     );
1530
1531     this->has_improvement = true;
1532     this->__closeBuildMenu();
1533
1534     if (
```



```

1535         (this->tile_type == TileType :: LAKE) or
1536         (this->tile_type == TileType :: OCEAN)
1537     ) {
1538         this->decoration_cleared = true;
1539         this->assets_manager_ptr->getSound("splash")->play();
1540     }
1541
1542     this->__sendCreditsSpentMessage(build_cost);
1543     this->__sendTileStateMessage();
1544     this->__sendGameStateRequest();
1545
1546     return;
1547 } /* __buildWindTurbine() */

```

#### 4.7.3.8 \_\_clearDecoration()

```

void HexTile::__clearDecoration (
    void ) [private]

```

Helper method to clear tile decoration.

```

791 {
792     this->decoration_cleared = true;
793     this->draw_explosion = true;
794
795     switch (this->tile_type) {
796         case (TileType :: FOREST): {
797             this->assets_manager_ptr->getSound("clear non-mountains tile")->play();
798
799             break;
800         }
801
802         case (TileType :: MOUNTAINS): {
803             this->assets_manager_ptr->getSound("clear mountains tile")->play();
804
805             break;
806         }
807
808         case (TileType :: PLAINS): {
809             this->assets_manager_ptr->getSound("clear non-mountains tile")->play();
810
811             break;
812         }
813
814         default: {
815             // do nothing!
816
817             break;
818         }
819     }
820
821     return;
822 } /* __clearDecoration() */

```

#### 4.7.3.9 \_\_closeBuildMenu()

```

void HexTile::__closeBuildMenu (
    void ) [private]

```

Helper method to close the tile improvement build menu.

```

1338 {
1339     if (not this->build_menu_open) {
1340         return;
1341     }
1342
1343     this->build_menu_open = false;
1344     this->assets_manager_ptr->getSound("build menu close")->play();
1345
1346     return;
1347 } /* __closeBuildMenu() */

```

#### 4.7.3.10 \_\_getTileCoordsSubstring()

```
std::string HexTile::__getTileCoordsSubstring (
    void ) [private]
```

Helper method to assemble and return tile coordinates substring.

##### Returns

Tile coordinates substring.

```
1798 {
1799     std::string coords_substring = "TILE COORDS:  ";
1800     coords_substring += std::to_string(int(this->position_x - 400));
1801     coords_substring += ", ";
1802     coords_substring += std::to_string(int(this->position_y - 400));
1803     coords_substring += "\n";
1804
1805     return coords_substring;
1806 } /* __getTileCoordsSubstring() */
```

#### 4.7.3.11 \_\_getTileImprovementSubstring()

```
std::string HexTile::__getTileImprovementSubstring (
    void ) [private]
```

Helper method to assemble and return the tile improvement substring.

##### Returns

Tile improvement substring.

```
1957 {
1958     std::string improvement_substring = "TILE IMPROVEMENT:  ";
1959
1960     if (this->has_improvement) {
1961         improvement_substring += this->tile_improvement_ptr->tile_improvement_string;
1962         improvement_substring += "\n";
1963     }
1964
1965     else {
1966         improvement_substring += "NONE\n";
1967     }
1968
1969     return improvement_substring;
1970 } /* __getTileImprovementSubstring() */
```

#### 4.7.3.12 \_\_getTileOptionsSubstring()

```
std::string HexTile::__getTileOptionsSubstring (
    void ) [private]
```

Helper method to assemble and return tile options substring.

## Returns

Tile options substring.

```

1987 {
1988     //          32 char x 17 line console "-----\n";
1989     std::string options_substring          = "      **** TILE OPTIONS **** \n";
1990     options_substring                     += " \n";
1991
1992     if (this->game_phase == "build settlement") {
1993         if (
1994             (this->tile_type != TileType :: OCEAN) and
1995             (this->tile_type != TileType :: LAKE)
1996         ) {
1997             options_substring += "[B]:  BUILD SETTLEMENT (";
1998             options_substring += std::to_string(BUILD_SETTLEMENT_COST);
1999             options_substring += " K)\n";
2000         }
2001     }
2002
2003
2004     else if (this->game_phase == "system management") {
2005         if (this->has_improvement) {
2006             options_substring.clear();
2007             options_substring = this->tile_improvement_ptr->getTileOptionsSubstring();
2008         }
2009
2010
2011         else if (not this->resource_assessed) {
2012             options_substring += "[A]:  ASSESS RESOURCE (";
2013             options_substring += std::to_string(RESOURCE_ASSESSMENT_COST);
2014             options_substring += " K)\n";
2015         }
2016
2017
2018         else if (
2019             (not this->decoration_cleared) and
2020             (this->tile_type != TileType :: OCEAN) and
2021             (this->tile_type != TileType :: LAKE)
2022         ) {
2023             options_substring += "[C]:  CLEAR TILE (";
2024
2025             switch (this->tile_type) {
2026                 case (TileType :: FOREST): {
2027                     options_substring += std::to_string(CLEAR_FOREST_COST);
2028
2029                     break;
2030                 }
2031
2032
2033                 case (TileType :: MOUNTAINS): {
2034                     options_substring += std::to_string(CLEAR_MOUNTAINS_COST);
2035
2036                     break;
2037                 }
2038
2039
2040                 case (TileType :: PLAINS): {
2041                     options_substring += std::to_string(CLEAR_PLAINS_COST);
2042
2043                     break;
2044                 }
2045
2046
2047                 default: {
2048                     //do nothing!
2049
2050                     break;
2051                 }
2052             }
2053
2054             options_substring += " K)\n";
2055         }
2056
2057
2058         else if (
2059             (this->decoration_cleared) or
2060             (this->tile_type == TileType :: OCEAN) or
2061             (this->tile_type == TileType :: LAKE)
2062         ) {
2063             options_substring += "[B]:  OPEN BUILD MENU\n";
2064         }
2065     }
2066
2067
2068     else if (this->game_phase == "victory") {
2069         options_substring          += "      **** VICTORY **** \n";
2070     }

```

```

2071
2072
2073     else {
2074         options_substring += "        **** LOSS ****        \n";
2075     }
2076
2077     return options_substring;
2078 } /* __getTileOptionsString() */

```

#### 4.7.3.13 \_\_getTileResourceSubstring()

```

std::string HexTile::__getTileResourceSubstring (
    void ) [private]

```

Helper method to assemble and return tile resource substring.

##### Returns

Tile resource substring.

```

1887 {
1888     std::string resource_substring = "TILE RESOURCE:        ";
1889
1890     if (this->resource_assessed) {
1891         switch (this->tile_resource) {
1892             case (TileResource :: POOR): {
1893                 resource_substring += "POOR\n";
1894
1895                 break;
1896             }
1897
1898             case (TileResource ::BELOW_AVERAGE): {
1899                 resource_substring += "BELOW AVERAGE\n";
1900
1901                 break;
1902             }
1903
1904             case (TileResource :: AVERAGE): {
1905                 resource_substring += "AVERAGE\n";
1906
1907                 break;
1908             }
1909
1910             case (TileResource :: ABOVE_AVERAGE): {
1911                 resource_substring += "ABOVE AVERAGE\n";
1912
1913                 break;
1914             }
1915
1916             case (TileResource :: GOOD): {
1917                 resource_substring += "GOOD\n";
1918
1919                 break;
1920             }
1921
1922             default: {
1923                 resource_substring += "???\n";
1924
1925                 break;
1926             }
1927         }
1928     }
1929
1930     else {
1931         resource_substring += "???\n";
1932     }
1933
1934     return resource_substring;
1935 } /* __getTileResourceSubstring() */

```

#### 4.7.3.14 \_\_getTileTypeSubstring()

```
std::string HexTile::__getTileTypeSubstring (
    void ) [private]
```

Helper method to assemble and return tile type substring.

##### Returns

Tile type substring.

```
1823 {
1824     std::string type_substring = "TILE TYPE:      ";
1825
1826     switch (this->tile_type) {
1827         case (TileType :: FOREST): {
1828             type_substring += "FOREST\n";
1829
1830             break;
1831         }
1832
1833         case (TileType :: LAKE): {
1834             type_substring += "LAKE\n";
1835
1836             break;
1837         }
1838
1839         case (TileType :: MOUNTAINS): {
1840             type_substring += "MOUNTAINS\n";
1841
1842             break;
1843         }
1844
1845         case (TileType :: OCEAN): {
1846             type_substring += "OCEAN\n";
1847
1848             break;
1849         }
1850
1851         case (TileType :: PLAINS): {
1852             type_substring += "PLAINS\n";
1853
1854             break;
1855         }
1856
1857         default: {
1858             type_substring += "???\n";
1859
1860             break;
1861         }
1862     }
1863
1864     return type_substring;
1865 }
1866
1867 /* __getTileTypeSubstring() */
```

#### 4.7.3.15 \_\_handleKeyPressEvents()

```
void HexTile::__handleKeyPressEvents (
    void ) [private]
```

Helper method to handle key press events.

```
874 {
875     if (not this->is_selected) {
876         return;
877     }
878
879     if (this->event_ptr->key.code == sf::Keyboard::Escape) {
```

```
881         this->__setIsSelected(false);
882     }
883
884
885     if (this->build_menu_open) {
886         switch (this->tile_type) {
887             case (TileType :: FOREST): {
888                 switch (this->event_ptr->key.code) {
889                     case (sf::Keyboard::D): {
890                         this->__buildDieselGenerator();
891
892                         break;
893                     }
894
895
896                     case (sf::Keyboard::S): {
897                         this->__buildSolarPV();
898
899                         break;
900                     }
901
902
903                     case (sf::Keyboard::W): {
904                         this->__buildWindTurbine();
905
906                         break;
907                     }
908
909
910                     case (sf::Keyboard::E): {
911                         this->__buildEnergyStorage();
912
913                         break;
914                     }
915
916
917                     default: {
918                         // do nothing!
919
920                         break;
921                     }
922                 }
923
924                 break;
925             }
926
927
928             case (TileType :: LAKE): {
929                 switch (this->event_ptr->key.code) {
930                     case (sf::Keyboard::S): {
931                         this->__buildSolarPV();
932
933                         break;
934                     }
935
936
937                     case (sf::Keyboard::W): {
938                         this->__buildWindTurbine();
939
940                         break;
941                     }
942
943
944                     default: {
945                         // do nothing!
946
947                         break;
948                     }
949                 }
950
951                 break;
952             }
953
954
955             case (TileType :: MOUNTAINS): {
956                 switch (this->event_ptr->key.code) {
957                     case (sf::Keyboard::D): {
958                         this->__buildDieselGenerator();
959
960                         break;
961                     }
962
963
964                     case (sf::Keyboard::S): {
965                         this->__buildSolarPV();
966
967                         break;
```

```
968         }
969
970
971         case (sf::Keyboard::W): {
972             this->__buildWindTurbine();
973
974             break;
975         }
976
977
978         case (sf::Keyboard::E): {
979             this->__buildEnergyStorage();
980
981             break;
982         }
983
984
985         default: {
986             // do nothing!
987
988             break;
989         }
990     }
991
992     break;
993 }
994
995
996 case (TileType :: OCEAN): {
997     switch (this->event_ptr->key.code) {
998         case (sf::Keyboard::W): {
999             this->__buildWindTurbine();
1000
1001             break;
1002         }
1003
1004
1005         case (sf::Keyboard::T): {
1006             this->__buildTidalTurbine();
1007
1008             break;
1009         }
1010
1011
1012         case (sf::Keyboard::A): {
1013             this->__buildWaveEnergyConverter();
1014
1015             break;
1016         }
1017
1018
1019         default: {
1020             // do nothing!
1021
1022             break;
1023         }
1024     }
1025
1026     break;
1027 }
1028
1029
1030 case (TileType :: PLAINS): {
1031     switch (this->event_ptr->key.code) {
1032         case (sf::Keyboard::D): {
1033             this->__buildDieselGenerator();
1034
1035             break;
1036         }
1037
1038
1039         case (sf::Keyboard::S): {
1040             this->__buildSolarPV();
1041
1042             break;
1043         }
1044
1045
1046         case (sf::Keyboard::W): {
1047             this->__buildWindTurbine();
1048
1049             break;
1050         }
1051
1052
1053         case (sf::Keyboard::E): {
1054             this->__buildEnergyStorage();
```

```

1055
1056             break;
1057         }
1058
1059         default: {
1060             // do nothing!
1061
1062             break;
1063         }
1064     }
1065 }
1066
1067     break;
1068 }
1069
1070
1071     default: {
1072         //do nothing!
1073
1074         break;
1075     }
1076 }
1077 }
1078
1079
1080 if (this->game_phase == "build settlement") {
1081     if (
1082         (this->tile_type != TileType :: OCEAN) and
1083         (this->tile_type != TileType :: LAKE)
1084     ) {
1085         if (this->event_ptr->key.code == sf::Keyboard::B) {
1086             this->__buildSettlement();
1087         }
1088     }
1089 }
1090
1091
1092 else if (this->game_phase == "system management") {
1093     if (this->has_improvement) {
1094         if (this->tile_improvement_ptr->tile_improvement_type != TileImprovementType :: SETTLEMENT)
1095     {
1096         if (this->event_ptr->key.code == sf::Keyboard::P) {
1097             this->__scrapImprovement();
1098         }
1099
1100         /*
1101          * All other inputs will be caught and handled by
1102          * this->tile_improvement_ptr->processEvent()
1103          */
1104     }
1105
1106
1107     else if (not this->resource_assessed) {
1108         if (this->event_ptr->key.code == sf::Keyboard::A) {
1109             if (this->credits < RESOURCE_ASSESSMENT_COST) {
1110                 std::cout << "Cannot assess resource: insufficient credits (need "
1111                     << RESOURCE_ASSESSMENT_COST << " K)" << std::endl;
1112
1113                 this->__sendInsufficientCreditsMessage();
1114             }
1115
1116             else {
1117                 this->assess();
1118                 this->__sendCreditsSpentMessage(RESOURCE_ASSESSMENT_COST);
1119                 this->__sendTileStateMessage();
1120                 this->__sendGameStateRequest();
1121             }
1122         }
1123     }
1124
1125
1126     else if (
1127         (not this->decoration_cleared) and
1128         (this->tile_type != TileType :: OCEAN) and
1129         (this->tile_type != TileType :: LAKE)
1130     ) {
1131         if (this->event_ptr->key.code == sf::Keyboard::C) {
1132             int clear_cost = 0;
1133
1134             switch (this->tile_type) {
1135                 case (TileType :: FOREST): {
1136                     clear_cost = CLEAR_FOREST_COST;
1137
1138                     break;
1139                 }
1140

```



```

1141
1142         case (TileType :: MOUNTAINS): {
1143             clear_cost = CLEAR_MOUNTAINS_COST;
1144
1145             break;
1146         }
1147
1148         case (TileType :: PLAINS): {
1149             clear_cost = CLEAR_PLAINS_COST;
1150
1151             break;
1152         }
1153
1154         default: {
1155             // do nothing!
1156
1157             break;
1158         }
1159     }
1160
1161     if (this->credits < clear_cost) {
1162         std::cout << "Cannot clear tile: insufficient credits (need "
1163             << clear_cost << " K)" << std::endl;
1164
1165         this->__sendInsufficientCreditsMessage();
1166     }
1167
1168     else {
1169         this->__clearDecoration();
1170         this->__sendCreditsSpentMessage(clear_cost);
1171         this->__sendTileStateMessage();
1172         this->__sendGameStateRequest();
1173     }
1174 }
1175
1176 }
1177
1178
1179
1180     else if (
1181         (this->decoration_cleared) or
1182         (this->tile_type == TileType :: OCEAN) or
1183         (this->tile_type == TileType :: LAKE)
1184     ) {
1185         if (this->event_ptr->key.code == sf::Keyboard::B) {
1186             this->__openBuildMenu();
1187         }
1188     }
1189 }
1190
1191 return;
1192 } /* __handleKeyPressEvents() */

```

#### 4.7.3.16 \_\_handleKeyReleaseEvents()

```

void HexTile::__handleKeyReleaseEvents (
    void ) [private]
1198 {
1199     if (not this->is_selected) {
1200         return;
1201     }
1202
1203     switch (this->event_ptr->key.code) {
1204         case (sf::Keyboard::P): {
1205             if (this->has_improvement) {
1206                 this->scrap_improvement_frame = 0;
1207
1208                 if (
1209                     this->tile_improvement_ptr->tile_improvement_sprite_static.getTexture() != NULL
1210                 ) {
1211                     this->tile_improvement_ptr->tile_improvement_sprite_static.setColor(
1212                         sf::Color(255, 255, 255, 255)
1213                     );
1214                 }
1215             }
1216
1217             else {
1218                 for (
1219                     size_t i = 0;

```

```

1220             i < this->tile_improvement_ptr->tile_improvement_sprite_animated.size();
1221             i++;
1222         } {
1223             this->tile_improvement_ptr->tile_improvement_sprite_animated[i].setColor(
1224                 sf::Color(255, 255, 255)
1225             );
1226         }
1227     }
1228 }
1229
1230
1231     break;
1232 }
1233
1234
1235     default: {
1236         // do nothing!
1237
1238         break;
1239     }
1240 }
1241
1242 /*
1243 if (this->event_ptr->key.code == sf::Keyboard::P) {
1244
1245 }
1246 */
1247
1248 return;
1249 } /* __handleKeyReleaseEvents() */

```

#### 4.7.3.17 \_\_handleMouseButtonEvents()

```

void HexTile::__handleMouseButtonEvents (
    void ) [private]

```

Helper method to handle mouse button events.

```

1262 {
1263     switch (this->event_ptr->mouseButton.button) {
1264         case (sf::Mouse::Left): {
1265             if (this->__isClicked()) {
1266                 std::cout << "Tile (" << this->position_x << ", " <<
1267                     this->position_y << ") was selected" << std::endl;
1268
1269                 this->__setIsSelected(true);
1270
1271                 this->__sendTileSelectedMessage();
1272                 this->__sendTileStateMessage();
1273                 this->__sendGameStateRequest();
1274             }
1275
1276             else {
1277                 this->__setIsSelected(false);
1278             }
1279
1280             break;
1281         }
1282
1283         case (sf::Mouse::Right): {
1284             this->__setIsSelected(false);
1285
1286             break;
1287         }
1288
1289         default: {
1290             // do nothing!
1291
1292             break;
1293         }
1294     }
1295
1296     return;
1297 } /* __handleMouseButtonEvents() */

```

**4.7.3.18 \_\_isClicked()**

```
bool HexTile::__isClicked (
    void ) [private]
```

Helper method to determine if tile was clicked on.

**Returns**

Boolean indicating whether or not tile was clicked on.

```
842 {
843     sf::Vector2i mouse_position = sf::Mouse::getPosition(*render_window_ptr);
844
845     double mouse_x = mouse_position.x;
846     double mouse_y = mouse_position.y;
847
848     double distance = sqrt(
849         pow(this->position_x - mouse_x, 2) +
850         pow(this->position_y - mouse_y, 2)
851     );
852
853     if (distance < this->minor_radius) {
854         return true;
855     }
856     else {
857         return false;
858     }
859 } /* __isClicked() */
```

**4.7.3.19 \_\_openBuildMenu()**

```
void HexTile::__openBuildMenu (
    void ) [private]
```

Helper method to open the tile improvement build menu.

```
1314 {
1315     if (this->build_menu_open) {
1316         return;
1317     }
1318
1319     this->build_menu_open = true;
1320     this->assets_manager_ptr->getSound("build menu open")->play();
1321
1322     return;
1323 } /* __openBuildMenu() */
```

**4.7.3.20 \_\_scrapImprovement()**

```
void HexTile::__scrapImprovement (
    void ) [private]
```

Helper method to scrap the tile improvement ([Settlement](#) cannot be scrapped). Requires the mapped key to be held continuously to confirm.

```
1697 {
1698     // 1. implement key hold confirmation
1699     if (this->scrap_improvement_frame <= FRAMES_PER_SECOND) {
1700         double colour_scalar =
1701             1 - ((double)(this->scrap_improvement_frame) / (FRAMES_PER_SECOND));
1702
1703         if (
1704             this->tile_improvement_ptr->tile_improvement_sprite_static.getTexture() != NULL
1705         ) {
```

```

1706         this->tile_improvement_ptr->tile_improvement_sprite_static.setColor(
1707             sf::Color(255, 255 * colour_scalar, 255 * colour_scalar, 255)
1708         );
1709     }
1710
1711     else {
1712         for (
1713             size_t i = 0;
1714             i < this->tile_improvement_ptr->tile_improvement_sprite_animated.size();
1715             i++
1716         ) {
1717             this->tile_improvement_ptr->tile_improvement_sprite_animated[i].setColor(
1718                 sf::Color(255, 255 * colour_scalar, 255 * colour_scalar, 255)
1719             );
1720         }
1721     }
1722
1723     this->scrap_improvement_frame += 4;
1724 }
1725
1726
1727 // 2. carry out scrapping
1728 else {
1729     this->draw_explosion = true;
1730     this->assets_manager_ptr->getSound("clear non-mountains tile")->play();
1731
1732     if (this->tile_improvement_ptr->production_menu_open) {
1733         this->tile_improvement_ptr->production_menu_open = false;
1734         this->assets_manager_ptr->getSound("build menu close")->play();
1735     }
1736
1737     delete this->tile_improvement_ptr;
1738     this->tile_improvement_ptr = NULL;
1739
1740     this->has_improvement = false;
1741
1742     this->scrap_improvement_frame = 0;
1743
1744     if (
1745         (this->tile_type == TileType :: LAKE) or
1746         (this->tile_type == TileType :: OCEAN)
1747     ) {
1748         this->decoration_cleared = false;
1749     }
1750
1751     this->__sendCreditsSpentMessage(SCRAP_COST);
1752     this->__sendTileStateMessage();
1753     this->__sendGameStateRequest();
1754 }
1755
1756 return;
1757 } /* __scrapImprovement() */

```

#### 4.7.3.21 \_\_sendAssessNeighboursMessage()

```

void HexTile::__sendAssessNeighboursMessage (
    void ) [private]

```

Helper method to format and send assess neighbours message.

```

2134 {
2135     Message assess_neighbours_message;
2136
2137     assess_neighbours_message.channel = HEX_MAP_CHANNEL;
2138     assess_neighbours_message.subject = "assess neighbours";
2139
2140     this->message_hub_ptr->sendMessage(assess_neighbours_message);
2141
2142     std::cout << "Assess neighbours message sent by " << this << std::endl;
2143
2144     return;
2145 } /* __sendAssessNeighboursMessage() */

```

**4.7.3.22 \_\_sendCreditsSpentMessage()**

```
void HexTile::__sendCreditsSpentMessage (
    int credits_spent ) [private]
```

Helper method to format and send a credits spent message.

**Parameters**

<i>credits_spent</i>	The number of credits that were spent.
----------------------	--

```
2217 {
2218     Message credits_spent_message;
2219
2220     credits_spent_message.channel = GAME_CHANNEL;
2221     credits_spent_message.subject = "credits spent";
2222
2223     credits_spent_message.int_payload["credits spent"] = credits_spent;
2224
2225     this->message_hub_ptr->sendMessage(credits_spent_message);
2226
2227     std::cout << "Credits spent (" << credits_spent << ") message sent by " << this
2228         << std::endl;
2229     return;
2230 } /* __sendCreditsSpentMessage() */
```

**4.7.3.23 \_\_sendGameStateRequest()**

```
void HexTile::__sendGameStateRequest (
    void ) [private]
```

Helper method to format and send a game state request (message).

```
2160 {
2161     Message game_state_request;
2162
2163     game_state_request.channel = GAME_CHANNEL;
2164     game_state_request.subject = "state request";
2165
2166     this->message_hub_ptr->sendMessage(game_state_request);
2167
2168     std::cout << "Game state request message sent by " << this << std::endl;
2169     return;
2170 } /* __sendGameStateRequest() */
```

**4.7.3.24 \_\_sendInsufficientCreditsMessage()**

```
void HexTile::__sendInsufficientCreditsMessage (
    void ) [private]
```

Helper method to format and send an insufficient credits message.

```
2245 {
2246     Message insufficient_credits_message;
2247
2248     insufficient_credits_message.channel = GAME_CHANNEL;
2249     insufficient_credits_message.subject = "insufficient credits";
2250
2251     this->message_hub_ptr->sendMessage(insufficient_credits_message);
2252
2253     std::cout << "Insufficient credits message sent by " << this << std::endl;
2254
2255     return;
2256 } /* __sendInsufficientCreditsMessage() */
```

#### 4.7.3.25 \_\_sendTileSelectedMessage()

```
void HexTile::__sendTileSelectedMessage (
    void ) [private]
```

Helper method to format and send message on tile selection.

```
1772 {
1773     Message tile_selected_message;
1774
1775     tile_selected_message.channel = TILE_SELECTED_CHANNEL;
1776     tile_selected_message.subject = "tile selected";
1777
1778     this->message_hub_ptr->sendMessage(tile_selected_message);
1779
1780     return;
1781 } /* __sendTileSelectedMessage() */
```

#### 4.7.3.26 \_\_sendTileStateMessage()

```
void HexTile::__sendTileStateMessage (
    void ) [private]
```

Helper method to format and send tile state message.

```
2093 {
2094     Message tile_state_message;
2095
2096     tile_state_message.channel = TILE_STATE_CHANNEL;
2097     tile_state_message.subject = "tile state";
2098
2099
2100     //          32 char x 17 line console "-----\n";
2101     std::string console_string = "          **** TILE INFO **** \n";
2102
2103     console_string += this->__getTileCoordsSubstring();
2104     console_string += "          \n";
2105
2106     console_string += this->__getTileTypeSubstring();
2107     console_string += this->__getTileResourceSubstring();
2108     console_string += this->__getTileImprovementSubstring();
2109     console_string += "          \n";
2110
2111     console_string += this->__getTileOptionsSubstring();
2112
2113     tile_state_message.string_payload["console string"] = console_string;
2114
2115     this->message_hub_ptr->sendMessage(tile_state_message);
2116
2117     std::cout << "Tile state message sent by " << this << std::endl;
2118     return;
2119 } /* __sendTileStateMessage() */
```

#### 4.7.3.27 \_\_sendUpdateGamePhaseMessage()

```
void HexTile::__sendUpdateGamePhaseMessage (
    std::string game_phase ) [private]
```

Helper method to format and send update game phase message.

##### Parameters

<i>game_phase</i>	The updated game phase.
-------------------	-------------------------

```

2187 {
2188     Message update_game_phase_message;
2189
2190     update_game_phase_message.channel = GAME_CHANNEL;
2191     update_game_phase_message.subject = "update game phase";
2192
2193     update_game_phase_message.string_payload["game phase"] = game_phase;
2194
2195     this->message_hub_ptr->sendMessage(update_game_phase_message);
2196
2197     std::cout << "Update game phase message sent by " << this << std::endl;
2198
2199     return;
2200 } /* __sendUpdateGamePhaseMessage() */

```

#### 4.7.3.28 \_\_setIsSelected()

```

void HexTile::__setIsSelected (
    bool is_selected ) [private]

```

Helper method to set the is selected attribute (of tile and improvement).

##### Parameters

<i>is_selected</i>	The value to set the is selected attribute to.
--------------------	--

```

764 {
765     this->is_selected = is_selected;
766
767     if (this->tile_improvement_ptr != NULL) {
768         this->tile_improvement_ptr->setIsSelected(is_selected);
769     }
770
771     if ((not is_selected) and this->build_menu_open) {
772         this->__closeBuildMenu();
773     }
774
775     return;
776 } /* __setIsSelected() */

```

#### 4.7.3.29 \_\_setResourceText()

```

void HexTile::__setResourceText (
    void ) [private]

```

Helper method to set up resource text.

```

193 {
194     this->resource_text.setFont(*(assets_manager_ptr->getFont("DroidSansMono")));
195
196     this->resource_text.setFillColor(sf::Color(0, 0, 0, 255));
197
198     if (this->resource_assessed) {
199         switch (this->tile_resource) {
200             case (TileResource :: POOR): {
201                 this->resource_text.setString("-2");
202                 this->resource_text.setFillColor(MONOCROME_TEXT_RED);
203
204                 break;
205             }
206
207             case (TileResource :: BELOW_AVERAGE): {
208                 this->resource_text.setString("-1");
209                 this->resource_text.setFillColor(MONOCROME_TEXT_RED);
210
211                 break;
212             }

```

```

213
214         case (TileResource :: AVERAGE): {
215             this->resource_text.setString("+0");
216
217             break;
218         }
219
220         case (TileResource :: ABOVE_AVERAGE): {
221             this->resource_text.setString("+1");
222             this->resource_text.setFillColor(MONOCROME_TEXT_GREEN);
223
224             break;
225         }
226
227         case (TileResource :: GOOD): {
228             this->resource_text.setString("+2");
229             this->resource_text.setFillColor(MONOCROME_TEXT_GREEN);
230
231             break;
232         }
233
234         default: {
235             this->resource_text.setString("");
236
237             break;
238         }
239     }
240 }
241
242 else {
243     this->resource_text.setString("");
244 }
245
246 this->resource_text.setCharacterSize(20);
247
248 this->resource_text.setOrigin(
249     this->resource_text.getLocalBounds().width / 2,
250     this->resource_text.getLocalBounds().height / 2
251 );
252
253 this->resource_text.setPosition(
254     this->position_x,
255     this->position_y - 4
256 );
257
258 this->resource_text.setOutlineThickness(1);
259 this->resource_text.setOutlineColor(sf::Color(0, 0, 0, 255));
260
261 return;
262 } /* __setResourceText() */

```

#### 4.7.3.30 \_\_setUpBuildMenu()

```

void HexTile::__setUpBuildMenu (
    void ) [private]

```

Helper method to set up and place build menu assets (drawable).

```

667 {
668     this->build_menu_options_vec.clear();
669     this->build_menu_options_text_vec.clear();
670
671     // 1. set up and place build menu backing and text
672     this->build_menu_backing.setSize(sf::Vector2f(600, 256));
673     this->build_menu_backing.setOrigin(300, 128);
674     this->build_menu_backing.setPosition(400, 400);
675     this->build_menu_backing.setFillColor(MONOCROME_SCREEN_BACKGROUND);
676     this->build_menu_backing.setOutlineColor(MENU_FRAME_GREY);
677     this->build_menu_backing.setOutlineThickness(4);
678
679     this->build_menu_backing_text.setString("**** BUILD MENU ****");
680     this->build_menu_backing_text.setFont(
681         *(this->assets_manager_ptr->getFont("Glass_TTY_VT220"))
682     );
683     this->build_menu_backing_text.setCharacterSize(16);
684     this->build_menu_backing_text.setFillColor(MONOCROME_TEXT_GREEN);
685     this->build_menu_backing_text.setOrigin(
686         this->build_menu_backing_text.getLocalBounds().width / 2, 0
687     );

```



```

688     this->build_menu_backing_text.setPosition(400, 400 - 128 + 4);
689
690     // 2. set up and place build menu option sprites and text
691     switch (this->tile_type) {
692     case (TileType :: FOREST): {
693         this->__setUpDieselGeneratorBuildOption();
694         this->__setUpSolarPVBuildOption();
695         this->__setUpWindTurbineBuildOption();
696         //this->__setUpEnergyStorageSystemBuildOption();
697
698         break;
699     }
700
701     case (TileType :: LAKE): {
702         this->__setUpSolarPVBuildOption(true);
703         this->__setUpWindTurbineBuildOption(true);
704
705         break;
706     }
707
708     case (TileType :: MOUNTAINS): {
709         this->__setUpDieselGeneratorBuildOption();
710         this->__setUpSolarPVBuildOption();
711         this->__setUpWindTurbineBuildOption();
712         //this->__setUpEnergyStorageSystemBuildOption();
713
714         break;
715     }
716
717     case (TileType :: OCEAN): {
718         this->__setUpWindTurbineBuildOption(false, true);
719         this->__setUpTidalTurbineBuildOption();
720         this->__setUpWaveEnergyConverterBuildOption();
721
722         break;
723     }
724
725     case (TileType :: PLAINS): {
726         this->__setUpDieselGeneratorBuildOption();
727         this->__setUpSolarPVBuildOption();
728         this->__setUpWindTurbineBuildOption();
729         //this->__setUpEnergyStorageSystemBuildOption();
730
731         break;
732     }
733
734     default: {
735         // do nothing!
736
737         break;
738     }
739 }
740
741 return;
742 }
743
744 /* __setUpBuildMenu() */

```

#### 4.7.3.31 \_\_setUpBuildOption()

```

void HexTile::__setUpBuildOption (
    std::string texture_key,
    std::string option_string ) [private]

```

Helper method to set up and position the sprite and text for a build option.

##### Parameters

<i>texture_key</i>	The key for the appropriate illustration asset for the build option.
<i>option_string</i>	A string for the build option.

```

357 {
358     size_t n_options = this->build_menu_options_vec.size();
359
360     // 1. set up option sprite(s)
361     this->build_menu_options_vec.push_back({});
362
363     if (not texture_key.empty()) {
364         sf::Sprite texture_sheet(
365             *(this->assets_manager_ptr->getTexture(texture_key))
366         );
367
368         int sheet_height = texture_sheet.getLocalBounds().height;
369         int n_subrects = sheet_height / 64;
370
371         for (int i = 0; i < n_subrects; i++) {
372             this->build_menu_options_vec.back().push_back(
373                 sf::Sprite(
374                     *(this->assets_manager_ptr->getTexture(texture_key)),
375                     sf::IntRect(0, i * 64, 64, 64)
376                 )
377             );
378
379             this->build_menu_options_vec.back().back().setOrigin(
380                 this->build_menu_options_vec.back().back().getLocalBounds().width / 2,
381                 this->build_menu_options_vec.back().back().getLocalBounds().height
382             );
383
384             this->build_menu_options_vec.back().back().setPosition(
385                 400 - 300 + 75 + n_options * 150,
386                 400 - 32
387             );
388         }
389     }
390
391     else {
392         this->build_menu_options_vec.back().push_back(sf::Sprite());
393     }
394
395
396     // 2. set up option text
397     this->build_menu_options_text_vec.push_back(
398         sf::Text(
399             option_string,
400             *(this->assets_manager_ptr->getFont("Glass_TTY_VT220")),
401             16
402         )
403     );
404
405     this->build_menu_options_text_vec.back().setOrigin(
406         this->build_menu_options_text_vec.back().getLocalBounds().width / 2,
407         0
408     );
409
410     this->build_menu_options_text_vec.back().setPosition(
411         400 - 300 + 75 + n_options * 150,
412         400 - 16 - 4
413     );
414
415     this->build_menu_options_text_vec.back().setFillColor(MONOCHROME_TEXT_GREEN);
416
417     return;
418 } /* __setUpBuildOption() */

```

#### 4.7.3.32 \_\_setUpDieselGeneratorBuildOption()

```

void HexTile::__setUpDieselGeneratorBuildOption (
    void ) [private]

```

Helper method to set up and position the diesel generator build option.

```

433 {
434     // 1. set up option sprite(s)
435     std::string texture_key = "diesel generator";
436
437     // 2. set up option string (up to 16 chars wide)
438     // "-----\n"
439     std::string diesel_generator_string = "DIESEL GENERATOR\n";
440     diesel_generator_string += "\n";
441     diesel_generator_string += "CAPACITY: 100 kW\n";

```

```

442     diesel_generator_string      += "COST:      ";
443     diesel_generator_string      += std::to_string(DIESEL_GENERATOR_BUILD_COST);
444     diesel_generator_string      += " K\n\n";
445     diesel_generator_string      += "BUILD:      [D]   \n";
446
447     // 3. call general method
448     this->__setUpBuildOption(texture_key, diesel_generator_string);
449
450     return;
451 } /* __setUpDieselGeneratorBuildOption() */

```

#### 4.7.3.33 \_\_setUpEnergyStorageSystemBuildOption()

```

void HexTile::__setUpEnergyStorageSystemBuildOption (
    void ) [private]

```

Helper method to set up and position the wave energy converter build option.

```

633 {
634     /*
635     // 1. set up option sprite(s)
636     std::string texture_key = "energy storage system";
637
638     // 2. set up option string (up to 16 chars wide)
639     //
640     std::string energy_storage_system_string      = "-----\n"
641     energy_storage_system_string                = " ENERGY STORAGE \n";
642     energy_storage_system_string                += " CAPCTY:   1 MWh\n";
643     energy_storage_system_string                += " COST:      ";
644     energy_storage_system_string                += std::to_string(ENERGY_STORAGE_SYSTEM_BUILD_COST);
645     energy_storage_system_string                += " K\n\n";
646     energy_storage_system_string                += "BUILD:      [E]   \n";
647
648     // 3. call general method
649     this->__setUpBuildOption(texture_key, energy_storage_system_string);
650     */
651     return;
652 } /* __setUpEnergyStorageSystemBuildOption() */

```

#### 4.7.3.34 \_\_setUpMagnifyingGlassSprite()

```

void HexTile::__setUpMagnifyingGlassSprite (
    void ) [private]

```

Helper method to set up and position magnifying glass sprite.

```

277 {
278     this->magnifying_glass_sprite.setTexture(
279     * (this->assets_manager_ptr->getTexture("magnifying_glass_64x64_1"))
280     );
281
282     this->magnifying_glass_sprite.setOrigin(
283     this->magnifying_glass_sprite.getLocalBounds().width / 2,
284     this->magnifying_glass_sprite.getLocalBounds().height / 2
285     );
286
287     this->magnifying_glass_sprite.setPosition(
288     this->position_x,
289     this->position_y
290     );
291
292     return;
293 } /* __setUpMagnifyingGlassSprite() */

```

**4.7.3.35 \_\_setUpNodeSprite()**

```
void HexTile::__setUpNodeSprite (
    void ) [private]
```

Helper method to set up node sprite.

```
68 {
69     this->node_sprite.setRadius(4);
70
71     this->node_sprite.setOrigin(
72         this->node_sprite.getLocalBounds().width / 2,
73         this->node_sprite.getLocalBounds().height / 2
74     );
75
76     this->node_sprite.setPosition(this->position_x, this->position_y);
77
78     this->node_sprite.setFillColor(sf::Color(255, 0, 0, 255));
79
80     return;
81 } /* __setUpNodeSprite() */
```

**4.7.3.36 \_\_setUpResourceChipSprite()**

```
void HexTile::__setUpResourceChipSprite (
    void ) [private]
```

Helper method to set up resource chip sprite.

```
166 {
167     this->resource_chip_sprite.setRadius(2 * this->minor_radius / 3);
168
169     this->resource_chip_sprite.setOrigin(
170         this->resource_chip_sprite.getLocalBounds().width / 2,
171         this->resource_chip_sprite.getLocalBounds().height / 2
172     );
173
174     this->resource_chip_sprite.setPosition(this->position_x, this->position_y);
175
176     this->resource_chip_sprite.setFillColor(RESOURCE_CHIP_GREY);
177
178     return;
179 } /* __setUpResourceChip() */
```

**4.7.3.37 \_\_setUpSelectOutlineSprite()**

```
void HexTile::__setUpSelectOutlineSprite (
    void ) [private]
```

Helper method to set up select outline sprite.

```
130 {
131     int n_points = 6;
132
133     this->select_outline_sprite.setPointCount(n_points);
134
135     for (int i = 0; i < n_points; i++) {
136         this->select_outline_sprite.setPoint(
137             i,
138             sf::Vector2f(
139                 this->position_x + this->major_radius * cos((30 + 60 * i) * (M_PI / 180)),
140                 this->position_y + this->major_radius * sin((30 + 60 * i) * (M_PI / 180))
141             )
142         );
143     }
144
145     this->select_outline_sprite.setOutlineThickness(4);
146     this->select_outline_sprite.setOutlineColor(MONOCHROME_TEXT_RED);
147
148     this->select_outline_sprite.setFillColor(sf::Color(0, 0, 0, 0));
149
150     return;
151 } /* __setUpSelectOutline() */
```

**4.7.3.38 \_\_setUpSolarPVBuildOption()**

```
void HexTile::__setUpSolarPVBuildOption (
    bool is_lake = false ) [private]
```

Helper method to set up and position the solar PV array build option.

**Parameters**

<i>is_lake</i>	If being built on a lake.
----------------	---------------------------

```
521 {
522     // 1. set up option sprite(s)
523     std::string texture_key = "solar PV array";
524
525     // 2. set up option string (up to 16 chars wide)
526     int build_cost = SOLAR_PV_BUILD_COST;
527     if (is_lake) {
528         build_cost *= SOLAR_PV_WATER_BUILD_MULTIPLIER;
529     }
530
531     // ----- \n"
532     std::string solar_PV_string = " SOLAR PV ARRAY \n";
533     solar_PV_string += " \n";
534     solar_PV_string += "CAPACITY: 100 kW\n";
535     solar_PV_string += "COST: ";
536     solar_PV_string += std::to_string(build_cost);
537     solar_PV_string += " K";
538
539     if (is_lake) {
540         solar_PV_string += "\n** LAKE BUILD **\n\n";
541     }
542     else {
543         solar_PV_string += "\n\n\n";
544     }
545
546     solar_PV_string += "BUILD: [S] \n";
547
548     // 3. call general method
549     this->__setUpBuildOption(texture_key, solar_PV_string);
550
551     return;
552 } /* __setUpSolarPVBuildOption() */
```

**4.7.3.39 \_\_setUpTidalTurbineBuildOption()**

```
void HexTile::__setUpTidalTurbineBuildOption (
    void ) [private]
```

Helper method to set up and position the tidal turbine build option.

```
567 {
568     // 1. set up option sprite(s)
569     std::string texture_key = "tidal turbine";
570
571     // 2. set up option string (up to 16 chars wide)
572     // ----- \n"
573     std::string tidal_turbine_string = " TIDAL TURBINE \n";
574     tidal_turbine_string += " \n";
575     tidal_turbine_string += "CAPACITY: 100 kW\n";
576     tidal_turbine_string += "COST: ";
577     tidal_turbine_string += std::to_string(TIDAL_TURBINE_BUILD_COST);
578     tidal_turbine_string += " K\n\n\n";
579     tidal_turbine_string += "BUILD: [T] \n";
580
581     // 3. call general method
582     this->__setUpBuildOption(texture_key, tidal_turbine_string);
583
584     return;
585 } /* __setUpTidalTurbineBuildOption() */
```

#### 4.7.3.40 \_\_setUpTileExplosionReel()

```
void HexTile::__setUpTileExplosionReel (
    void ) [private]
```

Helper method to set up tile explosion sprite reel.

```
308 {
309     for (int i = 0; i < 4; i++) {
310         for (int j = 0; j < 4; j++) {
311             this->explosion_sprite_reel.push_back(
312                 sf::Sprite(
313                     *(this->assets_manager_ptr->getTexture("tile clear explosion")),
314                     sf::IntRect(j * 64, i * 64, 64, 64)
315                 )
316             );
317             this->explosion_sprite_reel.back().setOrigin(
318                 this->explosion_sprite_reel.back().getLocalBounds().width / 2,
319                 this->explosion_sprite_reel.back().getLocalBounds().height / 2
320             );
321             this->explosion_sprite_reel.back().setPosition(
322                 this->position_x,
323                 this->position_y
324             );
325         }
326     }
327 }
328 }
329
330 return;
331 } /* __setUpTileExplosionReel() */
```

#### 4.7.3.41 \_\_setUpTileSprite()

```
void HexTile::__setUpTileSprite (
    void ) [private]
```

Helper method to set up tile sprite.

```
96 {
97     int n_points = 6;
98
99     this->tile_sprite.setPointCount(n_points);
100
101     for (int i = 0; i < n_points; i++) {
102         this->tile_sprite.setPoint(
103             i,
104             sf::Vector2f(
105                 this->position_x + this->major_radius * cos((30 + 60 * i) * (M_PI / 180)),
106                 this->position_y + this->major_radius * sin((30 + 60 * i) * (M_PI / 180))
107             )
108         );
109     }
110
111     this->tile_sprite.setOutlineThickness(1);
112     this->tile_sprite.setOutlineColor(sf::Color(175, 175, 175, 255));
113
114     return;
115 } /* __setUpTileSprite() */
```

#### 4.7.3.42 \_\_setUpWaveEnergyConverterBuildOption()

```
void HexTile::__setUpWaveEnergyConverterBuildOption (
    void ) [private]
```

Helper method to set up and position the wave energy converter build option.

```
600 {
601     // 1. set up option sprite(s)
```

```

602     std::string texture_key = "wave energy converter";
603
604     // 2. set up option string (up to 16 chars wide)
605     // -----
606     std::string wave_energy_converter_string = "WAVE ENERGY CVTR\n";
607     wave_energy_converter_string += " \n";
608     wave_energy_converter_string += "CAPACITY: 100 kW\n";
609     wave_energy_converter_string += "COST: ";
610     wave_energy_converter_string += std::to_string(WAVE_ENERGY_CONVERTER_BUILD_COST);
611     wave_energy_converter_string += " K\n\n";
612     wave_energy_converter_string += "BUILD: [A] \n";
613
614     // 3. call general method
615     this->__setUpBuildOption(texture_key, wave_energy_converter_string);
616
617     return;
618 } /* __setUpWaveEnergyConverterBuildOption() */

```

#### 4.7.3.43 \_\_setUpWindTurbineBuildOption()

```

void HexTile::__setUpWindTurbineBuildOption (
    bool is_lake = false,
    bool is_ocean = false ) [private]

```

Helper method to set up and position the wind turbine build option.

##### Parameters

<i>is_lake</i>	If being built on a lake tile.
<i>is_ocean</i>	If being built on an ocean tile.

```

470 {
471     // 1. set up option sprite(s)
472     std::string texture_key = "wind turbine";
473
474     // 2. set up option string (up to 16 chars wide)
475     int build_cost = WIND_TURBINE_BUILD_COST;
476     if (is_lake or is_ocean) {
477         build_cost *= WIND_TURBINE_WATER_BUILD_MULTIPLIER;
478     }
479
480     // -----
481     std::string wind_turbine_string = " WIND TURBINE \n";
482     wind_turbine_string += " \n";
483     wind_turbine_string += "CAPACITY: 100 kW\n";
484     wind_turbine_string += "COST: ";
485     wind_turbine_string += std::to_string(build_cost);
486     wind_turbine_string += " K";
487
488     if (is_lake) {
489         wind_turbine_string += "\n** LAKE BUILD **\n\n";
490     }
491     else if (is_ocean) {
492         wind_turbine_string += "\n* OCEAN BUILD * \n\n";
493     }
494     else {
495         wind_turbine_string += "\n\n\n";
496     }
497
498     wind_turbine_string += "BUILD: [W] \n";
499
500     // 3. call general method
501     this->__setUpBuildOption(texture_key, wind_turbine_string);
502
503     return;
504 } /* __setUpWindTurbineBuildOption() */

```

#### 4.7.3.44 assess()

```
void HexTile::assess (
    void )
```

Method to assess the tile's resource.

```
2679 {
2680     this->resource_assessed = true;
2681     this->resource_assessment = true;
2682
2683     this->assets_manager_ptr->getSound("resource assessment")->play();
2684
2685     this->__setResourceText();
2686     this->__sendTileStateMessage();
2687
2688     return;
2689 } /* assess() */
```

#### 4.7.3.45 decorateTile()

```
void HexTile::decorateTile (
    void )
```

Method to decorate tile.

```
2557 {
2558     switch (this->tile_type) {
2559         case (TileType :: FOREST): {
2560             this->tile_decoration_sprite.setTexture(
2561                 *(this->assets_manager_ptr->getTexture("pine_tree_64x64_1"))
2562             );
2563
2564             break;
2565         }
2566
2567         case (TileType :: LAKE): {
2568             this->tile_decoration_sprite.setTexture(
2569                 *(this->assets_manager_ptr->getTexture("water_shimmer_64x64_1"))
2570             );
2571
2572             break;
2573         }
2574
2575         case (TileType :: MOUNTAINS): {
2576             this->tile_decoration_sprite.setTexture(
2577                 *(this->assets_manager_ptr->getTexture("mountain_64x64_1"))
2578             );
2579
2580             break;
2581         }
2582
2583         case (TileType :: OCEAN): {
2584             this->tile_decoration_sprite.setTexture(
2585                 *(this->assets_manager_ptr->getTexture("water_waves_64x64_1"))
2586             );
2587
2588             break;
2589         }
2590
2591         case (TileType :: PLAINS): {
2592             this->tile_decoration_sprite.setTexture(
2593                 *(this->assets_manager_ptr->getTexture("wheat_64x64_1"))
2594             );
2595
2596             break;
2597         }
2598
2599         default: {
2600             // do nothing!
2601
2602             break;
2603         }
2604     }
2605
2606     if (this->tile_type == TileType :: OCEAN or this->tile_type == TileType :: LAKE) {
```



```

2608         this->tile_decoration_sprite.setOrigin(
2609             this->tile_decoration_sprite.getLocalBounds().width / 2,
2610             this->tile_decoration_sprite.getLocalBounds().height / 2
2611         );
2612
2613         this->tile_decoration_sprite.setPosition(
2614             this->position_x,
2615             this->position_y
2616         );
2617
2618         if ((double)rand() / RAND_MAX > 0.5) {
2619             this->tile_decoration_sprite.setScale(sf::Vector2f(-1, 1));
2620         }
2621     }
2622
2623     else {
2624         this->tile_decoration_sprite.setOrigin(
2625             this->tile_decoration_sprite.getLocalBounds().width / 2,
2626             this->tile_decoration_sprite.getLocalBounds().height
2627         );
2628
2629         this->tile_decoration_sprite.setPosition(
2630             this->position_x,
2631             this->position_y + 12
2632         );
2633
2634         if ((double)rand() / RAND_MAX > 0.5) {
2635             this->tile_decoration_sprite.setScale(sf::Vector2f(-1, 1));
2636         }
2637     }
2638
2639     return;
2640 } /* decorateTile(void) */

```

#### 4.7.3.46 draw()

```

void HexTile::draw (
    void )

```

Method to draw the hex tile to the render window. To be called once per frame.

```

2807 {
2808     // 1. draw hex
2809     this->render_window_ptr->draw(this->tile_sprite);
2810
2811     // 2. draw node
2812     if (this->show_node) {
2813         this->render_window_ptr->draw(this->node_sprite);
2814     }
2815
2816     // 3. draw tile decoration
2817     if (not this->decoration_cleared) {
2818         this->render_window_ptr->draw(this->tile_decoration_sprite);
2819     }
2820
2821     // 4. draw selection outline
2822     if (this->is_selected) {
2823         sf::Color outline_colour = this->select_outline_sprite.getOutlineColor();
2824
2825         outline_colour.a =
2826             255 * pow(cos((M_PI * this->frame) / FRAMES_PER_SECOND), 2);
2827
2828         this->select_outline_sprite.setOutlineColor(outline_colour);
2829
2830         this->render_window_ptr->draw(this->select_outline_sprite);
2831     }
2832
2833     // 5. draw tile improvement
2834     if (this->has_improvement) {
2835         if (not this->tile_improvement_ptr->just_built) {
2836             this->tile_improvement_ptr->draw();
2837         }
2838     }
2839
2840     // 6. draw resource
2841     if (this->show_resource) {
2842         this->render_window_ptr->draw(this->resource_chip_sprite);
2843         this->render_window_ptr->draw(this->resource_text);
2844     }

```

```

2845
2846 // 7. draw resource assessment notification
2847 if (this->resource_assessment) {
2848     int alpha = this->magnifying_glass_sprite.getColor().a;
2849
2850     alpha -= 0.05 * FRAMES_PER_SECOND;
2851     if (alpha < 0) {
2852         alpha = 0;
2853         this->resource_assessment = false;
2854     }
2855
2856     this->magnifying_glass_sprite.setColor(
2857         sf::Color(255, 255, 255, alpha)
2858     );
2859
2860     this->render_window_ptr->draw(this->magnifying_glass_sprite);
2861 }
2862
2863 // 8. draw explosion, then settlement placement
2864 if (this->draw_explosion) {
2865     this->render_window_ptr->draw(this->explosion_sprite_reel[this->explosion_frame]);
2866
2867     if (this->frame % (FRAMES_PER_SECOND / 20) == 0) {
2868         this->explosion_frame++;
2869     }
2870
2871     if (this->explosion_frame >= this->explosion_sprite_reel.size()) {
2872         this->draw_explosion = false;
2873         this->explosion_frame = 0;
2874     }
2875 }
2876
2877 else if (this->has_improvement) {
2878     if (this->tile_improvement_ptr->just_built) {
2879         this->tile_improvement_ptr->draw();
2880     }
2881 }
2882
2883 // 9. build menu
2884 if (this->build_menu_open) {
2885     this->render_window_ptr->draw(this->build_menu_backing);
2886     this->render_window_ptr->draw(this->build_menu_backing_text);
2887
2888     for (size_t i = 0; i < this->build_menu_options_vec.size(); i++) {
2889         for (size_t j = 0; j < this->build_menu_options_vec[i].size(); j++) {
2890             this->render_window_ptr->draw(this->build_menu_options_vec[i][j]);
2891         }
2892         this->render_window_ptr->draw(this->build_menu_options_text_vec[i]);
2893     }
2894 }
2895
2896 this->frame++;
2897 return;
2898 } /* draw() */

```

#### 4.7.3.47 processEvent()

```

void HexTile::processEvent (
    void )

```

Method to process [HexTile](#). To be called once per event.

```

2704 {
2705     // 1. process TileImprovement events
2706     if (
2707         this->is_selected and
2708         this->tile_improvement_ptr != NULL
2709     ) {
2710         this->tile_improvement_ptr->processEvent();
2711     }
2712
2713     // 2. process HexTile events
2714     if (this->event_ptr->type == sf::Event::KeyPressed) {
2715         this->__handleKeyPressEvents();
2716     }
2717
2718     if (this->event_ptr->type == sf::Event::KeyReleased) {
2719         this->__handleKeyReleaseEvents();
2720     }

```

```

2721
2722     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
2723         this->__handleMouseButtonEvents();
2724     }
2725
2726     return;
2727 } /* processEvent() */

```

#### 4.7.3.48 processMessage()

```

void HexTile::processMessage (
    void )

```

Method to process [HexTile](#). To be called once per message.

```

2742 {
2743     // 1. process TileImprovement messages
2744     if (
2745         this->is_selected and
2746         this->tile_improvement_ptr != NULL
2747     ) {
2748         this->tile_improvement_ptr->processMessage();
2749     }
2750
2751     // 2. process HexTile messages
2752     if (this->is_selected) {
2753         if (not this->message_hub_ptr->isEmpty(GAME_STATE_CHANNEL)) {
2754             Message game_state_message = this->message_hub_ptr->receiveMessage(
2755                 GAME_STATE_CHANNEL
2756             );
2757
2758             if (game_state_message.subject == "game state") {
2759                 this->credits = game_state_message.int_payload["credits"];
2760                 this->game_phase = game_state_message.string_payload["game phase"];
2761
2762                 if (this->tile_improvement_ptr != NULL) {
2763                     this->tile_improvement_ptr->credits = this->credits;
2764                     this->tile_improvement_ptr->game_phase = this->game_phase;
2765                 }
2766
2767                 std::cout << "Game state message received by " << this << std::endl;
2768                 this->__sendTileStateMessage();
2769                 this->message_hub_ptr->popMessage(GAME_STATE_CHANNEL);
2770             }
2771         }
2772
2773         if (not this->message_hub_ptr->isEmpty(TILE_STATE_CHANNEL)) {
2774             Message tile_state_message = this->message_hub_ptr->receiveMessage(
2775                 TILE_STATE_CHANNEL
2776             );
2777
2778             if (tile_state_message.subject == "state request") {
2779                 this->__sendTileStateMessage();
2780
2781                 std::cout << "Tile state request received by " << this << std::endl;
2782                 this->message_hub_ptr->popMessage(TILE_STATE_CHANNEL);
2783             }
2784         }
2785
2786         std::cout << "Current credits (HexTile): " << this->credits << " K" <<
2787             std::endl;
2788     }
2789
2790     return;
2791 } /* processMessage() */

```

#### 4.7.3.49 setTileResource() [1/2]

```

void HexTile::setTileResource (
    double input_value )

```

Method to set the tile resource (by numeric input).

## Parameters

<i>input_value</i>	A numerical input in the closed interval [0, 1].
--------------------	--

```

2506 {
2507     // 1. check input
2508     if (input_value < 0 or input_value > 1) {
2509         std::string error_str = "ERROR HexTile::setTileResource() given input value is ";
2510         error_str += "not in the closed interval [0, 1]";
2511
2512         #ifdef _WIN32
2513             std::cout << error_str << std::endl;
2514         #endif /* _WIN32 */
2515
2516         throw std::runtime_error(error_str);
2517     }
2518
2519     // 2. convert input value to tile resource
2520     TileResource tile_resource;
2521
2522     if (input_value <= TILE_RESOURCE_CUMULATIVE_PROBABILITIES[0]) {
2523         tile_resource = TileResource :: POOR;
2524     }
2525     else if (input_value <= TILE_RESOURCE_CUMULATIVE_PROBABILITIES[1]) {
2526         tile_resource = TileResource :: BELOW_AVERAGE;
2527     }
2528     else if (input_value <= TILE_RESOURCE_CUMULATIVE_PROBABILITIES[2]) {
2529         tile_resource = TileResource :: AVERAGE;
2530     }
2531     else if (input_value <= TILE_RESOURCE_CUMULATIVE_PROBABILITIES[3]) {
2532         tile_resource = TileResource :: ABOVE_AVERAGE;
2533     }
2534     else {
2535         tile_resource = TileResource :: GOOD;
2536     }
2537
2538     // 3. call alternate method
2539     this->setTileResource(tile_resource);
2540
2541     return;
2542 } /* setTileResource(double) */

```

## 4.7.3.50 setTileResource() [2/2]

```

void HexTile::setTileResource (
    TileResource tile_resource )

```

Method to set the tile resource (by enum value).

## Parameters

<i>tile_resource</i>	The resource (TileResource) value to attribute to the tile.
----------------------	---

```

2484 {
2485     this->tile_resource = tile_resource;
2486     this->__setResourceText();
2487
2488     return;
2489 } /* setTileResource(TileResource) */

```

## 4.7.3.51 setTileType() [1/2]

```

void HexTile::setTileType (
    double input_value )

```

Method to set the tile type (by numeric input).

## Parameters

<i>input_value</i>	A numerical input in the closed interval [0, 1].
--------------------	--

```

2434 {
2435     // 1. check input
2436     if (input_value < 0 or input_value > 1) {
2437         std::string error_str = "ERROR HexTile::setTileType() given input value is ";
2438         error_str += "not in the closed interval [0, 1]";
2439
2440         #ifdef _WIN32
2441             std::cout << error_str << std::endl;
2442         #endif /* _WIN32 */
2443
2444         throw std::runtime_error(error_str);
2445     }
2446
2447     // 2. convert input value to tile type
2448     TileType tile_type;
2449
2450     if (input_value <= TILE_TYPE_CUMULATIVE_PROBABILITIES[0]) {
2451         tile_type = TileType :: LAKE;
2452     }
2453     else if (input_value <= TILE_TYPE_CUMULATIVE_PROBABILITIES[1]) {
2454         tile_type = TileType :: PLAINS;
2455     }
2456     else if (input_value <= TILE_TYPE_CUMULATIVE_PROBABILITIES[2]) {
2457         tile_type = TileType :: FOREST;
2458     }
2459     else {
2460         tile_type = TileType :: MOUNTAINS;
2461     }
2462
2463     // 3. call alternate method
2464     this->setTileType(tile_type);
2465
2466     return;
2467 } /* setTileType(double) */

```

## 4.7.3.52 setTileType() [2/2]

```

void HexTile::setTileType (
    TileType tile_type )

```

Method to set the tile type (by enum value).

## Parameters

<i>tile_type</i>	The type (TileType) to set the tile to.
------------------	---

```

2373 {
2374     this->tile_type = tile_type;
2375
2376     switch (this->tile_type) {
2377         case (TileType :: FOREST): {
2378             this->tile_sprite.setFillColor(FOREST_GREEN);
2379
2380             break;
2381         }
2382
2383         case (TileType :: LAKE): {
2384             this->tile_sprite.setFillColor(LAKE_BLUE);
2385
2386             break;
2387         }
2388
2389         case (TileType :: MOUNTAINS): {
2390             this->tile_sprite.setFillColor(MOUNTAINS_GREY);
2391
2392             break;
2393         }
2394
2395         case (TileType :: OCEAN): {

```

```

2396         this->tile_sprite.setFillColor(OCEAN_BLUE);
2397
2398         break;
2399     }
2400
2401     case (TileType :: PLAINS): {
2402         this->tile_sprite.setFillColor(PLAINS_YELLOW);
2403
2404         break;
2405     }
2406
2407     default: {
2408         // do nothing!
2409
2410         break;
2411     }
2412 }
2413
2414 this->__setUpBuildMenu();
2415
2416 return;
2417 } /* setTileType(TileType) */

```

#### 4.7.3.53 toggleResourceOverlay()

```

void HexTile::toggleResourceOverlay (
    void )

```

Method to toggle the tile resource overlay.

```

2655 {
2656     if (this->show_resource) {
2657         this->show_resource = false;
2658     }
2659     else {
2660         this->show_resource = true;
2661     }
2662
2663     return;
2664 } /* toggleResourceOverlay() */

```

### 4.7.4 Member Data Documentation

#### 4.7.4.1 assets\_manager\_ptr

```
AssetsManager* HexTile::assets_manager_ptr [private]
```

A pointer to the assets manager.

#### 4.7.4.2 build\_menu\_backing

```
sf::RectangleShape HexTile::build_menu_backing
```

A backing for the tile build menu.

#### 4.7.4.3 build\_menu\_backing\_text

```
sf::Text HexTile::build_menu_backing_text
```

A text label for the build menu.

#### 4.7.4.4 build\_menu\_open

```
bool HexTile::build_menu_open
```

A boolean which indicates if the tile build menu is open.

#### 4.7.4.5 build\_menu\_options\_text\_vec

```
std::vector<sf::Text> HexTile::build_menu_options_text_vec
```

A vector of text for the tile build options.

#### 4.7.4.6 build\_menu\_options\_vec

```
std::vector<std::vector<sf::Sprite> > HexTile::build_menu_options_vec
```

A vector of sprites for illustrating the tile build options.

#### 4.7.4.7 credits

```
int HexTile::credits
```

The current balance of credits.

#### 4.7.4.8 decoration\_cleared

```
bool HexTile::decoration_cleared
```

A boolean which indicates if the tile decoration has been cleared.

#### 4.7.4.9 draw\_explosion

```
bool HexTile::draw_explosion
```

A boolean which indicates whether or not to draw a tile explosion.

#### 4.7.4.10 event\_ptr

```
sf::Event* HexTile::event_ptr [private]
```

A pointer to the event class.

#### 4.7.4.11 explosion\_frame

```
size_t HexTile::explosion_frame
```

The current frame of the explosion animation.

#### 4.7.4.12 explosion\_sprite\_reel

```
std::vector<sf::Sprite> HexTile::explosion_sprite_reel
```

A reel of sprites for a tile explosion animation.

#### 4.7.4.13 frame

```
unsigned long long int HexTile::frame
```

The current frame of this object.

#### 4.7.4.14 game\_phase

```
std::string HexTile::game_phase
```

The current phase of the game.



#### 4.7.4.15 has\_improvement

```
bool HexTile::has_improvement
```

A boolean which indicates if tile has improvement or not.

#### 4.7.4.16 is\_selected

```
bool HexTile::is_selected
```

A boolean which indicates whether or not the tile is selected.

#### 4.7.4.17 magnifying\_glass\_sprite

```
sf::Sprite HexTile::magnifying_glass_sprite
```

A magnifying glass sprite.

#### 4.7.4.18 major\_radius

```
double HexTile::major_radius
```

The radius of the smallest bounding circle.

#### 4.7.4.19 message\_hub\_ptr

```
MessageHub* HexTile::message_hub_ptr [private]
```

A pointer to the message hub.

#### 4.7.4.20 minor\_radius

```
double HexTile::minor_radius
```

The radius of the largest inscribed circle.

#### 4.7.4.21 node\_sprite

```
sf::CircleShape HexTile::node_sprite
```

A circle shape to mark the tile node.

#### 4.7.4.22 position\_x

```
double HexTile::position_x
```

The x position of the tile.

#### 4.7.4.23 position\_y

```
double HexTile::position_y
```

The y position of the tile.

#### 4.7.4.24 render\_window\_ptr

```
sf::RenderWindow* HexTile::render_window_ptr [private]
```

A pointer to the render window.

#### 4.7.4.25 resource\_assessed

```
bool HexTile::resource_assessed
```

A boolean which indicates whether or not the resource has been assessed.

#### 4.7.4.26 resource\_assessment

```
bool HexTile::resource_assessment
```

A boolean which triggers a resource assessment notification.

#### 4.7.4.27 resource\_chip\_sprite

```
sf::CircleShape HexTile::resource_chip_sprite
```

A circle shape which represents a resource chip.

#### 4.7.4.28 resource\_text

```
sf::Text HexTile::resource_text
```

A text representation of the resource.

#### 4.7.4.29 scrap\_improvement\_frame

```
int HexTile::scrap_improvement_frame
```

A frame for key-hold to confirm scrapping.

#### 4.7.4.30 select\_outline\_sprite

```
sf::ConvexShape HexTile::select_outline_sprite
```

A convex shape which outlines the tile when selected.

#### 4.7.4.31 show\_node

```
bool HexTile::show_node
```

A boolean which indicates whether or not to show the tile node.

#### 4.7.4.32 show\_resource

```
bool HexTile::show_resource
```

A boolean which indicates whether or not to show resource value.

#### 4.7.4.33 tile\_decoration\_sprite

```
sf::Sprite HexTile::tile_decoration_sprite
```

A tile decoration sprite.

#### 4.7.4.34 tile\_improvement\_ptr

```
TileImprovement* HexTile::tile_improvement_ptr
```

A pointer to the improvement for this tile.

#### 4.7.4.35 tile\_resource

```
TileResource HexTile::tile_resource
```

#### 4.7.4.36 tile\_sprite

```
sf::ConvexShape HexTile::tile_sprite
```

A convex shape which represents the tile.

#### 4.7.4.37 tile\_type

```
TileType HexTile::tile_type
```

The documentation for this class was generated from the following files:

- header/[HexTile.h](#)
- source/[HexTile.cpp](#)

## 4.8 Message Struct Reference

A structure which defines a standard message format.

```
#include <MessageHub.h>
```

## Public Attributes

- `std::string channel = ""`  
*A string identifying the appropriate channel for this message.*
- `std::string subject = ""`  
*A string describing the message subject.*
- `std::map< std::string, bool > bool_payload = {}`  
*A boolean payload.*
- `std::map< std::string, int > int_payload = {}`  
*A vector payload.*
- `std::map< std::string, double > double_payload = {}`  
*A vector payload.*
- `std::map< std::string, std::string > string_payload = {}`  
*A string payload.*

### 4.8.1 Detailed Description

A structure which defines a standard message format.

### 4.8.2 Member Data Documentation

#### 4.8.2.1 bool\_payload

```
std::map<std::string, bool> Message::bool_payload = {}
```

A boolean payload.

#### 4.8.2.2 channel

```
std::string Message::channel = ""
```

A string identifying the appropriate channel for this message.

#### 4.8.2.3 double\_payload

```
std::map<std::string, double> Message::double_payload = {}
```

A vector payload.

#### 4.8.2.4 int\_payload

```
std::map<std::string, int> Message::int_payload = {}
```

A vector payload.

#### 4.8.2.5 string\_payload

```
std::map<std::string, std::string> Message::string_payload = {}
```

A string payload.

#### 4.8.2.6 subject

```
std::string Message::subject = ""
```

A string describing the message subject.

The documentation for this struct was generated from the following file:

- [header/ESC\\_core/MessageHub.h](#)

## 4.9 MessageHub Class Reference

A class which acts as a central hub for inter-object message traffic.

```
#include <MessageHub.h>
```

### Public Member Functions

- [MessageHub](#) (void)  
*Constructor for the [MessageHub](#) class.*
- bool [hasTraffic](#) (void)  
*Method to determine if there remains any message traffic.*
- void [addChannel](#) (std::string)  
*Method to add channel to message map.*
- void [removeChannel](#) (std::string)  
*Method to remove channel from message map.*
- void [sendMessage](#) ([Message](#))  
*Method to send a message to the message map. Channels are implemented in a first in, first out manner (i.e. message queue).*
- bool [isEmpty](#) (std::string)  
*Method to check if channel is empty.*
- [Message](#) [receiveMessage](#) (std::string)  
*Method to receive the first message in the channel. Channels are implemented in a first in, first out manner (i.e. message queue).*
- void [popMessage](#) (std::string)  
*Method to pop first message off of the given channel. Channels are implemented in a first in, first out manner (i.e. message queue).*
- void [clearMessages](#) (void)  
*Method to clear messages from the [MessageHub](#).*
- void [clear](#) (void)  
*Method to clear the [MessageHub](#).*
- [~MessageHub](#) (void)  
*Destructor for the [MessageHub](#) class.*

## Private Attributes

- `std::map< std::string, std::list< Message > > message_map`

A map <string, list of [Message](#)> for sending and receiving messages. Here the key is the channel, and each channel maintains a list (history) of messages.

### 4.9.1 Detailed Description

A class which acts as a central hub for inter-object message traffic.

### 4.9.2 Constructor & Destructor Documentation

#### 4.9.2.1 MessageHub()

```
MessageHub::MessageHub (
    void )
```

Constructor for the [MessageHub](#) class.

```
78 {
79     //...
80
81     std::cout << "MessageHub constructed at " << this << std::endl;
82
83     return;
84 } /* MessageHub() */
```

#### 4.9.2.2 ~MessageHub()

```
MessageHub::~MessageHub (
    void )
```

Destructor for the [MessageHub](#) class.

```
425 {
426     this->clear();
427
428     std::cout << "MessageHub at " << this << " destroyed" << std::endl;
429
430     return;
431 } /* ~MessageHub() */
```

### 4.9.3 Member Function Documentation

#### 4.9.3.1 addChannel()

```
void MessageHub::addChannel (
    std::string channel )
```

Method to add channel to message map.

## Parameters

<i>channel</i>	The key for the message channel being added.
----------------	--

```

129 {
130     // 1. check if channel is in map (if so, throw error)
131     if (this->message_map.count(channel) > 0) {
132         std::string error_str = "ERROR MessageHub::addChannel() channel ";
133         error_str += channel;
134         error_str += " is already in message map";
135
136         #ifdef _WIN32
137             std::cout << error_str << std::endl;
138         #endif /* _WIN32 */
139
140         throw std::runtime_error(error_str);
141     }
142
143     // 2. add channel to map
144     this->message_map[channel] = {};
145
146     std::cout << "Channel " << channel << " added to message hub" << std::endl;
147
148     return;
149 } /* addChannel() */

```

## 4.9.3.2 clear()

```

void MessageHub::clear (
    void )

```

Method to clear the [MessageHub](#).

```

405 {
406
407     this->clearMessages();
408     this->message_map.clear();
409
410     return;
411 } /* clear() */

```

## 4.9.3.3 clearMessages()

```

void MessageHub::clearMessages (
    void )

```

Method to clear messages from the [MessageHub](#).

```

379 {
380     std::map<std::string, std::list<Message>::iterator map_iter;
381     for (
382         map_iter = this->message_map.begin();
383         map_iter != this->message_map.end();
384         map_iter++
385     ) {
386         map_iter->second.clear();
387     }
388
389     return;
390 } /* clearMessages() */

```



#### 4.9.3.4 hasTraffic()

```
bool MessageHub::hasTraffic (
    void )
```

Method to determine if there remains any message traffic.

```
99 {
100     std::map<std::string, std::list<Message>::iterator map_iter;
101     for (
102         map_iter = this->message_map.begin();
103         map_iter != this->message_map.end();
104         map_iter++
105     ) {
106         if (not map_iter->second.empty()) {
107             return true;
108         }
109     }
110     return false;
111 } /* hasTraffic() */
```

#### 4.9.3.5 isEmpty()

```
bool MessageHub::isEmpty (
    std::string channel )
```

Method to check if channel is empty.

##### Parameters

<i>channel</i>	The key for the message channel being checked.
----------------	--

##### Returns

A boolean indicating whether the channel is empty or not.

```
244 {
245     // 1. check if channel is in map (if not, throw error)
246     if (this->message_map.count(channel) <= 0) {
247         std::string error_str = "ERROR MessageHub::isEmpty() channel ";
248         error_str += channel;
249         error_str += " is not in message map";
250
251         #ifdef _WIN32
252             std::cout << error_str << std::endl;
253         #endif /* _WIN32 */
254
255         throw std::runtime_error(error_str);
256     }
257
258     if (this->message_map[channel].empty()) {
259         return true;
260     }
261     else {
262         return false;
263     }
264 } /* isEmpty() */
```

#### 4.9.3.6 popMessage()

```
void MessageHub::popMessage (
    std::string channel )
```

Method to pop first message off of the given channel. Channels are implemented in a first in, first out manner (i.e. message queue).

#### Parameters

<i>channel</i>	The key for the message channel being popped.
----------------	---

```

333 {
334     // 1. check if channel is in map (if not, throw error)
335     if (this->message_map.count(channel) <= 0) {
336         std::string error_str = "ERROR MessageHub::receiveMessage() channel ";
337         error_str += channel;
338         error_str += " is not in message map";
339
340         #ifdef _WIN32
341             std::cout << error_str << std::endl;
342         #endif /* _WIN32 */
343
344         throw std::runtime_error(error_str);
345     }
346
347     // 2. check if channel is empty (if so, throw error)
348     if (this->message_map[channel].empty()) {
349         std::string error_str = "ERROR MessageHub::receiveMessage() channel ";
350         error_str += channel;
351         error_str += " is empty";
352
353         #ifdef _WIN32
354             std::cout << error_str << std::endl;
355         #endif /* _WIN32 */
356
357         throw std::runtime_error(error_str);
358     }
359
360     // 3. pop message
361     this->message_map[channel].pop_front();
362
363     return;
364 } /* popMessage() */

```

#### 4.9.3.7 receiveMessage()

```

Message MessageHub::receiveMessage (
    std::string channel )

```

Method to receive the first message in the channel. Channels are implemented in a first in, first out manner (i.e. message queue).

#### Parameters

<i>channel</i>	The key for the message channel being received from.
----------------	--

#### Returns

The first message in the given channel.

```

284 {
285     // 1. check if channel is in map (if not, throw error)
286     if (this->message_map.count(channel) <= 0) {
287         std::string error_str = "ERROR MessageHub::receiveMessage() channel ";
288         error_str += channel;
289         error_str += " is not in message map";
290
291         #ifdef _WIN32
292             std::cout << error_str << std::endl;
293         #endif /* _WIN32 */
294

```

```

295         throw std::runtime_error(error_str);
296     }
297
298     // 2. check if channel is empty (if so, throw error)
299     if (this->message_map[channel].empty()) {
300         std::string error_str = "ERROR MessageHub::receiveMessage() channel ";
301         error_str += channel;
302         error_str += " is empty";
303
304         #ifdef _WIN32
305             std::cout << error_str << std::endl;
306         #endif /* _WIN32 */
307
308         throw std::runtime_error(error_str);
309     }
310
311     // 3. receive message
312     Message message = this->message_map[channel].front();
313
314     return message;
315 } /* receiveMessage() */

```

#### 4.9.3.8 removeChannel()

```

void MessageHub::removeChannel (
    std::string channel )

```

Method to remove channel from message map.

##### Parameters

<i>channel</i>	The key for the message channel being removed.
----------------	--

```

166 {
167     // 1. check if channel is in map (if not, throw error)
168     if (this->message_map.count(channel) <= 0) {
169         std::string error_str = "ERROR MessageHub::removeChannel() channel ";
170         error_str += channel;
171         error_str += " is not in message map";
172
173         #ifdef _WIN32
174             std::cout << error_str << std::endl;
175         #endif /* _WIN32 */
176
177         throw std::runtime_error(error_str);
178     }
179
180     // 2. remove channel from map
181     this->message_map[channel].clear();
182     this->message_map.erase(channel);
183
184     std::cout << "Channel " << channel << " removed from message hub" << std::endl;
185
186     return;
187 } /* removeChannel() */

```

#### 4.9.3.9 sendMessage()

```

void MessageHub::sendMessage (
    Message message )

```

Method to send a message to the message map. Channels are implemented in a first in, first out manner (i.e. message queue).

## Parameters

<i>message</i>	The message to be sent.
----------------	-------------------------

```

205 {
206     // 1. check if channel is in map (if not, throw error)
207     std::string channel = message.channel;
208
209     if (this->message_map.count(channel) <= 0) {
210         std::string error_str = "ERROR MessageHub::sendMessage() channel ";
211         error_str += channel;
212         error_str += " is not in message map";
213
214         #ifdef _WIN32
215             std::cout << error_str << std::endl;
216         #endif /* _WIN32 */
217
218         throw std::runtime_error(error_str);
219     }
220
221     // 2. send message to message map
222     this->message_map[channel].push_back(message);
223
224     return;
225 } /* sendMessage() */

```

## 4.9.4 Member Data Documentation

### 4.9.4.1 message\_map

`std::map<std::string, std::list<Message> > MessageHub::message_map [private]`

A map <string, list of [Message](#)> for sending and receiving messages. Here the key is the channel, and each channel maintains a list (history) of messages.

The documentation for this class was generated from the following files:

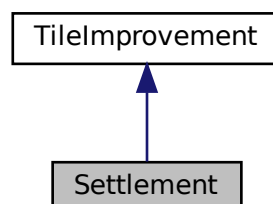
- header/ESC\_core/[MessageHub.h](#)
- source/ESC\_core/[MessageHub.cpp](#)

## 4.10 Settlement Class Reference

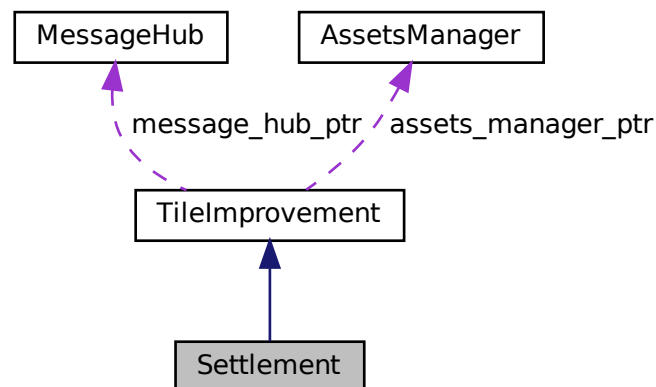
A settlement class (child class of [TileImprovement](#)).

```
#include <Settlement.h>
```

Inheritance diagram for Settlement:



Collaboration diagram for Settlement:



## Public Member Functions

- [Settlement](#) (double, double, sf::Event \*, sf::RenderWindow \*, [AssetsManager](#) \*, [MessageHub](#) \*)  
*Constructor for the [Settlement](#) class.*
- void [setIsSelected](#) (bool)  
*Method to set the is selected attribute.*
- std::string [getTileOptionsSubstring](#) (void)  
*Helper method to assemble and return tile options substring.*
- void [processEvent](#) (void)  
*Method to process [Settlement](#). To be called once per event.*
- void [processMessage](#) (void)  
*Method to process [Settlement](#). To be called once per message.*
- void [draw](#) (void)  
*Method to draw the hex tile to the render window. To be called once per frame.*
- virtual [~Settlement](#) (void)  
*Destructor for the [Settlement](#) class.*

## Public Attributes

- double [smoke\\_da](#)  
*The per frame delta in smoke particle alpha value.*
- double [smoke\\_dx](#)  
*The per frame delta in smoke particle x position.*
- double [smoke\\_dy](#)  
*The per frame delta in smoke particle y position.*
- double [smoke\\_prob](#)  
*The probability of spawning a new smoke prob in any given frame.*
- std::list< sf::Sprite > [smoke\\_sprite\\_list](#)  
*A list of smoke sprite (for chimney animation).*

## Private Member Functions

- void [\\_\\_setUpTileImprovementSpriteStatic](#) (void)  
*Helper method to set up tile improvement sprite (static).*
- void [\\_\\_handleKeyPressEvents](#) (void)  
*Helper method to handle key press events.*
- void [\\_\\_handleMouseButtonEvents](#) (void)  
*Helper method to handle mouse button events.*

## Additional Inherited Members

### 4.10.1 Detailed Description

A settlement class (child class of [TileImprovement](#)).

### 4.10.2 Constructor & Destructor Documentation

#### 4.10.2.1 Settlement()

```
Settlement::Settlement (
    double position_x,
    double position_y,
    sf::Event * event_ptr,
    sf::RenderWindow * render_window_ptr,
    AssetsManager * assets_manager_ptr,
    MessageHub * message_hub_ptr )
```

Constructor for the [Settlement](#) class.

Ref: [Wikipedia \[2023\]](#)

#### Parameters

<i>position_x</i>	The x position of the tile.
<i>position_y</i>	The y position of the tile.
<i>event_ptr</i>	Pointer to the event class.
<i>render_window_ptr</i>	Pointer to the render window.
<i>assets_manager_ptr</i>	Pointer to the assets manager.
<i>message_hub_ptr</i>	Pointer to the message hub.

```
209 :
210 TileImprovement (
211     position_x,
212     position_y,
213     event_ptr,
214     render_window_ptr,
215     assets_manager_ptr,
216     message_hub_ptr
217 )
```

```

218 {
219     // 1. set attributes
220
221     // 1.1. private
222     //...
223
224     // 1.2. public
225     this->tile_improvement_type = TileImprovementType :: SETTLEMENT;
226
227     this->smoke_da = SECONDS_PER_FRAME / 4;
228     this->smoke_dx = 5 * SECONDS_PER_FRAME;
229     this->smoke_dy = -10 * SECONDS_PER_FRAME;
230     this->smoke_prob = 3 * SECONDS_PER_FRAME;
231
232     this->smoke_sprite_list = {};
233
234     this->tile_improvement_string = "SETTLEMENT";
235
236     this->__setUpTileImprovementSpriteStatic();
237
238     std::cout << "Settlement constructed at " << this << std::endl;
239
240     return;
241 } /* Settlement() */

```

#### 4.10.2.2 ~Settlement()

```

Settlement::~~Settlement (
    void ) [virtual]

```

Destructor for the [Settlement](#) class.

```

440 {
441     std::cout << "Settlement at " << this << " destroyed" << std::endl;
442
443     return;
444 } /* ~Settlement() */

```

### 4.10.3 Member Function Documentation

#### 4.10.3.1 \_\_handleKeyPressEvents()

```

void Settlement::__handleKeyPressEvents (
    void ) [private]

```

Helper method to handle key press events.

```

103 {
104     if (this->just_built) {
105         return;
106     }
107
108     switch (this->event_ptr->key.code) {
109         //...
110
111         default: {
112             // do nothing!
113
114             break;
115         }
116     }
117
118     return;
119 } /* __handleKeyPressEvents() */

```

#### 4.10.3.2 \_\_handleMouseButtonEvents()

```
void Settlement::__handleMouseButtonEvents (
    void ) [private]
```

Helper method to handle mouse button events.

```
135 {
136     if (this->just_built) {
137         return;
138     }
139     switch (this->event_ptr->mouseButton.button) {
140         case (sf::Mouse::Left): {
141             //...
142             break;
143         }
144         case (sf::Mouse::Right): {
145             //...
146             break;
147         }
148         default: {
149             // do nothing!
150             break;
151         }
152     }
153     return;
154 }
155 /* __handleMouseButtonEvents() */
```

#### 4.10.3.3 \_\_setUpTileImprovementSpriteStatic()

```
void Settlement::__setUpTileImprovementSpriteStatic (
    void ) [private]
```

Helper method to set up tile improvement sprite (static).

```
68 {
69     this->tile_improvement_sprite_static.setTexture(
70         *(this->assets_manager_ptr->getTexture("brick_house_64x64_1"))
71     );
72     this->tile_improvement_sprite_static.setOrigin(
73         this->tile_improvement_sprite_static.getLocalBounds().width / 2,
74         this->tile_improvement_sprite_static.getLocalBounds().height
75     );
76     this->tile_improvement_sprite_static.setPosition(
77         this->position_x,
78         this->position_y - 32
79     );
80     this->tile_improvement_sprite_static.setColor(
81         sf::Color(255, 255, 255, 0)
82     );
83     return;
84 }
85 /* __setUpTileImprovementSpriteStatic() */
```



## 4.10.3.4 draw()

```
void Settlement::draw (
    void ) [virtual]
```

Method to draw the hex tile to the render window. To be called once per frame.

Reimplemented from [TileImprovement](#).

```
359 {
360     // 1. if just built, call base method and return
361     if (this->just_built) {
362         TileImprovement :: draw();
363     }
364     return;
365 }
366
367 // 2. draw static sprite and chimney smoke effects
368 this->render_window_ptr->draw(this->tile_improvement_sprite_static);
369
370 std::list<sf::Sprite>::iterator iter = this->smoke_sprite_list.begin();
371
372 double alpha = 255;
373
374 while (iter != this->smoke_sprite_list.end()) {
375     this->render_window_ptr->draw(*iter);
376
377     alpha = (*iter).getColor().a;
378     alpha -= this->smoke_da;
379
380     if (alpha <= 0) {
381         iter = this->smoke_sprite_list.erase(iter);
382         continue;
383     }
384
385     (*iter).setColor(sf::Color(255, 255, 255, alpha));
386
387     (*iter).move(
388         this->smoke_dx + 2 * (((double)rand() / RAND_MAX) - 1) / FRAMES_PER_SECOND,
389         this->smoke_dy
390     );
391
392     (*iter).rotate((((double)rand() / RAND_MAX)));
393
394     iter++;
395 }
396
397
398
399 if (((double)rand() / RAND_MAX < smoke_prob) {
400     this->smoke_sprite_list.push_back(
401         sf::Sprite(*(this->assets_manager_ptr->getTexture("emissions")))
402     );
403
404     this->smoke_sprite_list.back().setOrigin(
405         this->smoke_sprite_list.back().getLocalBounds().width / 2,
406         this->smoke_sprite_list.back().getLocalBounds().height / 2
407     );
408
409     this->smoke_sprite_list.back().setPosition(
410         this->position_x + 9 + 4 * (((double)rand() / RAND_MAX) - 2),
411         this->position_y - 33
412     );
413 }
414
415 // 3. draw production menu
416 if (this->production_menu_open) {
417     this->render_window_ptr->draw(this->production_menu_backing);
418     this->render_window_ptr->draw(this->production_menu_backing_text);
419
420     //...
421 }
422
423 this->frame++;
424 return;
425 } /* draw() */
```

#### 4.10.3.5 getTileOptionsSubstring()

```
std::string Settlement::getTileOptionsSubstring (
    void ) [virtual]
```

Helper method to assemble and return tile options substring.

##### Returns

Tile options substring.

Reimplemented from [TileImprovement](#).

```
283 {
284     //          32 char x 17 line console "-----\n";
285     std::string options_substring          = "    *** SETTLEMENT OPTIONS *** \n";
286     options_substring                     += " \n";
287     options_substring                     += " \n";
288     options_substring                     += " \n";
289     options_substring                     += " \n";
290     options_substring                     += " \n";
291     options_substring                     += " \n";
292     options_substring                     += " \n";
293
294     return options_substring;
295 } /* getTileOptionsSubstring() */
```

#### 4.10.3.6 processEvent()

```
void Settlement::processEvent (
    void ) [virtual]
```

Method to process [Settlement](#). To be called once per event.

Reimplemented from [TileImprovement](#).

```
310 {
311     TileImprovement :: processEvent();
312
313     if (this->event_ptr->type == sf::Event::KeyPressed) {
314         this->__handleKeyPressEvents();
315     }
316
317     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
318         this->__handleMouseButtonEvents();
319     }
320
321     return;
322 } /* processEvent() */
```

#### 4.10.3.7 processMessage()

```
void Settlement::processMessage (
    void ) [virtual]
```

Method to process [Settlement](#). To be called once per message.

Reimplemented from [TileImprovement](#).

```
337 {
338     TileImprovement :: processMessage();
339
340     //...
341
342     return;
343 } /* processMessage() */
```

#### 4.10.3.8 setIsSelected()

```
void Settlement::setIsSelected (
    bool is_selected ) [virtual]
```

Method to set the is selected attribute.

##### Parameters

<i>is_selected</i>	The value to set the is selected attribute to.
--------------------	--

Reimplemented from [TileImprovement](#).

```
258 {
259     TileImprovement :: setIsSelected(is_selected);
260
261     if (this->is_selected) {
262         this->assets_manager_ptr->getSound("people and children")->play();
263     }
264
265     return;
266 } /* setIsSelected() */
```

### 4.10.4 Member Data Documentation

#### 4.10.4.1 smoke\_da

```
double Settlement::smoke_da
```

The per frame delta in smoke particle alpha value.

#### 4.10.4.2 smoke\_dx

```
double Settlement::smoke_dx
```

The per frame delta in smoke particle x position.

#### 4.10.4.3 smoke\_dy

```
double Settlement::smoke_dy
```

The per frame delta in smoke particle y position.

#### 4.10.4.4 smoke\_prob

```
double Settlement::smoke_prob
```

The probability of spawning a new smoke prob in any given frame.

#### 4.10.4.5 smoke\_sprite\_list

```
std::list<sf::Sprite> Settlement::smoke_sprite_list
```

A list of smoke sprite (for chimney animation).

The documentation for this class was generated from the following files:

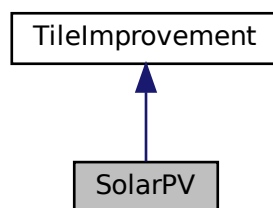
- header/[Settlement.h](#)
- source/[Settlement.cpp](#)

## 4.11 SolarPV Class Reference

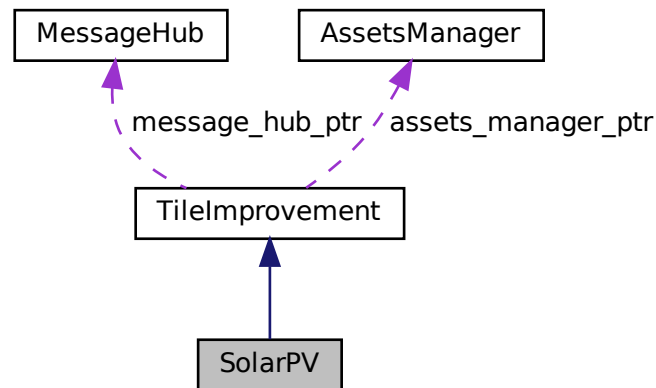
A settlement class (child class of [TileImprovement](#)).

```
#include <SolarPV.h>
```

Inheritance diagram for SolarPV:



Collaboration diagram for SolarPV:



## Public Member Functions

- [SolarPV](#) (double, double, sf::Event \*, sf::RenderWindow \*, [AssetsManager](#) \*, [MessageHub](#) \*)  
*Constructor for the [SolarPV](#) class.*
- std::string [getTileOptionsSubstring](#) (void)  
*Helper method to assemble and return tile options substring.*
- void [processEvent](#) (void)  
*Method to process [SolarPV](#). To be called once per event.*
- void [processMessage](#) (void)  
*Method to process [SolarPV](#). To be called once per message.*
- void [draw](#) (void)  
*Method to draw the hex tile to the render window. To be called once per frame.*
- virtual [~SolarPV](#) (void)  
*Destructor for the [SolarPV](#) class.*

## Public Attributes

- int [capacity\\_kW](#)  
*The rated production capacity [kW] of the solar PV array.*
- int [production\\_MWh](#)  
*The current production [MWh] of the solar PV array.*
- int [dispatchable\\_MWh](#)  
*The amount of production that is directly dispatchable to the grid (i.e. production correlated with demand).*

## Private Member Functions

- void [\\_\\_setUpTileImprovementSpriteStatic](#) (void)  
*Helper method to set up tile improvement sprite (static).*
- void [\\_\\_upgradePowerCapacity](#) (void)  
*Helper method to upgrade power capacity.*
- void [\\_\\_handleKeyPressEvents](#) (void)  
*Helper method to handle key press events.*
- void [\\_\\_handleMouseButtonEvents](#) (void)  
*Helper method to handle mouse button events.*
- void [\\_\\_drawUpgradeOptions](#) (void)  
*Helper method to set up and draw upgrade options.*

## Additional Inherited Members

### 4.11.1 Detailed Description

A settlement class (child class of [TileImprovement](#)).

### 4.11.2 Constructor & Destructor Documentation

#### 4.11.2.1 SolarPV()

```
SolarPV::SolarPV (
    double position_x,
    double position_y,
    sf::Event * event_ptr,
    sf::RenderWindow * render_window_ptr,
    AssetsManager * assets_manager_ptr,
    MessageHub * message_hub_ptr )
```

Constructor for the [SolarPV](#) class.

Ref: [Wikipedia \[2023\]](#)

#### Parameters

<i>position_x</i>	The x position of the tile.
<i>position_y</i>	The y position of the tile.
<i>event_ptr</i>	Pointer to the event class.
<i>render_window_ptr</i>	Pointer to the render window.
<i>assets_manager_ptr</i>	Pointer to the assets manager.
<i>message_hub_ptr</i>	Pointer to the message hub.

```
396 :
397 TileImprovement (
```

```

398     position_x,
399     position_y,
400     event_ptr,
401     render_window_ptr,
402     assets_manager_ptr,
403     message_hub_ptr
404 )
405 {
406     // 1. set attributes
407
408     // 1.1. private
409     //...
410
411     // 1.2. public
412     this->tile_improvement_type = TileImprovementType :: SOLAR_PV;
413
414     this->is_running = false;
415
416     this->health = 100;
417
418     this->capacity_kW = 100;
419     this->upgrade_level = 1;
420     this->storage_level = 0;
421
422     this->production_MWh = 0;
423     this->dispatchable_MWh = 0;
424
425     this->tile_improvement_string = "SOLAR PV ARRAY";
426
427     this->__setUpTileImprovementSpriteStatic();
428
429     std::cout << "SolarPV constructed at " << this << std::endl;
430
431     return;
432 } /* SolarPV() */

```

#### 4.11.2.2 ~SolarPV()

```

SolarPV::~SolarPV (
    void ) [virtual]

```

Destructor for the [SolarPV](#) class.

```

622 {
623     std::cout << "SolarPV at " << this << " destroyed" << std::endl;
624
625     return;
626 } /* ~SolarPV() */

```

### 4.11.3 Member Function Documentation

#### 4.11.3.1 \_\_drawUpgradeOptions()

```

void SolarPV::__drawUpgradeOptions (
    void ) [private]

```

Helper method to set up and draw upgrade options.

```

253 {
254     // 1. draw power capacity upgrade sprite
255     sf::Vector2f initial_position = this->tile_improvement_sprite_static.getPosition();
256     this->tile_improvement_sprite_static.setPosition(400 - 100, 400 - 32);
257
258     sf::Color initial_colour = this->tile_improvement_sprite_static.getColor();
259     this->tile_improvement_sprite_static.setColor(sf::Color(255, 255, 255, 255));
260
261     sf::Vector2f initial_scale = this->tile_improvement_sprite_static.getScale();

```

```

262     this->tile_improvement_sprite_static.setScale(sf::Vector2f(1, 1));
263
264     this->render_window_ptr->draw(this->tile_improvement_sprite_static);
265
266     this->tile_improvement_sprite_static.setPosition(initial_position);
267     this->tile_improvement_sprite_static.setColor(initial_colour);
268     this->tile_improvement_sprite_static.setScale(initial_scale);
269
270     this->render_window_ptr->draw(this->upgrade_arrow_sprite);
271
272
273     // 2. draw power capacity upgrade text
274     //      16 char line = "          \n"
275     std::string power_upgrade_string = "POWER CAPACITY \n";
276     power_upgrade_string           += "          \n";
277
278     power_upgrade_string           += "CAPACITY: ";
279     power_upgrade_string           += std::to_string(this->capacity_kW);
280     power_upgrade_string           += " kW\n";
281
282     power_upgrade_string           += "LEVEL: ";
283     power_upgrade_string           += std::to_string(this->upgrade_level);
284     power_upgrade_string           += "\n\n";
285
286     if (this->upgrade_level < MAX_UPGRADE_LEVELS) {
287         power_upgrade_string       += "[W]: + 100 kW (";
288         power_upgrade_string       += std::to_string(SOLAR_PV_BUILD_COST);
289         power_upgrade_string       += " K)\n";
290     }
291
292     else {
293         power_upgrade_string       += " * MAX LEVEL * \n";
294     }
295
296     sf::Text power_upgrade_text = sf::Text(
297         power_upgrade_string,
298         *(this->assets_manager_ptr->getFont("Glass_TTY_VT220")),
299         16
300     );
301
302     power_upgrade_text.setOrigin(power_upgrade_text.getLocalBounds().width / 2, 0);
303     power_upgrade_text.setPosition(400 - 100, 400 - 32 + 16);
304     power_upgrade_text.setFillColor(MONOCROME_TEXT_GREEN);
305
306     this->render_window_ptr->draw(power_upgrade_text);
307
308
309     // 3. draw energy capacity (storage) upgrade sprite
310     this->render_window_ptr->draw(this->storage_upgrade_sprite);
311     this->render_window_ptr->draw(this->upgrade_plus_sprite);
312
313
314     // 4. draw energy capacity (storage) upgrade text
315     //      16 char line = "          \n"
316     std::string energy_upgrade_string = "ENERGY CAPACITY \n";
317     energy_upgrade_string           += "          \n";
318
319     energy_upgrade_string           += "CAPACITY: ";
320     energy_upgrade_string           += std::to_string(this->storage_level * 200);
321     energy_upgrade_string           += " kWh\n";
322
323     energy_upgrade_string           += "LEVEL: ";
324     energy_upgrade_string           += std::to_string(this->storage_level);
325     energy_upgrade_string           += "\n\n";
326
327     if (this->storage_level < MAX_STORAGE_LEVELS) {
328         energy_upgrade_string       += "[D]: + 200 kWh (";
329         energy_upgrade_string       += std::to_string(ENERGY_STORAGE_SYSTEM_BUILD_COST);
330         energy_upgrade_string       += " K)\n";
331     }
332
333     else {
334         energy_upgrade_string += " * MAX LEVEL * \n";
335     }
336
337     sf::Text energy_upgrade_text = sf::Text(
338         energy_upgrade_string,
339         *(this->assets_manager_ptr->getFont("Glass_TTY_VT220")),
340         16
341     );
342
343     energy_upgrade_text.setOrigin(energy_upgrade_text.getLocalBounds().width / 2, 0);
344     energy_upgrade_text.setPosition(400 + 100, 400 - 32 + 16);
345     energy_upgrade_text.setFillColor(MONOCROME_TEXT_GREEN);
346
347     this->render_window_ptr->draw(energy_upgrade_text);
348

```



```

349     return;
350 } /* __drawUpgradeOptions() */

```

#### 4.11.3.2 \_\_handleKeyPressEvents()

```

void SolarPV::__handleKeyPressEvents (
    void ) [private]

```

Helper method to handle key press events.

```

145 {
146     if (this->just_built) {
147         return;
148     }
149
150     switch (this->event_ptr->key.code) {
151         case (sf::Keyboard::U): {
152             this->__openUpgradeMenu();
153
154             break;
155         }
156
157         case (sf::Keyboard::W): {
158             if (this->production_menu_open) {
159                 //...
160             }
161
162             else if (this->upgrade_menu_open) {
163                 this->__upgradePowerCapacity();
164             }
165
166             break;
167         }
168
169         case (sf::Keyboard::S): {
170             //...
171
172             break;
173         }
174
175         case (sf::Keyboard::D): {
176             if (this->upgrade_menu_open) {
177                 this->__upgradeStorageCapacity();
178             }
179
180             break;
181         }
182
183         default: {
184             // do nothing!
185
186             break;
187         }
188     }
189
190     return;
191 } /* __handleKeyPressEvents() */

```

#### 4.11.3.3 \_\_handleMouseButtonEvents()

```

void SolarPV::__handleMouseButtonEvents (
    void ) [private]

```

Helper method to handle mouse button events.

```

210 {
211     if (this->just_built) {

```

```

212         return;
213     }
214
215     switch (this->event_ptr->mouseButton.button) {
216     case (sf::Mouse::Left): {
217         //...
218
219         break;
220     }
221
222
223     case (sf::Mouse::Right): {
224         //...
225
226         break;
227     }
228
229
230     default: {
231         // do nothing!
232
233         break;
234     }
235     }
236
237     return;
238 } /* __handleMouseButtonEvents() */

```

#### 4.11.3.4 \_\_setUpTileImprovementSpriteStatic()

```

void SolarPV::__setUpTileImprovementSpriteStatic (
    void ) [private]

```

Helper method to set up tile improvement sprite (static).

```

68 {
69     this->tile_improvement_sprite_static.setTexture(
70         *(this->assets_manager_ptr->getTexture("solar PV array"))
71     );
72
73     this->tile_improvement_sprite_static.setOrigin(
74         this->tile_improvement_sprite_static.getLocalBounds().width / 2,
75         this->tile_improvement_sprite_static.getLocalBounds().height
76     );
77
78     this->tile_improvement_sprite_static.setPosition(
79         this->position_x,
80         this->position_y - 32
81     );
82
83     this->tile_improvement_sprite_static.setColor(
84         sf::Color(255, 255, 255, 0)
85     );
86
87     return;
88 } /* __setUpTileImprovementSpriteStatic() */

```

#### 4.11.3.5 \_\_upgradePowerCapacity()

```

void SolarPV::__upgradePowerCapacity (
    void ) [private]

```

Helper method to upgrade power capacity.

```

103 {
104     if (this->credits < SOLAR_PV_BUILD_COST) {
105         std::cout << "Cannot upgrade solar PV: insufficient credits (need "
106             << SOLAR_PV_BUILD_COST << " K)" << std::endl;
107
108         this->__sendInsufficientCreditsMessage();
109         return;

```

```

110     }
111
112     if (this->upgrade_level >= MAX_UPGRADE_LEVELS) {
113         return;
114     }
115
116     this->health = 100;
117
118     this->capacity_kW += 100;
119     this->upgrade_level++;
120
121     this->just_upgraded = true;
122
123     this->assets_manager_ptr->getSound("upgrade")->play();
124
125     this->__sendCreditsSpentMessage(SOLAR_PV_BUILD_COST);
126     this->__sendTileStateRequest();
127     this->__sendGameStateRequest();
128
129     return;
130 } /* __upgradePowerCapacity() */

```

#### 4.11.3.6 draw()

```

void SolarPV::draw (
    void ) [virtual]

```

Method to draw the hex tile to the render window. To be called once per frame.

Reimplemented from [TileImprovement](#).

```

543 {
544     // 1. if just built, call base method and return
545     if (this->just_built) {
546         TileImprovement :: draw();
547
548         return;
549     }
550
551
552     // 2. handle upgrade effects
553     if (this->just_upgraded) {
554         this->tile_improvement_sprite_static.setColor(
555             sf::Color(
556                 255 * pow(cos((M_PI * this->upgrade_frame) / FRAMES_PER_SECOND), 2),
557                 255,
558                 255 * pow(cos((M_PI * this->upgrade_frame) / FRAMES_PER_SECOND), 2),
559                 255
560             )
561         );
562
563         this->tile_improvement_sprite_static.setScale(
564             sf::Vector2f(
565                 1 + 0.2 * pow(cos((M_PI * this->upgrade_frame) / FRAMES_PER_SECOND), 2),
566                 1 + 0.2 * pow(cos((M_PI * this->upgrade_frame) / FRAMES_PER_SECOND), 2)
567             )
568         );
569
570         this->upgrade_frame++;
571     }
572
573     if (this->upgrade_frame >= 2 * FRAMES_PER_SECOND) {
574         this->tile_improvement_sprite_static.setColor(
575             sf::Color(255,255,255,255)
576         );
577
578         this->tile_improvement_sprite_static.setScale(sf::Vector2f(1,1));
579
580         this->just_upgraded = false;
581         this->upgrade_frame = 0;
582     }
583
584
585     // 3. draw static sprite
586     this->render_window_ptr->draw(this->tile_improvement_sprite_static);
587
588
589     // 4. draw production menu

```

```

590     if (this->production_menu_open) {
591         this->render_window_ptr->draw(this->production_menu_backing);
592         this->render_window_ptr->draw(this->production_menu_backing_text);
593
594         //...
595     }
596
597     // 5. draw upgrade menu
598     if (this->upgrade_menu_open) {
599         this->render_window_ptr->draw(this->upgrade_menu_backing);
600         this->render_window_ptr->draw(this->upgrade_menu_backing_text);
601
602         this->__drawUpgradeOptions();
603     }
604
605     this->frame++;
606     return;
607 } /* draw() */

```

#### 4.11.3.7 getTileOptionsSubstring()

```

std::string SolarPV::getTileOptionsSubstring (
    void ) [virtual]

```

Helper method to assemble and return tile options substring.

#### Returns

Tile options substring.

Reimplemented from [TileImprovement](#).

```

449 {
450     //          32 char x 17 line console "-----\n";
451     std::string options_substring = "CAPACITY: ";
452     options_substring += std::to_string(this->capacity_kW);
453     options_substring += " kW (level ";
454     options_substring += std::to_string(this->upgrade_level);
455     options_substring += ")\n";
456
457     options_substring += "PRODUCTION: ";
458     options_substring += std::to_string(this->production_MWh);
459     options_substring += " MWh\n";
460
461     options_substring += "DISPATCHABLE: ";
462     options_substring += std::to_string(this->dispatchable_MWh);
463     options_substring += " MWh\n";
464
465     options_substring += "HEALTH: ";
466     options_substring += std::to_string(this->health);
467     options_substring += "/100\n";
468
469     options_substring += "
470     options_substring += "    **** SOLAR PV OPTIONS ****
471     options_substring += "
472     options_substring += "        [E]: OPEN PRODUCTION MENU
473     options_substring += "        [U]: OPEN UPGRADE MENU
474     options_substring += "HOLD [P]: SCRAP ("
475     options_substring += std::to_string(SCRAP_COST);
476     options_substring += " K)";
477
478     return options_substring;
479 } /* getTileOptionsSubstring() */

```

#### 4.11.3.8 processEvent()

```
void SolarPV::processEvent (
    void ) [virtual]
```

Method to process [SolarPV](#). To be called once per event.

Reimplemented from [TileImprovement](#).

```
494 {
495     TileImprovement :: processEvent();
496
497     if (this->event_ptr->type == sf::Event::KeyPressed) {
498         this->__handleKeyPressEvents();
499     }
500
501     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
502         this->__handleMouseButtonEvents();
503     }
504
505     return;
506 } /* processEvent() */
```

#### 4.11.3.9 processMessage()

```
void SolarPV::processMessage (
    void ) [virtual]
```

Method to process [SolarPV](#). To be called once per message.

Reimplemented from [TileImprovement](#).

```
521 {
522     TileImprovement :: processMessage();
523
524     //...
525
526     return;
527 } /* processMessage() */
```

### 4.11.4 Member Data Documentation

#### 4.11.4.1 capacity\_kW

```
int SolarPV::capacity_kW
```

The rated production capacity [kW] of the solar PV array.

#### 4.11.4.2 dispatchable\_MWh

```
int SolarPV::dispatchable_MWh
```

The amount of production that is directly dispatchable to the grid (i.e. production correlated with demand).

#### 4.11.4.3 production\_MWh

```
int SolarPV::production_MWh
```

The current production [MWh] of the solar PV array.

The documentation for this class was generated from the following files:

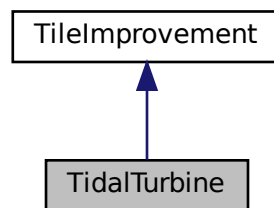
- header/[SolarPV.h](#)
- source/[SolarPV.cpp](#)

## 4.12 TidalTurbine Class Reference

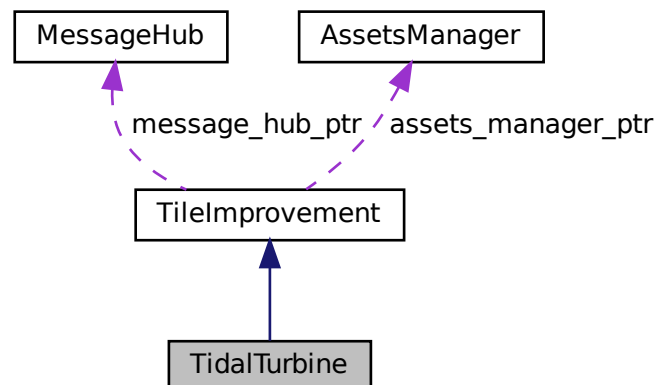
A settlement class (child class of [TileImprovement](#)).

```
#include <TidalTurbine.h>
```

Inheritance diagram for TidalTurbine:



Collaboration diagram for TidalTurbine:



## Public Member Functions

- [TidalTurbine](#) (double, double, sf::Event \*, sf::RenderWindow \*, [AssetsManager](#) \*, [MessageHub](#) \*)  
*Constructor for the [TidalTurbine](#) class.*
- std::string [getTileOptionsSubstring](#) (void)  
*Helper method to assemble and return tile options substring.*
- void [processEvent](#) (void)  
*Method to process [TidalTurbine](#). To be called once per event.*
- void [processMessage](#) (void)  
*Method to process [TidalTurbine](#). To be called once per message.*
- void [draw](#) (void)  
*Method to draw the hex tile to the render window. To be called once per frame.*
- virtual [~TidalTurbine](#) (void)  
*Destructor for the [TidalTurbine](#) class.*

## Public Attributes

- int [capacity\\_kW](#)  
*The rated production capacity [kW] of the solar PV array.*
- int [production\\_MWh](#)  
*The current production [MWh] of the solar PV array.*
- int [dispatchable\\_MWh](#)  
*The amount of production that is directly dispatchable to the grid (i.e. production correlated with demand).*

## Private Member Functions

- void [\\_\\_setUpTileImprovementSpriteAnimated](#) (void)  
*Helper method to set up tile improvement sprite (static).*
- void [\\_\\_upgradePowerCapacity](#) (void)  
*Helper method to upgrade power capacity.*
- void [\\_\\_handleKeyPressEvents](#) (void)  
*Helper method to handle key press events.*
- void [\\_\\_handleMouseButtonEvents](#) (void)  
*Helper method to handle mouse button events.*
- void [\\_\\_drawUpgradeOptions](#) (void)  
*Helper method to set up and draw upgrade options.*

## Additional Inherited Members

### 4.12.1 Detailed Description

A settlement class (child class of [TileImprovement](#)).

### 4.12.2 Constructor & Destructor Documentation

#### 4.12.2.1 TidalTurbine()

```
TidalTurbine::TidalTurbine (
    double position_x,
    double position_y,
    sf::Event * event_ptr,
    sf::RenderWindow * render_window_ptr,
    AssetsManager * assets_manager_ptr,
    MessageHub * message_hub_ptr )
```

Constructor for the [TidalTurbine](#) class.

Ref: [Wikipedia \[2023\]](#)

##### Parameters

<i>position_x</i>	The x position of the tile.
<i>position_y</i>	The y position of the tile.
<i>event_ptr</i>	Pointer to the event class.
<i>render_window_ptr</i>	Pointer to the render window.
<i>assets_manager_ptr</i>	Pointer to the assets manager.
<i>message_hub_ptr</i>	Pointer to the message hub.

```
409 :
410 TileImprovement (
411     position_x,
412     position_y,
413     event_ptr,
414     render_window_ptr,
415     assets_manager_ptr,
416     message_hub_ptr
417 )
418 {
419     // 1. set attributes
420
421     // 1.1. private
422     //...
423
424     // 1.2. public
425     this->tile_improvement_type = TileImprovementType :: TIDAL_TURBINE;
426
427     this->is_running = false;
428
429     this->health = 100;
430
431     this->capacity_kW = 100;
432     this->upgrade_level = 1;
433     this->storage_level = 0;
434
435     this->production_MWh = 0;
436     this->dispatchable_MWh = 0;
437
438     this->tile_improvement_string = "TIDAL TURBINE";
439
440     this->__setUpTileImprovementSpriteAnimated();
441
442     std::cout << "TidalTurbine constructed at " << this << std::endl;
443
444     return;
445 } /* TidalTurbine() */
```

#### 4.12.2.2 ~TidalTurbine()

```
TidalTurbine::~~TidalTurbine (
    void ) [virtual]
```



Destructor for the [TidalTurbine](#) class.

```
650 {
651     std::cout << "TidalTurbine at " << this << " destroyed" << std::endl;
652
653     return;
654 } /* ~TidalTurbine() */
```

## 4.12.3 Member Function Documentation

### 4.12.3.1 \_\_drawUpgradeOptions()

```
void TidalTurbine::__drawUpgradeOptions (
    void ) [private]
```

Helper method to set up and draw upgrade options.

```
264 {
265     // 1. draw power capacity upgrade sprite
266     for (size_t i = 0; i < this->tile_improvement_sprite_animated.size(); i++) {
267         sf::Vector2f initial_position = this->tile_improvement_sprite_animated[i].getPosition();
268         this->tile_improvement_sprite_animated[i].setPosition(400 - 100, 400 - 32 - 8);
269
270         sf::Color initial_colour = this->tile_improvement_sprite_animated[i].getColor();
271         this->tile_improvement_sprite_animated[i].setColor(sf::Color(255, 255, 255, 255));
272
273         sf::Vector2f initial_scale = this->tile_improvement_sprite_animated[i].getScale();
274         this->tile_improvement_sprite_animated[i].setScale(sf::Vector2f(1, 1));
275
276         this->render_window_ptr->draw(this->tile_improvement_sprite_animated[i]);
277
278         this->tile_improvement_sprite_animated[i].setPosition(initial_position);
279         this->tile_improvement_sprite_animated[i].setColor(initial_colour);
280         this->tile_improvement_sprite_animated[i].setScale(initial_scale);
281     }
282
283     this->render_window_ptr->draw(this->upgrade_arrow_sprite);
284
285
286     // 2. draw power capacity upgrade text
287     // 16 char line = "
288     std::string power_upgrade_string = "POWER CAPACITY \n";
289     power_upgrade_string += " \n";
290
291     power_upgrade_string += "CAPACITY: ";
292     power_upgrade_string += std::to_string(this->capacity_kW);
293     power_upgrade_string += " kW\n";
294
295     power_upgrade_string += "LEVEL: ";
296     power_upgrade_string += std::to_string(this->upgrade_level);
297     power_upgrade_string += "\n\n";
298
299     if (this->upgrade_level < MAX_UPGRADE_LEVELS) {
300         power_upgrade_string += "[W]: + 100 kW (";
301         power_upgrade_string += std::to_string(TIDAL_TURBINE_BUILD_COST);
302         power_upgrade_string += " K)\n";
303     }
304
305     else {
306         power_upgrade_string += " * MAX LEVEL * \n";
307     }
308
309     sf::Text power_upgrade_text = sf::Text(
310         power_upgrade_string,
311         *(this->assets_manager_ptr->getFont("Glass_TTY_VT220")),
312         16
313     );
314
315     power_upgrade_text.setOrigin(power_upgrade_text.getLocalBounds().width / 2, 0);
316     power_upgrade_text.setPosition(400 - 100, 400 - 32 + 16);
317     power_upgrade_text.setFillColor(MONOCROME_TEXT_GREEN);
318
319     this->render_window_ptr->draw(power_upgrade_text);
320
321
322     // 3. draw energy capacity (storage) upgrade sprite
```

```

323     this->render_window_ptr->draw(this->storage_upgrade_sprite);
324     this->render_window_ptr->draw(this->upgrade_plus_sprite);
325
326
327     // 4. draw energy capacity (storage) upgrade text
328     //          16 char line = "          \n"
329     std::string energy_upgrade_string = "ENERGY CAPACITY \n";
330     energy_upgrade_string            += "          \n";
331
332     energy_upgrade_string            += "CAPACITY: ";
333     energy_upgrade_string            += std::to_string(this->storage_level * 200);
334     energy_upgrade_string            += " kWh\n";
335
336     energy_upgrade_string            += "LEVEL: ";
337     energy_upgrade_string            += std::to_string(this->storage_level);
338     energy_upgrade_string            += "\n\n";
339
340     if (this->storage_level < MAX_STORAGE_LEVELS) {
341         energy_upgrade_string        += "[D]: + 200 kWh (";
342         energy_upgrade_string        += std::to_string(ENERGY_STORAGE_SYSTEM_BUILD_COST);
343         energy_upgrade_string        += " K)\n";
344     }
345
346     else {
347         energy_upgrade_string += " * MAX LEVEL * \n";
348     }
349
350     sf::Text energy_upgrade_text = sf::Text(
351         energy_upgrade_string,
352         *(this->assets_manager_ptr->getFont("Glass_TTY_VT220")),
353         16
354     );
355
356     energy_upgrade_text.setOrigin(energy_upgrade_text.getLocalBounds().width / 2, 0);
357     energy_upgrade_text.setPosition(400 + 100, 400 - 32 + 16);
358     energy_upgrade_text.setFillColor(MONOCHROME_TEXT_GREEN);
359
360     this->render_window_ptr->draw(energy_upgrade_text);
361
362     return;
363 } /* __drawUpgradeOptions() */

```

#### 4.12.3.2 \_\_handleKeyPressEvents()

```

void TidalTurbine::__handleKeyPressEvents (
    void ) [private]

```

Helper method to handle key press events.

```

156 {
157     if (this->just_built) {
158         return;
159     }
160
161     switch (this->event_ptr->key.code) {
162         case (sf::Keyboard::U): {
163             this->__openUpgradeMenu();
164
165             break;
166         }
167
168
169         case (sf::Keyboard::W): {
170             if (this->production_menu_open) {
171                 //...
172             }
173
174             else if (this->upgrade_menu_open) {
175                 this->__upgradePowerCapacity();
176             }
177
178             break;
179         }
180
181
182         case (sf::Keyboard::S): {
183             //...
184
185             break;

```

```

186         }
187
188
189         case (sf::Keyboard::D): {
190             if (this->upgrade_menu_open) {
191                 this->__upgradeStorageCapacity();
192             }
193
194             break;
195         }
196
197
198         default: {
199             // do nothing!
200
201             break;
202         }
203     }
204
205     return;
206 } /* __handleKeyPressEvents() */

```

#### 4.12.3.3 \_\_handleMouseButtonEvents()

```

void TidalTurbine::__handleMouseButtonEvents (
    void ) [private]

```

Helper method to handle mouse button events.

```

221 {
222     if (this->just_built) {
223         return;
224     }
225
226     switch (this->event_ptr->mouseButton.button) {
227         case (sf::Mouse::Left): {
228             //...
229
230             break;
231         }
232
233
234         case (sf::Mouse::Right): {
235             //...
236
237             break;
238         }
239
240
241         default: {
242             // do nothing!
243
244             break;
245         }
246     }
247
248     return;
249 } /* __handleMouseButtonEvents() */

```

#### 4.12.3.4 \_\_setUpTileImprovementSpriteAnimated()

```

void TidalTurbine::__setUpTileImprovementSpriteAnimated (
    void ) [private]

```

Helper method to set up tile improvement sprite (static).

```

68 {
69     sf::Sprite diesel_generator_sheet (
70         *(this->assets_manager_ptr->getTexture("tidal turbine"))
71     );
72

```

```

73     int n_elements = diesel_generator_sheet.getLocalBounds().height / 64;
74
75     for (int i = 0; i < n_elements; i++) {
76         this->tile_improvement_sprite_animated.push_back(
77             sf::Sprite(
78                 *(this->assets_manager_ptr->getTexture("tidal turbine")),
79                 sf::IntRect(0, i * 64, 64, 64)
80             )
81         );
82
83         this->tile_improvement_sprite_animated.back().setOrigin(
84             this->tile_improvement_sprite_animated.back().getLocalBounds().width / 2,
85             this->tile_improvement_sprite_animated.back().getLocalBounds().height
86         );
87
88         this->tile_improvement_sprite_animated.back().setPosition(
89             this->position_x,
90             this->position_y - 32
91         );
92
93         this->tile_improvement_sprite_animated.back().setColor(
94             sf::Color(255, 255, 255, 0)
95         );
96     }
97
98     return;
99 } /* __setUpTileImprovementSpriteAnimated() */

```

#### 4.12.3.5 \_\_upgradePowerCapacity()

```

void TidalTurbine::__upgradePowerCapacity (
    void ) [private]

```

Helper method to upgrade power capacity.

```

114 {
115     if (this->credits < TIDAL_TURBINE_BUILD_COST) {
116         std::cout << "Cannot upgrade tidal turbine: insufficient credits (need "
117             << TIDAL_TURBINE_BUILD_COST << " K)" << std::endl;
118
119         this->__sendInsufficientCreditsMessage();
120         return;
121     }
122
123     if (this->upgrade_level >= MAX_UPGRADE_LEVELS) {
124         return;
125     }
126
127     this->health = 100;
128
129     this->capacity_kW += 100;
130     this->upgrade_level++;
131
132     this->just_upgraded = true;
133
134     this->assets_manager_ptr->getSound("upgrade")->play();
135
136     this->__sendCreditsSpentMessage(TIDAL_TURBINE_BUILD_COST);
137     this->__sendTileStateRequest();
138     this->__sendGameStateRequest();
139
140     return;
141 } /* __upgradePowerCapacity() */

```

#### 4.12.3.6 draw()

```

void TidalTurbine::draw (
    void ) [virtual]

```

Method to draw the hex tile to the render window. To be called once per frame.

Reimplemented from [TileImprovement](#).

```

556 {
557     // 1. if just built, call base method and return
558     if (this->just_built) {
559         TileImprovement::draw();
560
561         return;
562     }
563
564     // 2. handle upgrade effects
565     if (this->just_upgraded) {
566         for (size_t i = 0; i < this->tile_improvement_sprite_animated.size(); i++) {
567             this->tile_improvement_sprite_animated[i].setColor(
568                 sf::Color(
569                     255 * pow(cos((M_PI * this->upgrade_frame) / FRAMES_PER_SECOND), 2),
570                     255,
571                     255 * pow(cos((M_PI * this->upgrade_frame) / FRAMES_PER_SECOND), 2),
572                     255
573                 )
574             );
575
576             this->tile_improvement_sprite_animated[i].setScale(
577                 sf::Vector2f(
578                     1 + 0.2 * pow(cos((M_PI * this->upgrade_frame) / FRAMES_PER_SECOND), 2),
579                     1 + 0.2 * pow(cos((M_PI * this->upgrade_frame) / FRAMES_PER_SECOND), 2)
580                 )
581             );
582         }
583
584         this->upgrade_frame++;
585     }
586
587     if (this->upgrade_frame >= 2 * FRAMES_PER_SECOND) {
588         for (size_t i = 0; i < this->tile_improvement_sprite_animated.size(); i++) {
589             this->tile_improvement_sprite_animated[i].setColor(
590                 sf::Color(255,255,255,255)
591             );
592
593             this->tile_improvement_sprite_animated[i].setScale(sf::Vector2f(1,1));
594         }
595
596         this->just_upgraded = false;
597         this->upgrade_frame = 0;
598     }
599
600     // 3. draw first element of animated sprite
601     this->render_window_ptr->draw(this->tile_improvement_sprite_animated[0]);
602
603     // 4. draw second element of animated sprite
604     if (this->is_running) {
605         //...
606     }
607     else {
608         //...
609     }
610
611     this->render_window_ptr->draw(this->tile_improvement_sprite_animated[1]);
612
613     // 5. draw production menu
614     if (this->production_menu_open) {
615         this->render_window_ptr->draw(this->production_menu_backing);
616         this->render_window_ptr->draw(this->production_menu_backing_text);
617
618         //...
619     }
620
621     // 6. draw upgrade menu
622     if (this->upgrade_menu_open) {
623         this->render_window_ptr->draw(this->upgrade_menu_backing);
624         this->render_window_ptr->draw(this->upgrade_menu_backing_text);
625
626         this->__drawUpgradeOptions();
627     }
628
629     this->frame++;
630     return;
631 } /* draw() */

```

#### 4.12.3.7 getTileOptionsSubstring()

```
std::string TidalTurbine::getTileOptionsSubstring (
    void ) [virtual]
```

Helper method to assemble and return tile options substring.

##### Returns

Tile options substring.

Reimplemented from [TileImprovement](#).

```
462 {
463     //          32 char x 17 line console "-----\n";
464     std::string options_substring = "CAPACITY: ";
465     options_substring += std::to_string(this->capacity_kW);
466     options_substring += " kW (level ";
467     options_substring += std::to_string(this->upgrade_level);
468     options_substring += ")\n";
469
470     options_substring += "PRODUCTION: ";
471     options_substring += std::to_string(this->production_MWh);
472     options_substring += " MWh\n";
473
474     options_substring += "DISPATCHABLE: ";
475     options_substring += std::to_string(this->dispatchable_MWh);
476     options_substring += " MWh\n";
477
478     options_substring += "HEALTH: ";
479     options_substring += std::to_string(this->health);
480     options_substring += "/100\n";
481
482     options_substring += "\n";
483     options_substring += "**** TIDAL TURBINE OPTIONS **** \n";
484     options_substring += "\n";
485     options_substring += "      [E]:  OPEN PRODUCTION MENU \n";
486     options_substring += "      [U]:  OPEN UPGRADE MENU   \n";
487     options_substring += "HOLD [P]:  SCRAP (";
488     options_substring += std::to_string(SCRAP_COST);
489     options_substring += " K)";
490
491     return options_substring;
492 } /* getTileOptionsSubstring() */
```

#### 4.12.3.8 processEvent()

```
void TidalTurbine::processEvent (
    void ) [virtual]
```

Method to process [TidalTurbine](#). To be called once per event.

Reimplemented from [TileImprovement](#).

```
507 {
508     TileImprovement :: processEvent();
509
510     if (this->event_ptr->type == sf::Event::KeyPressed) {
511         this->__handleKeyPressEvents();
512     }
513
514     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
515         this->__handleMouseButtonEvents();
516     }
517
518     return;
519 } /* processEvent() */
```

#### 4.12.3.9 processMessage()

```
void TidalTurbine::processMessage (
    void ) [virtual]
```

Method to process [TidalTurbine](#). To be called once per message.

Reimplemented from [TileImprovement](#).

```
534 {
535     TileImprovement :: processMessage ();
536
537     //...
538
539     return;
540 } /* processMessage() */
```

### 4.12.4 Member Data Documentation

#### 4.12.4.1 capacity\_kW

```
int TidalTurbine::capacity_kW
```

The rated production capacity [kW] of the solar PV array.

#### 4.12.4.2 dispatchable\_MWh

```
int TidalTurbine::dispatchable_MWh
```

The amount of production that is directly dispatchable to the grid (i.e. production correlated with demand).

#### 4.12.4.3 production\_MWh

```
int TidalTurbine::production_MWh
```

The current production [MWh] of the solar PV array.

The documentation for this class was generated from the following files:

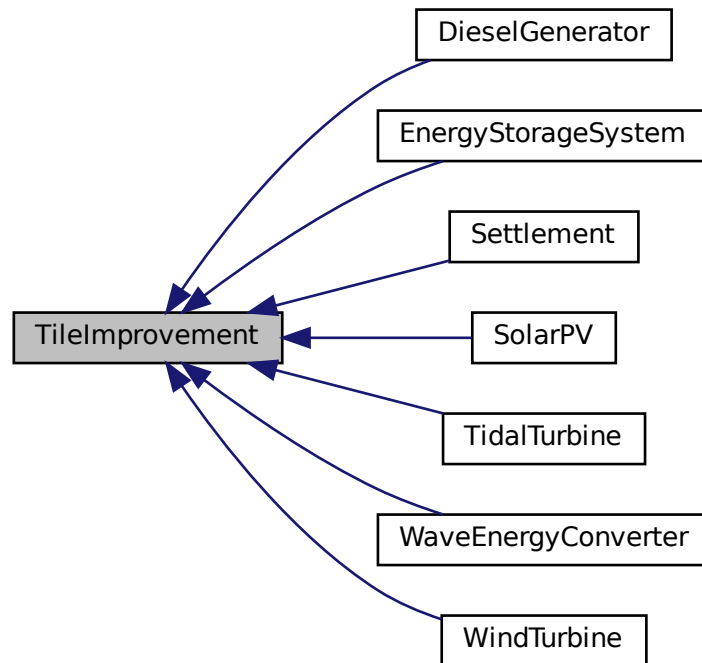
- header/[TidalTurbine.h](#)
- source/[TidalTurbine.cpp](#)

## 4.13 TileImprovement Class Reference

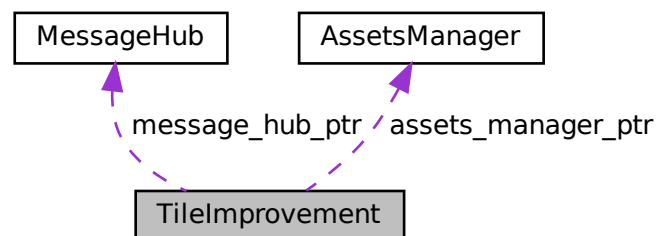
A base class for the tile improvement hierarchy.

```
#include <TileImprovement.h>
```

Inheritance diagram for TileImprovement:



Collaboration diagram for TileImprovement:





## Public Member Functions

- [TileImprovement](#) (double, double, sf::Event \*, sf::RenderWindow \*, [AssetsManager](#) \*, [MessageHub](#) \*)  
*Constructor for the [TileImprovement](#) class.*
- virtual void [setIsSelected](#) (bool)  
*Method to set the is selected attribute.*
- virtual std::string [getTileOptionsSubstring](#) (void)
- virtual void [processEvent](#) (void)  
*Method to process [TileImprovement](#). To be called once per event.*
- virtual void [processMessage](#) (void)  
*Method to process [TileImprovement](#). To be called once per message.*
- virtual void [draw](#) (void)  
*Method to draw the hex tile to the render window. To be called once per frame.*
- virtual [~TileImprovement](#) (void)  
*Destructor for the [TileImprovement](#) class.*

## Public Attributes

- [TileImprovementType](#) [tile\\_improvement\\_type](#)  
*The type of the tile improvement.*
- bool [is\\_running](#)  
*A boolean which indicates whether or not the improvement is running.*
- bool [is\\_selected](#)  
*A boolean which indicates whether or not the tile is selected.*
- bool [just\\_built](#)  
*A boolean which indicates that the improvement was just built.*
- bool [just\\_upgraded](#)  
*A boolean which indicates that the improvement was just upgraded.*
- bool [production\\_menu\\_open](#)  
*A boolean which indicates whether or not the production menu is open.*
- bool [upgrade\\_menu\\_open](#)  
*A boolean which indicates whether or not the build menu is open.*
- unsigned long long int [frame](#)  
*The current frame of this object.*
- int [credits](#)  
*The current balance of credits.*
- int [health](#)  
*The health of the improvement.*
- int [upgrade\\_level](#)  
*The upgrade level of the improvement.*
- int [upgrade\\_frame](#)  
*The frame of the upgrade animation.*
- int [storage\\_level](#)  
*The level of storage installed alongside the tile improvement.*
- double [position\\_x](#)  
*The x position of the tile improvement.*
- double [position\\_y](#)  
*The y position of the tile improvement.*
- std::string [game\\_phase](#)  
*The current phase of the game.*

- `std::string tile_improvement_string`  
*A string representation of the tile improvement type.*
- `sf::Sprite tile_improvement_sprite_static`  
*A static sprite, for decorating the tile.*
- `std::vector< sf::Sprite > tile_improvement_sprite_animated`  
*An animated sprite, for the [ContextMenu](#) visual screen.*
- `sf::RectangleShape production_menu_backing`  
*A backing for the production menu.*
- `sf::Text production_menu_backing_text`  
*Text for the production menu backing.*
- `sf::RectangleShape upgrade_menu_backing`  
*A backing for the upgrade menu.*
- `sf::Text upgrade_menu_backing_text`  
*Text for the upgrade menu backing.*
- `sf::Sprite storage_upgrade_sprite`  
*A sprite for illustrating storage (in upgrade menu).*
- `sf::Sprite upgrade_arrow_sprite`  
*An upgrade arrow sprite.*
- `sf::Sprite upgrade_plus_sprite`  
*An upgrade plus sprite.*

## Protected Member Functions

- `void __setUpProductionMenu (void)`  
*Helper method to set up and position production menu assets (drawable).*
- `void __setUpUpgradeMenu (void)`  
*Helper method to set up and position upgrade menu assets (drawable).*
- `void __upgradeStorageCapacity (void)`  
*Helper method to upgrade storage capacity.*
- `void __handleKeyPressEvents (void)`  
*Helper method to handle key press events.*
- `void __handleMouseButtonEvents (void)`  
*Helper method to handle mouse button events.*
- `void __openProductionMenu (void)`  
*Helper method to open the production menu.*
- `void __closeProductionMenu (void)`  
*Helper method to close the production menu.*
- `void __openUpgradeMenu (void)`  
*Helper method to open the upgrade menu.*
- `void __closeUpgradeMenu (void)`  
*Helper method to close the build menu.*
- `void __sendTileStateRequest (void)`  
*Helper method to format and send a request for the parent [HexTile](#) to send a tile state message.*
- `void __sendGameStateRequest (void)`  
*Helper method to format and send a game state request (message).*
- `void __sendCreditsSpentMessage (int)`  
*Helper method to format and send a credits spent message.*
- `void __sendInsufficientCreditsMessage (void)`  
*Helper method to format and send an insufficient credits message.*

## Protected Attributes

- `sf::Event * event_ptr`  
A pointer to the event class.
- `sf::RenderWindow * render_window_ptr`  
A pointer to the render window.
- `AssetsManager * assets_manager_ptr`  
A pointer to the assets manager.
- `MessageHub * message_hub_ptr`  
A pointer to the message hub.

### 4.13.1 Detailed Description

A base class for the tile improvement hierarchy.

### 4.13.2 Constructor & Destructor Documentation

#### 4.13.2.1 TileImprovement()

```
TileImprovement::TileImprovement (
    double position_x,
    double position_y,
    sf::Event * event_ptr,
    sf::RenderWindow * render_window_ptr,
    AssetsManager * assets_manager_ptr,
    MessageHub * message_hub_ptr )
```

Constructor for the [TileImprovement](#) class.

Ref: [Wikipedia \[2023\]](#)

#### Parameters

<i>position_x</i>	The x position of the tile.
<i>position_y</i>	The y position of the tile.
<i>event_ptr</i>	Pointer to the event class.
<i>render_window_ptr</i>	Pointer to the render window.
<i>assets_manager_ptr</i>	Pointer to the assets manager.
<i>message_hub_ptr</i>	Pointer to the message hub.

```
549 {
550     // 1. set attributes
551
552     // 1.1. protected
553     this->event_ptr = event_ptr;
554     this->render_window_ptr = render_window_ptr;
555
556     this->assets_manager_ptr = assets_manager_ptr;
557     this->message_hub_ptr = message_hub_ptr;
558 }
```

```

559 // 1.2. public
560 this->is_selected = true;
561 this->just_built = true;
562 this->production_menu_open = false;
563 this->upgrade_menu_open = false;
564
565 this->frame = 0;
566 this->credits = 0;
567
568 this->position_x = position_x;
569 this->position_y = position_y;
570
571 this->game_phase = "build settlement";
572
573 this->__setUpProductionMenu();
574 this->__setUpUpgradeMenu();
575
576 std::cout << "TileImprovement constructed at " << this << std::endl;
577
578 return;
579 } /* TileImprovement() */

```

#### 4.13.2.2 ~TileImprovement()

```

TileImprovement::~~TileImprovement (
    void ) [virtual]

```

Destructor for the [TileImprovement](#) class.

```

797 {
798     std::cout << "TileImprovement at " << this << " destroyed" << std::endl;
799
800     return;
801 } /* ~TileImprovement() */

```

### 4.13.3 Member Function Documentation

#### 4.13.3.1 \_\_closeProductionMenu()

```

void TileImprovement::__closeProductionMenu (
    void ) [protected]

```

Helper method to close the production menu.

```

334 {
335     if (not this->production_menu_open) {
336         return;
337     }
338
339     this->production_menu_open = false;
340     this->assets_manager_ptr->getSound("build menu close")->play();
341
342     return;
343 } /* __closeProductionMenu() */

```

#### 4.13.3.2 \_\_closeUpgradeMenu()

```
void TileImprovement::__closeUpgradeMenu (
    void ) [protected]
```

Helper method to close the build menu.

```
386 {
387     if (not this->upgrade_menu_open) {
388         return;
389     }
390
391     this->upgrade_menu_open = false;
392     this->assets_manager_ptr->getSound("build menu close")->play();
393
394     return;
395 } /* __closeUpgradeMenu() */
```

#### 4.13.3.3 \_\_handleKeyPressEvents()

```
void TileImprovement::__handleKeyPressEvents (
    void ) [protected]
```

Helper method to handle key press events.

```
219 {
220     if (this->tile_improvement_type == TileImprovementType :: SETTLEMENT) {
221         return;
222     }
223
224     if (this->just_built) {
225         return;
226     }
227
228     switch (this->event_ptr->key.code) {
229         case (sf::Keyboard::E): {
230             this->__openProductionMenu();
231
232             break;
233         }
234
235         default: {
236             // do nothing!
237
238             break;
239         }
240     }
241
242     return;
243 } /* __handleKeyPressEvents() */
```

#### 4.13.3.4 \_\_handleMouseButtonEvents()

```
void TileImprovement::__handleMouseButtonEvents (
    void ) [protected]
```

Helper method to handle mouse button events.

```
259 {
260     if (this->tile_improvement_type == TileImprovementType :: SETTLEMENT) {
261         return;
262     }
263
264     if (this->just_built) {
265         return;
266     }
267
268     switch (this->event_ptr->mouseButton.button) {
```

```

269         case (sf::Mouse::Left): {
270             //...
271
272             break;
273         }
274
275         case (sf::Mouse::Right): {
276             //...
277
278             break;
279         }
280
281
282         default: {
283             // do nothing!
284
285             break;
286         }
287     }
288 }
289
290 return;
291 } /* __handleMouseButtonEvents() */

```

#### 4.13.3.5 \_\_openProductionMenu()

```

void TileImprovement::__openProductionMenu (
    void ) [protected]

```

Helper method to open the production menu.

```

306 {
307     if (this->production_menu_open) {
308         return;
309     }
310
311     if (this->upgrade_menu_open) {
312         this->__closeUpgradeMenu();
313     }
314
315     this->production_menu_open = true;
316     this->assets_manager_ptr->getSound("build menu open")->play();
317
318     return;
319 } /* __openProductionMenu() */

```

#### 4.13.3.6 \_\_openUpgradeMenu()

```

void TileImprovement::__openUpgradeMenu (
    void ) [protected]

```

Helper method to open the upgrade menu.

```

358 {
359     if (this->upgrade_menu_open) {
360         return;
361     }
362
363     if (this->production_menu_open) {
364         this->__closeProductionMenu();
365     }
366
367     this->upgrade_menu_open = true;
368     this->assets_manager_ptr->getSound("build menu open")->play();
369
370     return;
371 } /* __openUpgradeMenu() */

```

#### 4.13.3.7 \_\_sendCreditsSpentMessage()

```
void TileImprovement::__sendCreditsSpentMessage (
    int credits_spent ) [protected]
```

Helper method to format and send a credits spent message.

##### Parameters

<i>credits_spent</i>	The number of credits that were spent.
----------------------	--

```
463 {
464     Message credits_spent_message;
465
466     credits_spent_message.channel = GAME_CHANNEL;
467     credits_spent_message.subject = "credits spent";
468
469     credits_spent_message.int_payload["credits spent"] = credits_spent;
470
471     this->message_hub_ptr->sendMessage(credits_spent_message);
472
473     std::cout << "Credits spent (" << credits_spent << ") message sent by " << this
474         << std::endl;
475     return;
476 } /* __sendCreditsSpentMessage() */
```

#### 4.13.3.8 \_\_sendGameStateRequest()

```
void TileImprovement::__sendGameStateRequest (
    void ) [protected]
```

Helper method to format and send a game state request (message).

```
436 {
437     Message game_state_request;
438
439     game_state_request.channel = GAME_CHANNEL;
440     game_state_request.subject = "state request";
441
442     this->message_hub_ptr->sendMessage(game_state_request);
443
444     std::cout << "Game state request message sent by " << this << std::endl;
445     return;
446 } /* __sendGameStateRequest() */
```

#### 4.13.3.9 \_\_sendInsufficientCreditsMessage()

```
void TileImprovement::__sendInsufficientCreditsMessage (
    void ) [protected]
```

Helper method to format and send an insufficient credits message.

```
491 {
492     Message insufficient_credits_message;
493
494     insufficient_credits_message.channel = GAME_CHANNEL;
495     insufficient_credits_message.subject = "insufficient credits";
496
497     this->message_hub_ptr->sendMessage(insufficient_credits_message);
498
499     std::cout << "Insufficient credits message sent by " << this << std::endl;
500
501     return;
502 } /* __sendInsufficientCreditsMessage() */
```

#### 4.13.3.10 \_\_sendTileStateRequest()

```
void TileImprovement::__sendTileStateRequest (
    void ) [protected]
```

Helper method to format and send a request for the parent [HexTile](#) to send a tile state message.

```
411 {
412     Message tile_state_request;
413
414     tile_state_request.channel = TILE_STATE_CHANNEL;
415     tile_state_request.subject = "state request";
416
417     this->message_hub_ptr->sendMessage(tile_state_request);
418
419     std::cout << "Tile state request sent by " << this << std::endl;
420     return;
421 } /* __sendTileStateRequest() */
```

#### 4.13.3.11 \_\_setUpProductionMenu()

```
void TileImprovement::__setUpProductionMenu (
    void ) [protected]
```

Helper method to set up and position production menu assets (drawable).

```
68 {
69     // 1. set up and place production menu backing and text
70     this->production_menu_backing.setSize(sf::Vector2f(400, 256));
71     this->production_menu_backing.setOrigin(200, 128);
72     this->production_menu_backing.setPosition(400, 400);
73     this->production_menu_backing.setFillColor(MONOCROME_SCREEN_BACKGROUND);
74     this->production_menu_backing.setOutlineColor(MENU_FRAME_GREY);
75     this->production_menu_backing.setOutlineThickness(4);
76
77     this->production_menu_backing_text.setString("**** PRODUCTION MENU ****");
78     this->production_menu_backing_text.setFont (
79         *(this->assets_manager_ptr->getFont ("Glass_TTY_VT220"))
80     );
81     this->production_menu_backing_text.setCharacterSize(16);
82     this->production_menu_backing_text.setFillColor(MONOCROME_TEXT_GREEN);
83     this->production_menu_backing_text.setOrigin(
84         this->production_menu_backing_text.getLocalBounds().width / 2, 0
85     );
86     this->production_menu_backing_text.setPosition(400, 400 - 128 + 4);
87
88     return;
89 } /* __setUpProductionMenu() */
```

#### 4.13.3.12 \_\_setUpUpgradeMenu()

```
void TileImprovement::__setUpUpgradeMenu (
    void ) [protected]
```

Helper method to set up and position upgrade menu assets (drawable).

```
104 {
105     // 1. set up and place upgrade menu backing and text
106     this->upgrade_menu_backing.setSize(sf::Vector2f(400, 256));
107     this->upgrade_menu_backing.setOrigin(200, 128);
108     this->upgrade_menu_backing.setPosition(400, 400);
109     this->upgrade_menu_backing.setFillColor(MONOCROME_SCREEN_BACKGROUND);
110     this->upgrade_menu_backing.setOutlineColor(MENU_FRAME_GREY);
111     this->upgrade_menu_backing.setOutlineThickness(4);
112
113     this->upgrade_menu_backing_text.setString("**** UPGRADE MENU ****");
114     this->upgrade_menu_backing_text.setFont (
115         *(this->assets_manager_ptr->getFont ("Glass_TTY_VT220"))
116     );
```



```

117     this->upgrade_menu_backing_text.setCharacterSize(16);
118     this->upgrade_menu_backing_text.setFillColor(MONOCROME_TEXT_GREEN);
119     this->upgrade_menu_backing_text.setOrigin(
120         this->upgrade_menu_backing_text.getLocalBounds().width / 2, 0
121     );
122     this->upgrade_menu_backing_text.setPosition(400, 400 - 128 + 4);
123
124
125     // 2. set up and place storage upgrade sprite (with upgrade plus)
126     this->storage_upgrade_sprite = sf::Sprite(
127         *(this->assets_manager_ptr->getTexture("energy storage system"))
128     );
129
130     this->storage_upgrade_sprite.setOrigin(
131         this->storage_upgrade_sprite.getLocalBounds().width / 2,
132         this->storage_upgrade_sprite.getLocalBounds().height
133     );
134
135     this->storage_upgrade_sprite.setPosition(400 + 100, 400 - 32);
136
137     this->upgrade_plus_sprite = sf::Sprite(
138         *(this->assets_manager_ptr->getTexture("upgrade plus"))
139     );
140
141     this->upgrade_plus_sprite.setOrigin(
142         this->upgrade_plus_sprite.getLocalBounds().width / 2,
143         this->upgrade_plus_sprite.getLocalBounds().height / 2
144     );
145
146     this->upgrade_plus_sprite.setPosition(400 + 130, 400 - 64);
147
148
149     // 3. set up and place upgrade arrow sprite
150     this->upgrade_arrow_sprite = sf::Sprite(
151         *(this->assets_manager_ptr->getTexture("upgrade arrow"))
152     );
153
154     this->upgrade_arrow_sprite.setOrigin(
155         this->upgrade_arrow_sprite.getLocalBounds().width / 2,
156         this->upgrade_arrow_sprite.getLocalBounds().height / 2
157     );
158
159     this->upgrade_arrow_sprite.setPosition(400 - 64, 400 - 64);
160
161
162     return;
163 } /* __setUpUpgradeMenu() */

```

#### 4.13.3.13 \_\_upgradeStorageCapacity()

```

void TileImprovement::__upgradeStorageCapacity (
    void ) [protected]

```

Helper method to upgrade storage capacity.

```

178 {
179     if (this->credits < ENERGY_STORAGE_SYSTEM_BUILD_COST) {
180         std::cout << "Cannot add energy storage: insufficient credits (need "
181             << ENERGY_STORAGE_SYSTEM_BUILD_COST << " K)" << std::endl;
182
183         this->__sendInsufficientCreditsMessage();
184         return;
185     }
186
187     if (this->storage_level >= MAX_STORAGE_LEVELS) {
188         return;
189     }
190
191     this->health = 100;
192
193     this->storage_level++;
194
195     this->just_upgraded = true;
196
197     this->assets_manager_ptr->getSound("upgrade")->play();
198
199     this->__sendCreditsSpentMessage(ENERGY_STORAGE_SYSTEM_BUILD_COST);
200     this->__sendTileStateRequest();
201     this->__sendGameStateRequest();

```

```

202
203     return;
204 } /* __upgradeStorageCapacity() */

```

#### 4.13.3.14 draw()

```

void TileImprovement::draw (
    void ) [virtual]

```

Method to draw the hex tile to the render window. To be called once per frame.

Reimplemented in [WindTurbine](#), [WaveEnergyConverter](#), [TidalTurbine](#), [SolarPV](#), [Settlement](#), [EnergyStorageSystem](#), and [DieselGenerator](#).

```

668 {
669     if (this->tile_improvement_sprite_static.getTexture() != NULL) {
670         int alpha = this->tile_improvement_sprite_static.getColor().a;
671
672         alpha += 0.08 * FRAMES_PER_SECOND;
673
674         this->tile_improvement_sprite_static.setColor(
675             sf::Color(255, 255, 255, alpha)
676         );
677
678         this->tile_improvement_sprite_static.move(0, 50 * SECONDS_PER_FRAME);
679
680         if (
681             (alpha >= 255) or
682             (this->tile_improvement_sprite_static.getPosition().y >= this->position_y + 12)
683         ) {
684             this->tile_improvement_sprite_static.setColor(
685                 sf::Color(255, 255, 255, 255)
686             );
687
688             this->tile_improvement_sprite_static.setPosition(
689                 this->position_x,
690                 this->position_y + 12
691             );
692
693             this->just_built = false;
694             this->assets_manager_ptr->getSound("place improvement")->play();
695         }
696
697         this->render_window_ptr->draw(this->tile_improvement_sprite_static);
698     }
699
700     else {
701         int alpha = 0;
702
703         for (size_t i = 0; i < this->tile_improvement_sprite_animated.size(); i++) {
704             alpha = this->tile_improvement_sprite_animated[i].getColor().a;
705
706             alpha += 0.08 * FRAMES_PER_SECOND;
707
708             this->tile_improvement_sprite_animated[i].setColor(
709                 sf::Color(255, 255, 255, alpha)
710             );
711
712             this->tile_improvement_sprite_animated[i].move(0, 50 * SECONDS_PER_FRAME);
713
714             if (
715                 (alpha >= 255) or
716                 (this->tile_improvement_sprite_animated[i].getPosition().y >= this->position_y + 12)
717             ) {
718                 this->tile_improvement_sprite_animated[i].setColor(
719                     sf::Color(255, 255, 255, 255)
720                 );
721
722                 this->tile_improvement_sprite_animated[i].setPosition(
723                     this->position_x,
724                     this->position_y + 12
725                 );
726             }
727
728             this->render_window_ptr->draw(this->tile_improvement_sprite_animated[i]);
729         }
730     }
731 }

```

```

732         if (
733             (alpha >= 255) or
734             (this->tile_improvement_sprite_animated[0].getPosition().y >= this->position_y + 12)
735         ) {
736             this->just_built = false;
737             this->assets_manager_ptr->getSound("place_improvement")->play();
738
739             switch (this->tile_improvement_type) {
740                 case (TileImprovementType :: WIND_TURBINE): {
741                     for (size_t i = 0; i < this->tile_improvement_sprite_animated.size(); i++) {
742                         this->tile_improvement_sprite_animated[i].setOrigin(32, 32);
743                         this->tile_improvement_sprite_animated[i].move(0, -32);
744                     }
745
746                     break;
747                 }
748
749                 case (TileImprovementType :: TIDAL_TURBINE): {
750                     for (size_t i = 0; i < this->tile_improvement_sprite_animated.size(); i++) {
751                         this->tile_improvement_sprite_animated[i].setOrigin(32, 45);
752                         this->tile_improvement_sprite_animated[i].move(0, -19);
753                     }
754
755                     break;
756                 }
757
758                 case (TileImprovementType :: WAVE_ENERGY_CONVERTER): {
759                     for (size_t i = 0; i < this->tile_improvement_sprite_animated.size(); i++) {
760                         this->tile_improvement_sprite_animated[i].setOrigin(32, 32);
761                         this->tile_improvement_sprite_animated[i].move(0, -32);
762                     }
763
764                     break;
765                 }
766
767                 default: {
768                     // do nothing!
769
770                     break;
771                 }
772             }
773         }
774     }
775 }
776
777 }
778
779
780 this->frame++;
781 return;
782 } /* draw() */

```

#### 4.13.3.15 getTileOptionsSubstring()

```

virtual std::string TileImprovement::getTileOptionsSubstring (
    void ) [inline], [virtual]

```

Reimplemented in [WindTurbine](#), [WaveEnergyConverter](#), [TidalTurbine](#), [SolarPV](#), [Settlement](#), [EnergyStorageSystem](#), and [DieselGenerator](#).

```
167 {return "";}

```

#### 4.13.3.16 processEvent()

```

void TileImprovement::processEvent (
    void ) [virtual]

```

Method to process [TileImprovement](#). To be called once per event.

Reimplemented in [WindTurbine](#), [WaveEnergyConverter](#), [TidalTurbine](#), [SolarPV](#), [Settlement](#), [EnergyStorageSystem](#), and [DieselGenerator](#).

```

623 {
624     if (this->event_ptr->type == sf::Event::KeyPressed) {
625         this->__handleKeyPressEvents();
626     }
627
628     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
629         this->__handleMouseButtonEvents();
630     }
631
632     return;
633 } /* processEvent() */

```

#### 4.13.3.17 processMessage()

```

void TileImprovement::processMessage (
    void ) [virtual]

```

Method to process [TileImprovement](#). To be called once per message.

Reimplemented in [WindTurbine](#), [WaveEnergyConverter](#), [TidalTurbine](#), [SolarPV](#), [Settlement](#), [EnergyStorageSystem](#), and [DieselGenerator](#).

```

648 {
649     //...
650
651     return;
652 } /* processMessage() */

```

#### 4.13.3.18 setIsSelected()

```

void TileImprovement::setIsSelected (
    bool is_selected ) [virtual]

```

Method to set the is selected attribute.

##### Parameters

<i>is_selected</i>	The value to set the is selected attribute to.
--------------------	--

Reimplemented in [Settlement](#), and [EnergyStorageSystem](#).

```

596 {
597     this->is_selected = is_selected;
598
599     if ((not is_selected) and this->production_menu_open) {
600         this->__closeProductionMenu();
601     }
602
603     if ((not is_selected) and this->upgrade_menu_open) {
604         this->__closeUpgradeMenu();
605     }
606
607     return;
608 } /* setIsSelected() */

```

### 4.13.4 Member Data Documentation

#### 4.13.4.1 assets\_manager\_ptr

```
AssetsManager* TileImprovement::assets_manager_ptr [protected]
```

A pointer to the assets manager.

#### 4.13.4.2 credits

```
int TileImprovement::credits
```

The current balance of credits.

#### 4.13.4.3 event\_ptr

```
sf::Event* TileImprovement::event_ptr [protected]
```

A pointer to the event class.

#### 4.13.4.4 frame

```
unsigned long long int TileImprovement::frame
```

The current frame of this object.

#### 4.13.4.5 game\_phase

```
std::string TileImprovement::game_phase
```

The current phase of the game.

#### 4.13.4.6 health

```
int TileImprovement::health
```

The health of the improvement.

#### 4.13.4.7 is\_running

```
bool TileImprovement::is_running
```

A boolean which indicates whether or not the improvement is running.

#### 4.13.4.8 is\_selected

```
bool TileImprovement::is_selected
```

A boolean which indicates whether or not the tile is selected.

#### 4.13.4.9 just\_built

```
bool TileImprovement::just_built
```

A boolean which indicates that the improvement was just built.

#### 4.13.4.10 just\_upgraded

```
bool TileImprovement::just_upgraded
```

A boolean which indicates that the improvement was just upgraded.

#### 4.13.4.11 message\_hub\_ptr

```
MessageHub* TileImprovement::message_hub_ptr [protected]
```

A pointer to the message hub.

#### 4.13.4.12 position\_x

```
double TileImprovement::position_x
```

The x position of the tile improvement.

#### 4.13.4.13 position\_y

```
double TileImprovement::position_y
```

The y position of the tile improvement.

#### 4.13.4.14 production\_menu\_backing

```
sf::RectangleShape TileImprovement::production_menu_backing
```

A backing for the production menu.

#### 4.13.4.15 production\_menu\_backing\_text

```
sf::Text TileImprovement::production_menu_backing_text
```

Text for the production menu backing.

#### 4.13.4.16 production\_menu\_open

```
bool TileImprovement::production_menu_open
```

A boolean which indicates whether or not the production menu is open.

#### 4.13.4.17 render\_window\_ptr

```
sf::RenderWindow* TileImprovement::render_window_ptr [protected]
```

A pointer to the render window.

#### 4.13.4.18 storage\_level

```
int TileImprovement::storage_level
```

The level of storage installed alongside the tile improvement.

#### 4.13.4.19 storage\_upgrade\_sprite

```
sf::Sprite TileImprovement::storage_upgrade_sprite
```

A sprite for illustrating storage (in upgrade menu).

#### 4.13.4.20 tile\_improvement\_sprite\_animated

```
std::vector<sf::Sprite> TileImprovement::tile_improvement_sprite_animated
```

An animated sprite, for the [ContextMenu](#) visual screen.

#### 4.13.4.21 tile\_improvement\_sprite\_static

```
sf::Sprite TileImprovement::tile_improvement_sprite_static
```

A static sprite, for decorating the tile.

#### 4.13.4.22 tile\_improvement\_string

```
std::string TileImprovement::tile_improvement_string
```

A string representation of the tile improvement type.

#### 4.13.4.23 tile\_improvement\_type

```
TileImprovementType TileImprovement::tile_improvement_type
```

The type of the tile improvement.

#### 4.13.4.24 upgrade\_arrow\_sprite

```
sf::Sprite TileImprovement::upgrade_arrow_sprite
```

An upgrade arrow sprite.



**4.13.4.25 upgrade\_frame**

```
int TileImprovement::upgrade_frame
```

The frame of the upgrade animation.

**4.13.4.26 upgrade\_level**

```
int TileImprovement::upgrade_level
```

The upgrade level of the improvement.

**4.13.4.27 upgrade\_menu\_backing**

```
sf::RectangleShape TileImprovement::upgrade_menu_backing
```

A backing for the upgrade menu.

**4.13.4.28 upgrade\_menu\_backing\_text**

```
sf::Text TileImprovement::upgrade_menu_backing_text
```

Text for the upgrade menu backing.

**4.13.4.29 upgrade\_menu\_open**

```
bool TileImprovement::upgrade_menu_open
```

A boolean which indicates whether or not the build menu is open.

**4.13.4.30 upgrade\_plus\_sprite**

```
sf::Sprite TileImprovement::upgrade_plus_sprite
```

An upgrade plus sprite.

The documentation for this class was generated from the following files:

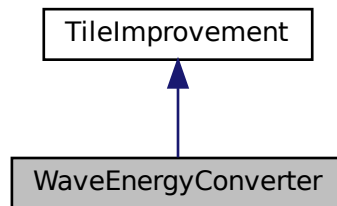
- header/[TileImprovement.h](#)
- source/[TileImprovement.cpp](#)

## 4.14 WaveEnergyConverter Class Reference

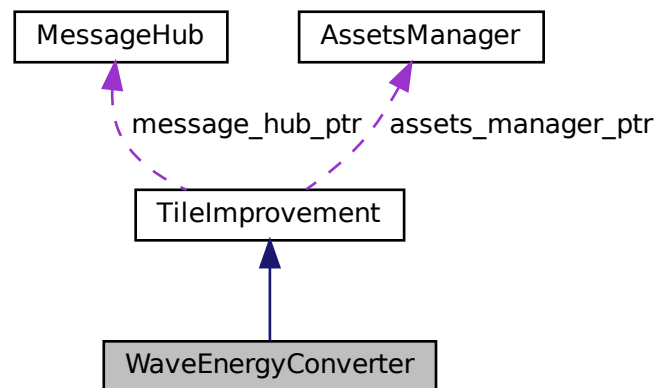
A settlement class (child class of [TileImprovement](#)).

```
#include <WaveEnergyConverter.h>
```

Inheritance diagram for WaveEnergyConverter:



Collaboration diagram for WaveEnergyConverter:



### Public Member Functions

- [WaveEnergyConverter](#) (double, double, sf::Event \*, sf::RenderWindow \*, [AssetsManager](#) \*, [MessageHub](#) \*)  
*Constructor for the [WaveEnergyConverter](#) class.*
- std::string [getTileOptionsSubstring](#) (void)  
*Helper method to assemble and return tile options substring.*
- void [processEvent](#) (void)  
*Method to process [WaveEnergyConverter](#). To be called once per event.*
- void [processMessage](#) (void)

- Method to process [WaveEnergyConverter](#). To be called once per message.
- void [draw](#) (void)  
Method to draw the hex tile to the render window. To be called once per frame.
- virtual [~WaveEnergyConverter](#) (void)  
Destructor for the [WaveEnergyConverter](#) class.

## Public Attributes

- int [capacity\\_kW](#)  
The rated production capacity [kW] of the solar PV array.
- int [production\\_MWh](#)  
The current production [MWh] of the solar PV array.
- int [dispatchable\\_MWh](#)  
The amount of production that is directly dispatchable to the grid (i.e. production correlated with demand).

## Private Member Functions

- void [\\_\\_setUpTileImprovementSpriteAnimated](#) (void)  
Helper method to set up tile improvement sprite (static).
- void [\\_\\_upgradePowerCapacity](#) (void)  
Helper method to upgrade power capacity.
- void [\\_\\_handleKeyPressEvents](#) (void)  
Helper method to handle key press events.
- void [\\_\\_handleMouseButtonEvents](#) (void)  
Helper method to handle mouse button events.
- void [\\_\\_drawUpgradeOptions](#) (void)  
Helper method to set up and draw upgrade options.

## Additional Inherited Members

### 4.14.1 Detailed Description

A settlement class (child class of [TileImprovement](#)).

### 4.14.2 Constructor & Destructor Documentation

#### 4.14.2.1 WaveEnergyConverter()

```
WaveEnergyConverter::WaveEnergyConverter (
    double position_x,
    double position_y,
    sf::Event * event_ptr,
    sf::RenderWindow * render_window_ptr,
    AssetsManager * assets_manager_ptr,
    MessageHub * message_hub_ptr )
```

Constructor for the [WaveEnergyConverter](#) class.

Ref: [Wikipedia \[2023\]](#)

## Parameters

<i>position_x</i>	The x position of the tile.
<i>position_y</i>	The y position of the tile.
<i>event_ptr</i>	Pointer to the event class.
<i>render_window_ptr</i>	Pointer to the render window.
<i>assets_manager_ptr</i>	Pointer to the assets manager.
<i>message_hub_ptr</i>	Pointer to the message hub.

```

408 :
409 TileImprovement (
410     position_x,
411     position_y,
412     event_ptr,
413     render_window_ptr,
414     assets_manager_ptr,
415     message_hub_ptr
416 )
417 {
418     // 1. set attributes
419
420     // 1.1. private
421     //...
422
423     // 1.2. public
424     this->tile_improvement_type = TileImprovementType :: WAVE_ENERGY_CONVERTER;
425
426     this->is_running = false;
427
428     this->health = 100;
429
430     this->capacity_kW = 100;
431     this->upgrade_level = 1;
432     this->storage_level = 0;
433
434     this->production_MWh = 0;
435     this->dispatchable_MWh = 0;
436
437     this->tile_improvement_string = "WAVE ENERGY";
438
439     this->__setUpTileImprovementSpriteAnimated();
440
441     std::cout << "WaveEnergyConverter constructed at " << this << std::endl;
442
443     return;
444 } /* WaveEnergyConverter() */

```

## 4.14.2.2 ~WaveEnergyConverter()

```

WaveEnergyConverter::~WaveEnergyConverter (
    void ) [virtual]

```

Destructor for the [WaveEnergyConverter](#) class.

```

649 {
650     std::cout << "WaveEnergyConverter at " << this << " destroyed" << std::endl;
651
652     return;
653 } /* ~WaveEnergyConverter() */

```

## 4.14.3 Member Function Documentation

## 4.14.3.1 \_\_drawUpgradeOptions()

```
void WaveEnergyConverter::__drawUpgradeOptions (
    void ) [private]
```

Helper method to set up and draw upgrade options.

```
263 {
264     // 1. draw power capacity upgrade sprite
265     for (size_t i = 0; i < this->tile_improvement_sprite_animated.size(); i++) {
266         sf::Vector2f initial_position = this->tile_improvement_sprite_animated[i].getPosition();
267         this->tile_improvement_sprite_animated[i].setPosition(400 - 100, 400 - 32 - 20);
268
269         sf::Color initial_colour = this->tile_improvement_sprite_animated[i].getColor();
270         this->tile_improvement_sprite_animated[i].setColor(sf::Color(255, 255, 255, 255));
271
272         sf::Vector2f initial_scale = this->tile_improvement_sprite_animated[i].getScale();
273         this->tile_improvement_sprite_animated[i].setScale(sf::Vector2f(1, 1));
274
275         this->render_window_ptr->draw(this->tile_improvement_sprite_animated[i]);
276
277         this->tile_improvement_sprite_animated[i].setPosition(initial_position);
278         this->tile_improvement_sprite_animated[i].setColor(initial_colour);
279         this->tile_improvement_sprite_animated[i].setScale(initial_scale);
280     }
281
282     this->render_window_ptr->draw(this->upgrade_arrow_sprite);
283
284
285     // 2. draw power capacity upgrade text
286     // 16 char line = "
287     std::string power_upgrade_string = "POWER CAPACITY \n";
288     power_upgrade_string += " \n";
289
290     power_upgrade_string += "CAPACITY: ";
291     power_upgrade_string += std::to_string(this->capacity_kW);
292     power_upgrade_string += " kW\n";
293
294     power_upgrade_string += "LEVEL: ";
295     power_upgrade_string += std::to_string(this->upgrade_level);
296     power_upgrade_string += "\n\n";
297
298     if (this->upgrade_level < MAX_UPGRADE_LEVELS) {
299         power_upgrade_string += "[W]: + 100 kW (";
300         power_upgrade_string += std::to_string(WAVE_ENERGY_CONVERTER_BUILD_COST);
301         power_upgrade_string += " K)\n";
302     }
303
304     else {
305         power_upgrade_string += " * MAX LEVEL * \n";
306     }
307
308     sf::Text power_upgrade_text = sf::Text(
309         power_upgrade_string,
310         * (this->assets_manager_ptr->getFont("Glass_TTY_VT220")),
311         16
312     );
313
314     power_upgrade_text.setOrigin(power_upgrade_text.getLocalBounds().width / 2, 0);
315     power_upgrade_text.setPosition(400 - 100, 400 - 32 + 16);
316     power_upgrade_text.setFillColor(MONOCROME_TEXT_GREEN);
317
318     this->render_window_ptr->draw(power_upgrade_text);
319
320
321     // 3. draw energy capacity (storage) upgrade sprite
322     this->render_window_ptr->draw(this->storage_upgrade_sprite);
323     this->render_window_ptr->draw(this->upgrade_plus_sprite);
324
325
326     // 4. draw energy capacity (storage) upgrade text
327     // 16 char line = "
328     std::string energy_upgrade_string = "ENERGY CAPACITY \n";
329     energy_upgrade_string += " \n";
330
331     energy_upgrade_string += "CAPACITY: ";
332     energy_upgrade_string += std::to_string(this->storage_level * 200);
333     energy_upgrade_string += " kWh\n";
334
335     energy_upgrade_string += "LEVEL: ";
336     energy_upgrade_string += std::to_string(this->storage_level);
337     energy_upgrade_string += "\n\n";
338
339     if (this->storage_level < MAX_STORAGE_LEVELS) {
340         energy_upgrade_string += "[D]: + 200 kWh (";
```

```

341         energy_upgrade_string      += std::to_string(ENERGY_STORAGE_SYSTEM_BUILD_COST);
342         energy_upgrade_string      += " K)\n";
343     }
344
345     else {
346         energy_upgrade_string += " * MAX LEVEL *  \n";
347     }
348
349     sf::Text energy_upgrade_text = sf::Text(
350         energy_upgrade_string,
351         *(this->assets_manager_ptr->getFont("Glass_TTY_VT220")),
352         16
353     );
354
355     energy_upgrade_text.setOrigin(energy_upgrade_text.getLocalBounds().width / 2, 0);
356     energy_upgrade_text.setPosition(400 + 100, 400 - 32 + 16);
357     energy_upgrade_text.setFillColor(MONOCHROME_TEXT_GREEN);
358
359     this->render_window_ptr->draw(energy_upgrade_text);
360
361     return;
362 } /* __drawUpgradeOptions() */

```

#### 4.14.3.2 \_\_handleKeyPressEvents()

```

void WaveEnergyConverter::__handleKeyPressEvents (
    void ) [private]

```

Helper method to handle key press events.

```

156 {
157     if (this->just_built) {
158         return;
159     }
160
161     switch (this->event_ptr->key.code) {
162         case (sf::Keyboard::U): {
163             this->__openUpgradeMenu();
164
165             break;
166         }
167
168         case (sf::Keyboard::W): {
169             if (this->production_menu_open) {
170                 //...
171             }
172
173             else if (this->upgrade_menu_open) {
174                 this->__upgradePowerCapacity();
175             }
176
177             break;
178         }
179
180         case (sf::Keyboard::S): {
181             //...
182
183             break;
184         }
185
186         case (sf::Keyboard::D): {
187             if (this->upgrade_menu_open) {
188                 this->__upgradeStorageCapacity();
189             }
190
191             break;
192         }
193
194         default: {
195             // do nothing!
196
197             break;
198         }
199     }
200
201     return;
202 } /* __handleKeyPressEvents() */

```

#### 4.14.3.3 \_\_handleMouseButtonEvents()

```
void WaveEnergyConverter::__handleMouseButtonEvents (
    void ) [private]
```

Helper method to handle mouse button events.

```
221 {
222     if (this->just_built) {
223         return;
224     }
225     switch (this->event_ptr->mouseButton.button) {
226         case (sf::Mouse::Left): {
227             //...
228
229             break;
230         }
231
232
233         case (sf::Mouse::Right): {
234             //...
235
236             break;
237         }
238
239
240         default: {
241             // do nothing!
242
243             break;
244         }
245     }
246
247     return;
248 } /* __handleMouseButtonEvents() */
```

#### 4.14.3.4 \_\_setUpTileImprovementSpriteAnimated()

```
void WaveEnergyConverter::__setUpTileImprovementSpriteAnimated (
    void ) [private]
```

Helper method to set up tile improvement sprite (static).

```
68 {
69     sf::Sprite diesel_generator_sheet (
70         *(this->assets_manager_ptr->getTexture("wave energy converter"))
71     );
72
73     int n_elements = diesel_generator_sheet.getLocalBounds().height / 64;
74
75     for (int i = 0; i < n_elements; i++) {
76         this->tile_improvement_sprite_animated.push_back(
77             sf::Sprite(
78                 *(this->assets_manager_ptr->getTexture("wave energy converter")),
79                 sf::IntRect(0, i * 64, 64, 64)
80             )
81         );
82
83         this->tile_improvement_sprite_animated.back().setOrigin(
84             this->tile_improvement_sprite_animated.back().getLocalBounds().width / 2,
85             this->tile_improvement_sprite_animated.back().getLocalBounds().height
86         );
87
88         this->tile_improvement_sprite_animated.back().setPosition(
89             this->position_x,
90             this->position_y - 32
91         );
92
93         this->tile_improvement_sprite_animated.back().setColor(
94             sf::Color(255, 255, 255, 0)
95         );
96     }
97
98     return;
99 } /* __setUpTileImprovementSpriteAnimated() */
```

#### 4.14.3.5 \_\_upgradePowerCapacity()

```
void WaveEnergyConverter::__upgradePowerCapacity (
    void ) [private]
```

Helper method to upgrade power capacity.

```
114 {
115     if (this->credits < WAVE_ENERGY_CONVERTER_BUILD_COST) {
116         std::cout << "Cannot upgrade wave energy converter: insufficient credits (need "
117             << WAVE_ENERGY_CONVERTER_BUILD_COST << " K)" << std::endl;
118
119         this->__sendInsufficientCreditsMessage();
120         return;
121     }
122
123     if (this->upgrade_level >= MAX_UPGRADE_LEVELS) {
124         return;
125     }
126
127     this->health = 100;
128
129     this->capacity_kW += 100;
130     this->upgrade_level++;
131
132     this->just_upgraded = true;
133
134     this->assets_manager_ptr->getSound("upgrade")->play();
135
136     this->__sendCreditsSpentMessage(WAVE_ENERGY_CONVERTER_BUILD_COST);
137     this->__sendTileStateRequest();
138     this->__sendGameStateRequest();
139
140     return;
141 } /* __upgradePowerCapacity() */
```

#### 4.14.3.6 draw()

```
void WaveEnergyConverter::draw (
    void ) [virtual]
```

Method to draw the hex tile to the render window. To be called once per frame.

Reimplemented from [TileImprovement](#).

```
555 {
556     // 1. if just built, call base method and return
557     if (this->just_built) {
558         TileImprovement::draw();
559
560         return;
561     }
562
563     // 2. handle upgrade effects
564     if (this->just_upgraded) {
565         for (size_t i = 0; i < this->tile_improvement_sprite_animated.size(); i++) {
566             this->tile_improvement_sprite_animated[i].setColor(
567                 sf::Color(
568                     255 * pow(cos((M_PI * this->upgrade_frame) / FRAMES_PER_SECOND), 2),
569                     255,
570                     255 * pow(cos((M_PI * this->upgrade_frame) / FRAMES_PER_SECOND), 2),
571                     255
572                 )
573             );
574
575             this->tile_improvement_sprite_animated[i].setScale(
576                 sf::Vector2f(
577                     1 + 0.2 * pow(cos((M_PI * this->upgrade_frame) / FRAMES_PER_SECOND), 2),
578                     1 + 0.2 * pow(cos((M_PI * this->upgrade_frame) / FRAMES_PER_SECOND), 2)
579                 )
580             );
581         }
582
583         this->upgrade_frame++;
584     }
585 }
```



```

586
587     if (this->upgrade_frame >= 2 * FRAMES_PER_SECOND) {
588         for (size_t i = 0; i < this->tile_improvement_sprite_animated.size(); i++) {
589             this->tile_improvement_sprite_animated[i].setColor(
590                 sf::Color(255,255,255,255)
591             );
592             this->tile_improvement_sprite_animated[i].setScale(sf::Vector2f(1,1));
593         }
594
595         this->just_upgraded = false;
596         this->upgrade_frame = 0;
597     }
598 }
599
600
601 // 3. draw first element of animated sprite
602 this->render_window_ptr->draw(this->tile_improvement_sprite_animated[0]);
603
604
605 // 4. draw second element of animated sprite
606 if (this->is_running) {
607     //...
608 }
609
610 else {
611     //...
612 }
613
614 this->render_window_ptr->draw(this->tile_improvement_sprite_animated[1]);
615
616 // 5. draw production menu
617 if (this->production_menu_open) {
618     this->render_window_ptr->draw(this->production_menu_backing);
619     this->render_window_ptr->draw(this->production_menu_backing_text);
620
621     //...
622 }
623
624 // 6. draw upgrade menu
625 if (this->upgrade_menu_open) {
626     this->render_window_ptr->draw(this->upgrade_menu_backing);
627     this->render_window_ptr->draw(this->upgrade_menu_backing_text);
628
629     this->__drawUpgradeOptions();
630 }
631
632 this->frame++;
633 return;
634 } /* draw() */

```

#### 4.14.3.7 getTileOptionsSubstring()

```

std::string WaveEnergyConverter::getTileOptionsSubstring (
    void ) [virtual]

```

Helper method to assemble and return tile options substring.

#### Returns

Tile options substring.

Reimplemented from [TileImprovement](#).

```

461 {
462     //          32 char x 17 line console "-----\n";
463     std::string options_substring = "CAPACITY: ";
464     options_substring += std::to_string(this->capacity_kW);
465     options_substring += " kW (level ";
466     options_substring += std::to_string(this->upgrade_level);
467     options_substring += ") \n";
468
469     options_substring += "PRODUCTION: ";
470     options_substring += std::to_string(this->production_MWh);
471     options_substring += " MWh \n";
472 }

```

```

473     options_substring           += "DISPATCHABLE:  ";
474     options_substring           += std::to_string(this->dispatchable_MWh);
475     options_substring           += " MWh\n";
476
477     options_substring           += "HEALTH:          ";
478     options_substring           += std::to_string(this->health);
479     options_substring           += "/100\n";
480
481     options_substring           += "
482     options_substring           += " **** WAVE ENERGY OPTIONS **** \n";
483     options_substring           += "
484     options_substring           += "      [E]:  OPEN PRODUCTION MENU \n";
485     options_substring           += "      [U]:  OPEN UPGRADE MENU   \n";
486     options_substring           += "HOLD [P]:  SCRAP (";
487     options_substring           += std::to_string(SCRAP_COST);
488     options_substring           += " K)";
489
490     return options_substring;
491 } /* getTileOptionsSubstring() */

```

#### 4.14.3.8 processEvent()

```

void WaveEnergyConverter::processEvent (
    void ) [virtual]

```

Method to process [WaveEnergyConverter](#). To be called once per event.

Reimplemented from [TileImprovement](#).

```

506 {
507     TileImprovement :: processEvent();
508
509     if (this->event_ptr->type == sf::Event::KeyPressed) {
510         this->__handleKeyPressEvents();
511     }
512
513     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
514         this->__handleMouseButtonEvents();
515     }
516
517     return;
518 } /* processEvent() */

```

#### 4.14.3.9 processMessage()

```

void WaveEnergyConverter::processMessage (
    void ) [virtual]

```

Method to process [WaveEnergyConverter](#). To be called once per message.

Reimplemented from [TileImprovement](#).

```

533 {
534     TileImprovement :: processMessage();
535
536     //...
537
538     return;
539 } /* processMessage() */

```

### 4.14.4 Member Data Documentation

#### 4.14.4.1 capacity\_kW

```
int WaveEnergyConverter::capacity_kW
```

The rated production capacity [kW] of the solar PV array.

#### 4.14.4.2 dispatchable\_MWh

```
int WaveEnergyConverter::dispatchable_MWh
```

The amount of production that is directly dispatchable to the grid (i.e. production correlated with demand).

#### 4.14.4.3 production\_MWh

```
int WaveEnergyConverter::production_MWh
```

The current production [MWh] of the solar PV array.

The documentation for this class was generated from the following files:

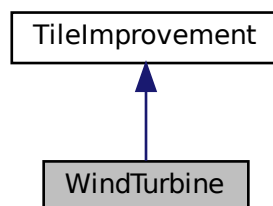
- header/[WaveEnergyConverter.h](#)
- source/[WaveEnergyConverter.cpp](#)

## 4.15 WindTurbine Class Reference

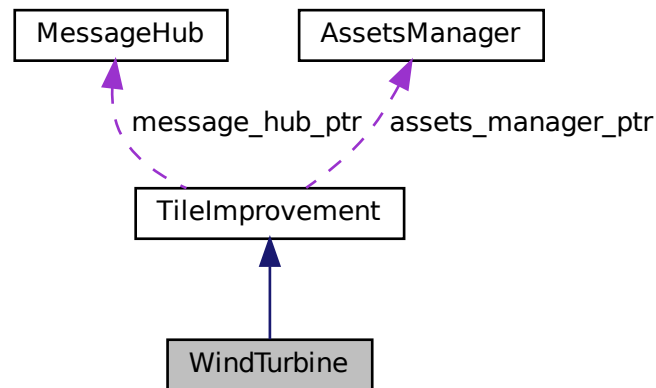
A settlement class (child class of [TileImprovement](#)).

```
#include <WindTurbine.h>
```

Inheritance diagram for WindTurbine:



Collaboration diagram for WindTurbine:



## Public Member Functions

- [WindTurbine](#) (double, double, sf::Event \*, sf::RenderWindow \*, [AssetsManager](#) \*, [MessageHub](#) \*)  
*Constructor for the [WindTurbine](#) class.*
- std::string [getTileOptionsSubstring](#) (void)  
*Helper method to assemble and return tile options substring.*
- void [processEvent](#) (void)  
*Method to process [WindTurbine](#). To be called once per event.*
- void [processMessage](#) (void)  
*Method to process [WindTurbine](#). To be called once per message.*
- void [draw](#) (void)  
*Method to draw the hex tile to the render window. To be called once per frame.*
- virtual [~WindTurbine](#) (void)  
*Destructor for the [WindTurbine](#) class.*

## Public Attributes

- int [capacity\\_kW](#)  
*The rated production capacity [kW] of the solar PV array.*
- int [production\\_MWh](#)  
*The current production [MWh] of the solar PV array.*
- int [dispatchable\\_MWh](#)  
*The amount of production that is directly dispatchable to the grid (i.e. production correlated with demand).*

## Private Member Functions

- void [\\_\\_setUpTileImprovementSpriteAnimated](#) (void)  
*Helper method to set up tile improvement sprite (static).*
- void [\\_\\_upgradePowerCapacity](#) (void)  
*Helper method to upgrade the power capacity.*
- void [\\_\\_handleKeyPressEvents](#) (void)  
*Helper method to handle key press events.*
- void [\\_\\_handleMouseButtonEvents](#) (void)  
*Helper method to handle mouse button events.*
- void [\\_\\_drawUpgradeOptions](#) (void)  
*Helper method to set up and draw upgrade options.*

## Additional Inherited Members

### 4.15.1 Detailed Description

A settlement class (child class of [TileImprovement](#)).

### 4.15.2 Constructor & Destructor Documentation

#### 4.15.2.1 WindTurbine()

```
WindTurbine::WindTurbine (
    double position_x,
    double position_y,
    sf::Event * event_ptr,
    sf::RenderWindow * render_window_ptr,
    AssetsManager * assets_manager_ptr,
    MessageHub * message_hub_ptr )
```

Constructor for the [WindTurbine](#) class.

Ref: [Wikipedia](#) [2023]

#### Parameters

<i>position_x</i>	The x position of the tile.
<i>position_y</i>	The y position of the tile.
<i>event_ptr</i>	Pointer to the event class.
<i>render_window_ptr</i>	Pointer to the render window.
<i>assets_manager_ptr</i>	Pointer to the assets manager.
<i>message_hub_ptr</i>	Pointer to the message hub.

```
409 :
410 TileImprovement (
```

```

411     position_x,
412     position_y,
413     event_ptr,
414     render_window_ptr,
415     assets_manager_ptr,
416     message_hub_ptr
417 )
418 {
419     // 1. set attributes
420
421     // 1.1. private
422     //...
423
424     // 1.2. public
425     this->tile_improvement_type = TileImprovementType :: WIND_TURBINE;
426
427     this->is_running = false;
428
429     this->health = 100;
430
431     this->capacity_kW = 100;
432     this->upgrade_level = 1;
433     this->storage_level = 0;
434
435     this->production_MWh = 0;
436     this->dispatchable_MWh = 0;
437
438     this->tile_improvement_string = "WIND TURBINE";
439
440     this->__setUpTileImprovementSpriteAnimated();
441
442     std::cout << "WindTurbine constructed at " << this << std::endl;
443
444     return;
445 } /* WindTurbine() */

```

#### 4.15.2.2 ~WindTurbine()

```

WindTurbine::~~WindTurbine (
    void ) [virtual]

```

Destructor for the [WindTurbine](#) class.

```

650 {
651     std::cout << "WindTurbine at " << this << " destroyed" << std::endl;
652
653     return;
654 } /* ~WindTurbine() */

```

### 4.15.3 Member Function Documentation

#### 4.15.3.1 \_\_drawUpgradeOptions()

```

void WindTurbine::__drawUpgradeOptions (
    void ) [private]

```

Helper method to set up and draw upgrade options.

```

264 {
265     // 1. draw power capacity upgrade sprite
266     for (size_t i = 0; i < this->tile_improvement_sprite_animated.size(); i++) {
267         sf::Vector2f initial_position = this->tile_improvement_sprite_animated[i].getPosition();
268         this->tile_improvement_sprite_animated[i].setPosition(400 - 100, 400 - 56);
269
270         sf::Color initial_colour = this->tile_improvement_sprite_animated[i].getColor();
271         this->tile_improvement_sprite_animated[i].setColor(sf::Color(255, 255, 255, 255));
272

```

```

273         sf::Vector2f initial_scale = this->tile_improvement_sprite_animated[i].getScale();
274         this->tile_improvement_sprite_animated[i].setScale(sf::Vector2f(1, 1));
275
276         this->render_window_ptr->draw(this->tile_improvement_sprite_animated[i]);
277
278         this->tile_improvement_sprite_animated[i].setPosition(initial_position);
279         this->tile_improvement_sprite_animated[i].setColor(initial_colour);
280         this->tile_improvement_sprite_animated[i].setScale(initial_scale);
281     }
282
283     this->render_window_ptr->draw(this->upgrade_arrow_sprite);
284
285
286     // 2. draw power capacity upgrade text
287     //      16 char line = "                \n"
288     std::string power_upgrade_string = "POWER CAPACITY \n";
289     power_upgrade_string             += "                \n";
290
291     power_upgrade_string             += "CAPACITY: ";
292     power_upgrade_string             += std::to_string(this->capacity_kW);
293     power_upgrade_string             += " kW\n";
294
295     power_upgrade_string             += "LEVEL: ";
296     power_upgrade_string             += std::to_string(this->upgrade_level);
297     power_upgrade_string             += "\n\n";
298
299     if (this->upgrade_level < MAX_UPGRADE_LEVELS) {
300         power_upgrade_string         += "[W]: + 100 kW (";
301         power_upgrade_string         += std::to_string(WIND_TURBINE_BUILD_COST);
302         power_upgrade_string         += " K)\n";
303     }
304
305     else {
306         power_upgrade_string         += " * MAX LEVEL * \n";
307     }
308
309     sf::Text power_upgrade_text = sf::Text(
310         power_upgrade_string,
311         *(this->assets_manager_ptr->getFont("Glass_TTY_VT220")),
312         16
313     );
314
315     power_upgrade_text.setOrigin(power_upgrade_text.getLocalBounds().width / 2, 0);
316     power_upgrade_text.setPosition(400 - 100, 400 - 32 + 16);
317     power_upgrade_text.setFill_color(MONOCROME_TEXT_GREEN);
318
319     this->render_window_ptr->draw(power_upgrade_text);
320
321
322     // 3. draw energy capacity (storage) upgrade sprite
323     this->render_window_ptr->draw(this->storage_upgrade_sprite);
324     this->render_window_ptr->draw(this->upgrade_plus_sprite);
325
326
327     // 4. draw energy capacity (storage) upgrade text
328     //      16 char line = "                \n"
329     std::string energy_upgrade_string = "ENERGY CAPACITY \n";
330     energy_upgrade_string             += "                \n";
331
332     energy_upgrade_string             += "CAPACITY: ";
333     energy_upgrade_string             += std::to_string(this->storage_level * 200);
334     energy_upgrade_string             += " kWh\n";
335
336     energy_upgrade_string             += "LEVEL: ";
337     energy_upgrade_string             += std::to_string(this->storage_level);
338     energy_upgrade_string             += "\n\n";
339
340     if (this->storage_level < MAX_STORAGE_LEVELS) {
341         energy_upgrade_string         += "[D]: + 200 kWh (";
342         energy_upgrade_string         += std::to_string(ENERGY_STORAGE_SYSTEM_BUILD_COST);
343         energy_upgrade_string         += " K)\n";
344     }
345
346     else {
347         energy_upgrade_string += " * MAX LEVEL * \n";
348     }
349
350     sf::Text energy_upgrade_text = sf::Text(
351         energy_upgrade_string,
352         *(this->assets_manager_ptr->getFont("Glass_TTY_VT220")),
353         16
354     );
355
356     energy_upgrade_text.setOrigin(energy_upgrade_text.getLocalBounds().width / 2, 0);
357     energy_upgrade_text.setPosition(400 + 100, 400 - 32 + 16);
358     energy_upgrade_text.setFill_color(MONOCROME_TEXT_GREEN);
359

```

```

360     this->render_window_ptr->draw(energy_upgrade_text);
361
362     return;
363 } /* __drawUpgradeOptions() */

```

#### 4.15.3.2 \_\_handleKeyPressEvents()

```

void WindTurbine::__handleKeyPressEvents (
    void ) [private]

```

Helper method to handle key press events.

```

156 {
157     if (this->just_built) {
158         return;
159     }
160
161     switch (this->event_ptr->key.code) {
162         case (sf::Keyboard::U): {
163             this->__openUpgradeMenu();
164
165             break;
166         }
167
168         case (sf::Keyboard::W): {
169             if (this->production_menu_open) {
170                 //...
171             }
172
173             else if (this->upgrade_menu_open) {
174                 this->__upgradePowerCapacity();
175             }
176
177             break;
178         }
179
180         case (sf::Keyboard::S): {
181             //...
182
183             break;
184         }
185
186         case (sf::Keyboard::D): {
187             if (this->upgrade_menu_open) {
188                 this->__upgradeStorageCapacity();
189             }
190
191             break;
192         }
193
194         default: {
195             // do nothing!
196
197             break;
198         }
199     }
200
201     return;
202 } /* __handleKeyPressEvents() */

```

#### 4.15.3.3 \_\_handleMouseButtonEvents()

```

void WindTurbine::__handleMouseButtonEvents (
    void ) [private]

```

Helper method to handle mouse button events.



```

221 {
222     if (this->just_built) {
223         return;
224     }
225
226     switch (this->event_ptr->mouseButton.button) {
227         case (sf::Mouse::Left): {
228             //...
229
230             break;
231         }
232
233         case (sf::Mouse::Right): {
234             //...
235
236             break;
237         }
238
239         default: {
240             // do nothing!
241
242             break;
243         }
244     }
245
246     return;
247 }
248 /* __handleMouseButtonEvents() */
249 }

```

#### 4.15.3.4 \_\_setUpTileImprovementSpriteAnimated()

```

void WindTurbine::__setUpTileImprovementSpriteAnimated (
    void ) [private]

```

Helper method to set up tile improvement sprite (static).

```

68 {
69     sf::Sprite diesel_generator_sheet(
70         *(this->assets_manager_ptr->getTexture("wind turbine"))
71     );
72
73     int n_elements = diesel_generator_sheet.getLocalBounds().height / 64;
74
75     for (int i = 0; i < n_elements; i++) {
76         this->tile_improvement_sprite_animated.push_back(
77             sf::Sprite(
78                 *(this->assets_manager_ptr->getTexture("wind turbine")),
79                 sf::IntRect(0, i * 64, 64, 64)
80             )
81         );
82
83         this->tile_improvement_sprite_animated.back().setOrigin(
84             this->tile_improvement_sprite_animated.back().getLocalBounds().width / 2,
85             this->tile_improvement_sprite_animated.back().getLocalBounds().height
86         );
87
88         this->tile_improvement_sprite_animated.back().setPosition(
89             this->position_x,
90             this->position_y - 32
91         );
92
93         this->tile_improvement_sprite_animated.back().setColor(
94             sf::Color(255, 255, 255, 0)
95         );
96     }
97
98     return;
99 } /* __setUpTileImprovementSpriteAnimated() */

```

#### 4.15.3.5 \_\_upgradePowerCapacity()

```
void WindTurbine::__upgradePowerCapacity (
    void ) [private]
```

Helper method to upgrade the power capacity.

```
114 {
115     if (this->credits < WIND_TURBINE_BUILD_COST) {
116         std::cout << "Cannot upgrade wind turbine: insufficient credits (need "
117             << WIND_TURBINE_BUILD_COST << " K)" << std::endl;
118
119         this->__sendInsufficientCreditsMessage();
120         return;
121     }
122
123     if (this->upgrade_level >= MAX_UPGRADE_LEVELS) {
124         return;
125     }
126
127     this->health = 100;
128
129     this->capacity_kW += 100;
130     this->upgrade_level++;
131
132     this->just_upgraded = true;
133
134     this->assets_manager_ptr->getSound("upgrade")->play();
135
136     this->__sendCreditsSpentMessage(WIND_TURBINE_BUILD_COST);
137     this->__sendTileStateRequest();
138     this->__sendGameStateRequest();
139
140     return;
141 } /* __upgradePowerCapacity() */
```

#### 4.15.3.6 draw()

```
void WindTurbine::draw (
    void ) [virtual]
```

Method to draw the hex tile to the render window. To be called once per frame.

Reimplemented from [TileImprovement](#).

```
556 {
557     // 1. if just built, call base method and return
558     if (this->just_built) {
559         TileImprovement::draw();
560
561         return;
562     }
563
564
565     // 2. handle upgrade effects
566     if (this->just_upgraded) {
567         for (size_t i = 0; i < this->tile_improvement_sprite_animated.size(); i++) {
568             this->tile_improvement_sprite_animated[i].setColor(
569                 sf::Color(
570                     255 * pow(cos((M_PI * this->upgrade_frame) / FRAMES_PER_SECOND), 2),
571                     255,
572                     255 * pow(cos((M_PI * this->upgrade_frame) / FRAMES_PER_SECOND), 2),
573                     255
574                 )
575             );
576
577             this->tile_improvement_sprite_animated[i].setScale(
578                 sf::Vector2f(
579                     1 + 0.2 * pow(cos((M_PI * this->upgrade_frame) / FRAMES_PER_SECOND), 2),
580                     1 + 0.2 * pow(cos((M_PI * this->upgrade_frame) / FRAMES_PER_SECOND), 2)
581                 )
582             );
583         }
584
585         this->upgrade_frame++;
586     }
```

```

587
588     if (this->upgrade_frame >= 2 * FRAMES_PER_SECOND) {
589         for (size_t i = 0; i < this->tile_improvement_sprite_animated.size(); i++) {
590             this->tile_improvement_sprite_animated[i].setColor(
591                 sf::Color(255,255,255,255)
592             );
593             this->tile_improvement_sprite_animated[i].setScale(sf::Vector2f(1,1));
594         }
595         this->just_upgraded = false;
596         this->upgrade_frame = 0;
597     }
598
599
600
601
602     // 3. draw first element of animated sprite
603     this->render_window_ptr->draw(this->tile_improvement_sprite_animated[0]);
604
605
606     // 4. draw second element of animated sprite
607     if (this->is_running) {
608         //...
609     }
610
611     else {
612         //...
613     }
614
615     this->render_window_ptr->draw(this->tile_improvement_sprite_animated[1]);
616
617     // 5. draw production menu
618     if (this->production_menu_open) {
619         this->render_window_ptr->draw(this->production_menu_backing);
620         this->render_window_ptr->draw(this->production_menu_backing_text);
621
622         //...
623     }
624
625     // 6. draw upgrade menu
626     if (this->upgrade_menu_open) {
627         this->render_window_ptr->draw(this->upgrade_menu_backing);
628         this->render_window_ptr->draw(this->upgrade_menu_backing_text);
629
630         this->__drawUpgradeOptions();
631     }
632
633     this->frame++;
634     return;
635 } /* draw() */

```

#### 4.15.3.7 getTileOptionsSubstring()

```

std::string WindTurbine::getTileOptionsSubstring (
    void ) [virtual]

```

Helper method to assemble and return tile options substring.

#### Returns

Tile options substring.

Reimplemented from [TileImprovement](#).

```

462 {
463     // 32 char x 17 line console "-----\n";
464     std::string options_substring = "CAPACITY: ";
465     options_substring += std::to_string(this->capacity_kW);
466     options_substring += " kW (level ";
467     options_substring += std::to_string(this->upgrade_level);
468     options_substring += ") \n";
469
470     options_substring += "PRODUCTION: ";
471     options_substring += std::to_string(this->production_MWh);
472     options_substring += " MWh \n";
473 }

```

```

474     options_substring           += "DISPATCHABLE:  ";
475     options_substring           += std::to_string(this->dispatchable_MWh);
476     options_substring           += " MWh\n";
477
478     options_substring           += "HEALTH:          ";
479     options_substring           += std::to_string(this->health);
480     options_substring           += "/100\n";
481
482     options_substring           += "
483     options_substring           += " **** WIND TURBINE OPTIONS **** \n";
484     options_substring           += "
485     options_substring           += "      [E]:  OPEN PRODUCTION MENU \n";
486     options_substring           += "      [U]:  OPEN UPGRADE MENU   \n";
487     options_substring           += "HOLD [P]:  SCRAP (";
488     options_substring           += std::to_string(SCRAP_COST);
489     options_substring           += " K)";
490
491     return options_substring;
492 } /* getTileOptionsSubstring() */

```

#### 4.15.3.8 processEvent()

```

void WindTurbine::processEvent (
    void ) [virtual]

```

Method to process [WindTurbine](#). To be called once per event.

Reimplemented from [TileImprovement](#).

```

507 {
508     TileImprovement :: processEvent();
509
510     if (this->event_ptr->type == sf::Event::KeyPressed) {
511         this->__handleKeyPressEvents();
512     }
513
514     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
515         this->__handleMouseButtonEvents();
516     }
517
518     return;
519 } /* processEvent() */

```

#### 4.15.3.9 processMessage()

```

void WindTurbine::processMessage (
    void ) [virtual]

```

Method to process [WindTurbine](#). To be called once per message.

Reimplemented from [TileImprovement](#).

```

534 {
535     TileImprovement :: processMessage();
536
537     //...
538
539     return;
540 } /* processMessage() */

```

### 4.15.4 Member Data Documentation

#### 4.15.4.1 capacity\_kW

```
int WindTurbine::capacity_kW
```

The rated production capacity [kW] of the solar PV array.

#### 4.15.4.2 dispatchable\_MWh

```
int WindTurbine::dispatchable_MWh
```

The amount of production that is directly dispatchable to the grid (i.e. production correlated with demand).

#### 4.15.4.3 production\_MWh

```
int WindTurbine::production_MWh
```

The current production [MWh] of the solar PV array.

The documentation for this class was generated from the following files:

- header/[WindTurbine.h](#)
- source/[WindTurbine.cpp](#)



## Chapter 5

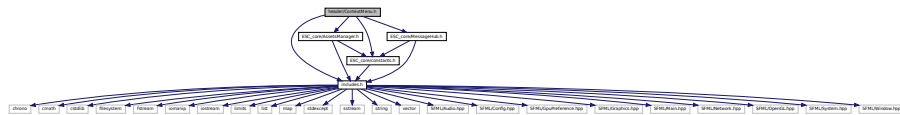
# File Documentation

### 5.1 header/ContextMenu.h File Reference

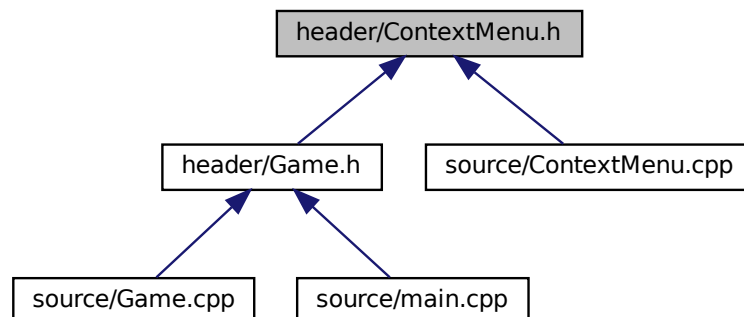
Header file for the [ContextMenu](#) class.

```
#include "ESC_core/constants.h"
#include "ESC_core/includes.h"
#include "ESC_core/AssetsManager.h"
#include "ESC_core/MessageHub.h"
```

Include dependency graph for ContextMenu.h:



This graph shows which files directly or indirectly include this file:



## Classes

- class [ContextMenu](#)

*A class which defines a context menu for the game.*

## Enumerations

- enum [ConsoleState](#) {  
[NONE\\_STATE](#) , [READY](#) , [MENU](#) , [TILE](#) ,  
[N\\_CONSOLE\\_STATES](#) }

*An enumeration of the different console screen states.*

### 5.1.1 Detailed Description

Header file for the [ContextMenu](#) class.

### 5.1.2 Enumeration Type Documentation

#### 5.1.2.1 ConsoleState

enum [ConsoleState](#)

An enumeration of the different console screen states.

##### Enumerator

NONE_STATE	None state (for initialization)
READY	Ready (default) state.
MENU	<a href="#">Game</a> menu state.
TILE	Tile context state.
N_CONSOLE_STATES	A simple hack to get the number of console screen states.

```

68     {
69         NONE_STATE,
70         READY,
71         MENU,
72         TILE,
73         N_CONSOLE_STATES
74     };

```

## 5.2 header/DieselGenerator.h File Reference

Header file for the [DieselGenerator](#) class.

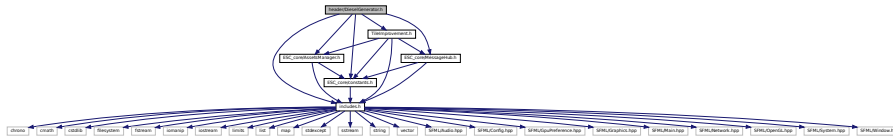
```

#include "ESC_core/constants.h"
#include "ESC_core/includes.h"
#include "ESC_core/AssetsManager.h"

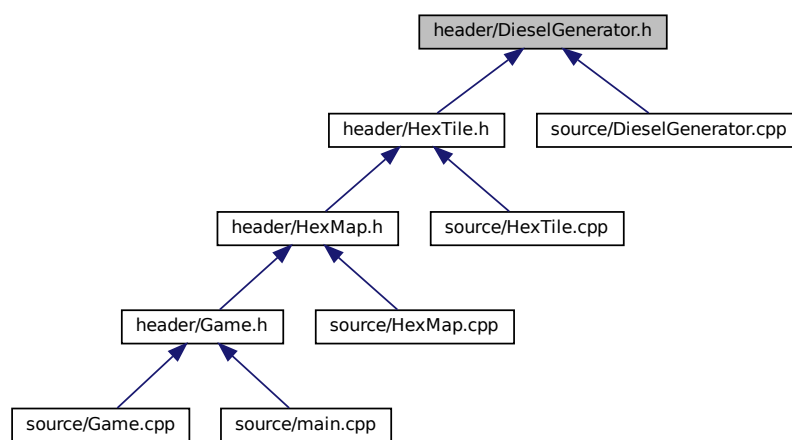
```



```
#include "ESC_core/MessageHub.h"
#include "TileImprovement.h"
Include dependency graph for DieselGenerator.h:
```



This graph shows which files directly or indirectly include this file:



## Classes

- class [DieselGenerator](#)  
A settlement class (child class of [TileImprovement](#)).

### 5.2.1 Detailed Description

Header file for the [DieselGenerator](#) class.

## 5.3 header/EnergyStorageSystem.h File Reference

Header file for the [EnergyStorageSystem](#) class.

```
#include "ESC_core/constants.h"
#include "ESC_core/includes.h"
#include "ESC_core/AssetsManager.h"
#include "ESC_core/MessageHub.h"
```



- class `AssetsManager`  
*A class which manages visual and sound assets.*

Header file for the `AssetsManager` class.

Header file for various constants.

[illegible]

## Functions

- `const sf::Color FOREST_GREEN` (34, 139, 34)  
*The base colour of a forest tile.*
- `const sf::Color LAKE_BLUE` (0, 102, 204)  
*The base colour of a lake (water) tile.*
- `const sf::Color MOUNTAINS_GREY` (97, 110, 113)  
*The base colour of a mountains tile.*
- `const sf::Color OCEAN_BLUE` (0, 51, 102)  
*The base colour of an ocean (water) tile.*
- `const sf::Color PLAINS_YELLOW` (245, 222, 133)  
*The base colour of a plains tile.*
- `const sf::Color RESOURCE_CHIP_GREY` (175, 175, 175, 250)  
*The base colour of the resource chip (backing).*
- `const sf::Color MENU_FRAME_GREY` (185, 187, 182)  
*The base colour of the context menu frame.*
- `const sf::Color MONOCHROME_SCREEN_BACKGROUND` (40, 40, 40)  
*The base colour of old monochrome screens.*
- `const sf::Color VISUAL_SCREEN_FRAME_GREY` (151, 151, 143)  
*The base colour of the framing of the visual screen.*
- `const sf::Color MONOCHROME_TEXT_GREEN` (0, 255, 102)  
*The base colour of old monochrome text (green).*
- `const sf::Color MONOCHROME_TEXT_AMBER` (255, 176, 0)  
*The base colour of old monochrome text (amber).*
- `const sf::Color MONOCHROME_TEXT_RED` (255, 44, 0)  
*The base colour of old monochrome text (red).*

## Variables

- `const double FLOAT_TOLERANCE` = 1e-6  
*Tolerance for floating point equality tests.*
- `const unsigned long long int SECONDS_PER_YEAR` = 31537970
- `const unsigned long long int SECONDS_PER_MONTH` = 2628164
- `const int FRAMES_PER_SECOND` = 60  
*Target frames per second.*
- `const double SECONDS_PER_FRAME` = 1.0 / 60  
*Target seconds per frame (just reciprocal of target frames per second).*
- `const int GAME_WIDTH` = 1200  
*Width of the game space.*
- `const int GAME_HEIGHT` = 800  
*Height of the game space.*
- `const std::vector< double > TILE_TYPE_CUMULATIVE_PROBABILITIES`  
*Cumulative probabilities for each tile type (to support procedural generation).*
- `const std::vector< double > TILE_RESOURCE_CUMULATIVE_PROBABILITIES`  
*Cumulative probabilities for each tile resource (to support procedural generation).*
- `const std::string TILE_SELECTED_CHANNEL` = "TILE SELECTED CHANNEL"  
*A message channel for tile selection messages.*
- `const std::string NO_TILE_SELECTED_CHANNEL` = "NO TILE SELECTED CHANNEL"  
*A message channel for no tile selected messages.*
- `const std::string TILE_STATE_CHANNEL` = "TILE STATE CHANNEL"

- A message channel for tile state messages.*
- const std::string `HEX_MAP_CHANNEL` = "HEX MAP CHANNEL"
- A message channel for hex map messages.*
- const int `CLEAR_FOREST_COST` = 40
- The cost of clearing a forest tile.*
- const int `CLEAR_MOUNTAINS_COST` = 250
- The cost of clearing a mountains tile.*
- const int `CLEAR_PLAINS_COST` = 20
- The cost of clearing a plains tile.*
- const int `DIESEL_GENERATOR_BUILD_COST` = 100
- The cost of building (or upgrading) a diesel generator in 100 kW increments.*
- const int `WIND_TURBINE_BUILD_COST` = 400
- The cost of building (or upgrading) a wind turbine in 100 kW increments.*
- const double `WIND_TURBINE_WATER_BUILD_MULTIPLIER` = 1.25
- The additional cost of building on water.*
- const int `SOLAR_PV_BUILD_COST` = 300
- The cost of building (or upgrading) a solar PV array in 100 kW increments.*
- const double `SOLAR_PV_WATER_BUILD_MULTIPLIER` = 1.5
- The additional cost of building on water.*
- const int `TIDAL_TURBINE_BUILD_COST` = 600
- The cost of building (or upgrading) a tidal turbine in 100 kW increments.*
- const int `WAVE_ENERGY_CONVERTER_BUILD_COST` = 800
- The cost of building (or upgrading) a wave energy converter in 100 kW increments.*
- const int `ENERGY_STORAGE_SYSTEM_BUILD_COST` = 160
- The cost of adding energy storage in 200 kWh increments.*
- const int `SCRAP_COST` = 50
- The cost of scrapping a tile improvement (other than settlement).*
- const int `MAX_UPGRADE_LEVELS` = 5
- The maximum upgrade level of any tile improvement.*
- const int `MAX_STORAGE_LEVELS` = 5
- The maximum storage level of any tile improvement.*
- const int `STARTING_CREDITS` = 99999
- The starting balance of credits.*
- const int `EMISSIONS_LIFETIME_LIMIT_TONNES` = 1500
- The CO2-equivalent mass of emissions that would result from burning 1,000,000 L of diesel fuel.*
- const int `RESOURCE_ASSESSMENT_COST` = 20
- The cost of doing a resource assessment.*
- const int `BUILD_SETTLEMENT_COST` = 250
- The cost of building a settlement.*
- const int `STARTING_POPULATION` = 100
- The starting population of a settlement.*
- const double `CO2E_KG_PER_LITRE_DIESEL` = 3.1596
- The CO2-equivalent mass of emissions that result from burning one litre of diesel fuel.*
- const std::string `GAME_CHANNEL` = "GAME CHANNEL"
- A message channel for game messages.*
- const std::string `GAME_STATE_CHANNEL` = "GAME STATE CHANNEL"
- A message channel for game state messages.*

### 5.5.1 Detailed Description

Header file for various constants.

## 5.5.2 Function Documentation

### 5.5.2.1 FOREST\_GREEN()

```
const sf::Color FOREST_GREEN (
    34 ,
    139 ,
    34 )
```

The base colour of a forest tile.

### 5.5.2.2 LAKE\_BLUE()

```
const sf::Color LAKE_BLUE (
    0 ,
    102 ,
    204 )
```

The base colour of a lake (water) tile.

### 5.5.2.3 MENU\_FRAME\_GREY()

```
const sf::Color MENU_FRAME_GREY (
    185 ,
    187 ,
    182 )
```

The base colour of the context menu frame.

### 5.5.2.4 MONOCHROME\_SCREEN\_BACKGROUND()

```
const sf::Color MONOCHROME_SCREEN_BACKGROUND (
    40 ,
    40 ,
    40 )
```

The base colour of old monochrome screens.

#### 5.5.2.5 MONOCHROME\_TEXT\_AMBER()

```
const sf::Color MONOCHROME_TEXT_AMBER (
    255 ,
    176 ,
    0 )
```

The base colour of old monochrome text (amber).

#### 5.5.2.6 MONOCHROME\_TEXT\_GREEN()

```
const sf::Color MONOCHROME_TEXT_GREEN (
    0 ,
    255 ,
    102 )
```

The base colour of old monochrome text (green).

#### 5.5.2.7 MONOCHROME\_TEXT\_RED()

```
const sf::Color MONOCHROME_TEXT_RED (
    255 ,
    44 ,
    0 )
```

The base colour of old monochrome text (red).

#### 5.5.2.8 MOUNTAINS\_GREY()

```
const sf::Color MOUNTAINS_GREY (
    97 ,
    110 ,
    113 )
```

The base colour of a mountains tile.

#### 5.5.2.9 OCEAN\_BLUE()

```
const sf::Color OCEAN_BLUE (
    0 ,
    51 ,
    102 )
```

The base colour of an ocean (water) tile.

#### 5.5.2.10 PLAINS\_YELLOW()

```
const sf::Color PLAINS_YELLOW (
    245 ,
    222 ,
    133 )
```

The base colour of a plains tile.

#### 5.5.2.11 RESOURCE\_CHIP\_GREY()

```
const sf::Color RESOURCE_CHIP_GREY (
    175 ,
    175 ,
    175 ,
    250 )
```

The base colour of the resource chip (backing).

#### 5.5.2.12 VISUAL\_SCREEN\_FRAME\_GREY()

```
const sf::Color VISUAL_SCREEN_FRAME_GREY (
    151 ,
    151 ,
    143 )
```

The base colour of the framing of the visual screen.

### 5.5.3 Variable Documentation

#### 5.5.3.1 BUILD\_SETTLEMENT\_COST

```
const int BUILD_SETTLEMENT_COST = 250
```

The cost of building a settlement.

#### 5.5.3.2 CLEAR\_FOREST\_COST

```
const int CLEAR_FOREST_COST = 40
```

The cost of clearing a forest tile.



#### 5.5.3.3 CLEAR\_MOUNTAINS\_COST

```
const int CLEAR_MOUNTAINS_COST = 250
```

The cost of clearing a mountains tile.

#### 5.5.3.4 CLEAR\_PLAINS\_COST

```
const int CLEAR_PLAINS_COST = 20
```

The cost of clearing a plains tile.

#### 5.5.3.5 CO2E\_KG\_PER\_LITRE\_DIESEL

```
const double CO2E_KG_PER_LITRE_DIESEL = 3.1596
```

The CO2-equivalent mass of emissions that result from burning one litre of diesel fuel.

#### 5.5.3.6 DIESEL\_GENERATOR\_BUILD\_COST

```
const int DIESEL_GENERATOR_BUILD_COST = 100
```

The cost of building (or upgrading) a diesel generator in 100 kW increments.

#### 5.5.3.7 EMISSIONS\_LIFETIME\_LIMIT\_TONNES

```
const int EMISSIONS_LIFETIME_LIMIT_TONNES = 1500
```

The CO2-equivalent mass of emissions that would result from burning 1,000,000 L of diesel fuel.

#### 5.5.3.8 ENERGY\_STORAGE\_SYSTEM\_BUILD\_COST

```
const int ENERGY_STORAGE_SYSTEM_BUILD_COST = 160
```

The cost of adding energy storage in 200 kWh increments.

#### 5.5.3.9 FLOAT\_TOLERANCE

```
const double FLOAT_TOLERANCE = 1e-6
```

Tolerance for floating point equality tests.

#### 5.5.3.10 FRAMES\_PER\_SECOND

```
const int FRAMES_PER_SECOND = 60
```

Target frames per second.

#### 5.5.3.11 GAME\_CHANNEL

```
const std::string GAME_CHANNEL = "GAME CHANNEL"
```

A message channel for game messages.

#### 5.5.3.12 GAME\_HEIGHT

```
const int GAME_HEIGHT = 800
```

Height of the game space.

#### 5.5.3.13 GAME\_STATE\_CHANNEL

```
const std::string GAME_STATE_CHANNEL = "GAME STATE CHANNEL"
```

A message channel for game state messages.

#### 5.5.3.14 GAME\_WIDTH

```
const int GAME_WIDTH = 1200
```

Width of the game space.

#### 5.5.3.15 HEX\_MAP\_CHANNEL

```
const std::string HEX_MAP_CHANNEL = "HEX MAP CHANNEL"
```

A message channel for hex map messages.

#### 5.5.3.16 MAX\_STORAGE\_LEVELS

```
const int MAX_STORAGE_LEVELS = 5
```

The maximum storage level of any tile improvement.

#### 5.5.3.17 MAX\_UPGRADE\_LEVELS

```
const int MAX_UPGRADE_LEVELS = 5
```

The maximum upgrade level of any tile improvement.

#### 5.5.3.18 NO\_TILE\_SELECTED\_CHANNEL

```
const std::string NO_TILE_SELECTED_CHANNEL = "NO TILE SELECTED CHANNEL"
```

A message channel for no tile selected messages.

#### 5.5.3.19 RESOURCE\_ASSESSMENT\_COST

```
const int RESOURCE_ASSESSMENT_COST = 20
```

The cost of doing a resource assessment.

#### 5.5.3.20 SCRAP\_COST

```
const int SCRAP_COST = 50
```

The cost of scrapping a tile improvement (other than settlement).

#### 5.5.3.21 SECONDS\_PER\_FRAME

```
const double SECONDS_PER_FRAME = 1.0 / 60
```

Target seconds per frame (just reciprocal of target frames per second).

#### 5.5.3.22 SECONDS\_PER\_MONTH

```
const unsigned long long int SECONDS_PER_MONTH = 2628164
```

#### 5.5.3.23 SECONDS\_PER\_YEAR

```
const unsigned long long int SECONDS_PER_YEAR = 31537970
```

#### 5.5.3.24 SOLAR\_PV\_BUILD\_COST

```
const int SOLAR_PV_BUILD_COST = 300
```

The cost of building (or upgrading) a solar PV array in 100 kW increments.

#### 5.5.3.25 SOLAR\_PV\_WATER\_BUILD\_MULTIPLIER

```
const double SOLAR_PV_WATER_BUILD_MULTIPLIER = 1.5
```

The additional cost of building on water.

#### 5.5.3.26 STARTING\_CREDITS

```
const int STARTING_CREDITS = 99999
```

The starting balance of credits.

#### 5.5.3.27 STARTING\_POPULATION

```
const int STARTING_POPULATION = 100
```

The starting population of a settlement.

#### 5.5.3.28 TIDAL\_TURBINE\_BUILD\_COST

```
const int TIDAL_TURBINE_BUILD_COST = 600
```

The cost of building (or upgrading) a tidal turbine in 100 kW increments.

#### 5.5.3.29 TILE\_RESOURCE\_CUMULATIVE\_PROBABILITIES

```
const std::vector<double> TILE_RESOURCE_CUMULATIVE_PROBABILITIES
```

**Initial value:**

```
= {  
    0.10,  
    0.30,  
    0.70,  
    0.90,  
    1.00  
}
```

Cumulative probabilities for each tile resource (to support procedural generation).

#### 5.5.3.30 TILE\_SELECTED\_CHANNEL

```
const std::string TILE_SELECTED_CHANNEL = "TILE SELECTED CHANNEL"
```

A message channel for tile selection messages.

#### 5.5.3.31 TILE\_STATE\_CHANNEL

```
const std::string TILE_STATE_CHANNEL = "TILE STATE CHANNEL"
```

A message channel for tile state messages.

### 5.5.3.32 TILE\_TYPE\_CUMULATIVE\_PROBABILITIES

```
const std::vector<double> TILE_TYPE_CUMULATIVE_PROBABILITIES
```

**Initial value:**

```
= {  
    0.25,  
    0.50,  
    0.75,  
    1.00  
}
```

Cumulative probabilities for each tile type (to support procedural generation).

### 5.5.3.33 WAVE\_ENERGY\_CONVERTER\_BUILD\_COST

```
const int WAVE_ENERGY_CONVERTER_BUILD_COST = 800
```

The cost of building (or upgrading) a wave energy converter in 100 kW increments.

### 5.5.3.34 WIND\_TURBINE\_BUILD\_COST

```
const int WIND_TURBINE_BUILD_COST = 400
```

The cost of building (or upgrading) a wind turbine in 100 kW increments.

### 5.5.3.35 WIND\_TURBINE\_WATER\_BUILD\_MULTIPLIER

```
const double WIND_TURBINE_WATER_BUILD_MULTIPLIER = 1.25
```

The additional cost of building on water.

## 5.6 header/ESC\_core/doxygen\_cite.h File Reference

Header file which simply cites the doxygen tool.

### 5.6.1 Detailed Description

Header file which simply cites the doxygen tool.

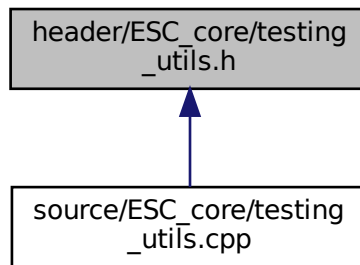
Ref: [van Heesch. \[2023\]](#)







This graph shows which files directly or indirectly include this file:



## Functions

- void `printGreen` (std::string)  
*A function that sends green text to std::cout.*
- void `printGold` (std::string)  
*A function that sends gold text to std::cout.*
- void `printRed` (std::string)  
*A function that sends red text to std::cout.*
- void `testFloatEquals` (double, double, std::string, int)  
*Tests for the equality of two floating point numbers  $x$  and  $y$  (to within `FLOAT_TOLERANCE`).*
- void `testGreaterThan` (double, double, std::string, int)  
*Tests if  $x > y$ .*
- void `testGreaterThanOrEqualTo` (double, double, std::string, int)  
*Tests if  $x \geq y$ .*
- void `testLessThan` (double, double, std::string, int)  
*Tests if  $x < y$ .*
- void `testLessThanOrEqualTo` (double, double, std::string, int)  
*Tests if  $x \leq y$ .*
- void `testTruth` (bool, std::string, int)  
*Tests if the given statement is true.*
- void `expectedErrorNotDetected` (std::string, int)  
*A utility function to print out a meaningful error message whenever an expected error fails to be thrown/caught/detected.*

### 5.9.1 Detailed Description

Header file for various testing utilities.

This is a library of utility functions used throughout the various test suites.

### 5.9.2 Function Documentation

### 5.9.2.1 expectedErrorNotDetected()

```
void expectedErrorNotDetected (
    std::string file,
    int line )
```

A utility function to print out a meaningful error message whenever an expected error fails to be thrown/caught/detected.

#### Parameters

<i>file</i>	The file in which the test is applied (you should be able to just pass in "__FILE__").
<i>line</i>	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```
462 {
463     std::string error_str = "\n ERROR   failed to throw expected error prior to line ";
464     error_str += std::to_string(line);
465     error_str += " of ";
466     error_str += file;
467
468     #ifdef _WIN32
469         std::cout << error_str << std::endl;
470     #endif
471
472     throw std::runtime_error(error_str);
473     return;
474 } /* expectedErrorNotDetected() */
```

### 5.9.2.2 printGold()

```
void printGold (
    std::string input_str )
```

A function that sends gold text to std::cout.

#### Parameters

<i>input_str</i>	The text of the string to be sent to std::cout.
------------------	---

```
114 {
115     std::cout << "\x1B[33m" << input_str << "\033[0m";
116     return;
117 } /* printGold() */
```

### 5.9.2.3 printGreen()

```
void printGreen (
    std::string input_str )
```

A function that sends green text to std::cout.

#### Parameters

<i>input_str</i>	The text of the string to be sent to std::cout.
------------------	---

```

94 {
95     std::cout << "\x1B[32m" << input_str << "\033[0m";
96     return;
97 } /* printGreen() */

```

#### 5.9.2.4 printRed()

```

void printRed (
    std::string input_str )

```

A function that sends red text to std::cout.

##### Parameters

<i>input_str</i>	The text of the string to be sent to std::cout.
------------------	---

```

134 {
135     std::cout << "\x1B[31m" << input_str << "\033[0m";
136     return;
137 } /* printRed() */

```

#### 5.9.2.5 testFloatEquals()

```

void testFloatEquals (
    double x,
    double y,
    std::string file,
    int line )

```

Tests for the equality of two floating point numbers *x* and *y* (to within FLOAT\_TOLERANCE).

##### Parameters

<i>x</i>	The first of two numbers to test.
<i>y</i>	The second of two numbers to test.
<i>file</i>	The file in which the test is applied (you should be able to just pass in "__FILE__").
<i>line</i>	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```

168 {
169     if (fabs(x - y) <= FLOAT_TOLERANCE) {
170         return;
171     }
172
173     std::string error_str = "ERROR: testFloatEquals():\t in ";
174     error_str += file;
175     error_str += "\tline ";
176     error_str += std::to_string(line);
177     error_str += ":\t\n";
178     error_str += std::to_string(x);
179     error_str += " and ";
180     error_str += std::to_string(y);
181     error_str += " are not equal to within +/- ";
182     error_str += std::to_string(FLOAT_TOLERANCE);
183     error_str += "\n";
184
185     #ifdef _WIN32
186         std::cout << error_str << std::endl;
187     #endif

```

```

188
189     throw std::runtime_error(error_str);
190     return;
191 } /* testFloatEquals() */

```

### 5.9.2.6 testGreaterThanOrEqualTo()

```

void testGreaterThanOrEqualTo (
    double x,
    double y,
    std::string file,
    int line )

```

Tests if  $x > y$ .

#### Parameters

<i>x</i>	The first of two numbers to test.
<i>y</i>	The second of two numbers to test.
<i>file</i>	The file in which the test is applied (you should be able to just pass in "__FILE__").
<i>line</i>	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```

221 {
222     if (x > y) {
223         return;
224     }
225
226     std::string error_str = "ERROR: testGreaterThanOrEqualTo():\t in ";
227     error_str += file;
228     error_str += "\tline ";
229     error_str += std::to_string(line);
230     error_str += ":\t\n";
231     error_str += std::to_string(x);
232     error_str += " is not greater than ";
233     error_str += std::to_string(y);
234     error_str += "\n";
235
236     #ifdef _WIN32
237         std::cout << error_str << std::endl;
238     #endif
239
240     throw std::runtime_error(error_str);
241     return;
242 } /* testGreaterThanOrEqualTo() */

```

### 5.9.2.7 testGreaterThanOrEqualTo()

```

void testGreaterThanOrEqualTo (
    double x,
    double y,
    std::string file,
    int line )

```

Tests if  $x \geq y$ .

#### Parameters

<i>x</i>	The first of two numbers to test.
----------	-----------------------------------

## Parameters

<i>y</i>	The second of two numbers to test.
<i>file</i>	The file in which the test is applied (you should be able to just pass in "__FILE__").
<i>line</i>	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```

272 {
273     if (x >= y) {
274         return;
275     }
276
277     std::string error_str = "ERROR: testGreaterThanOrEqualTo():\t in ";
278     error_str += file;
279     error_str += "\tline ";
280     error_str += std::to_string(line);
281     error_str += ":\t\n";
282     error_str += std::to_string(x);
283     error_str += " is not greater than or equal to ";
284     error_str += std::to_string(y);
285     error_str += "\n";
286
287     #ifdef _WIN32
288         std::cout << error_str << std::endl;
289     #endif
290
291     throw std::runtime_error(error_str);
292     return;
293 } /* testGreaterThanOrEqualTo() */

```

## 5.9.2.8 testLessThan()

```

void testLessThan (
    double x,
    double y,
    std::string file,
    int line )

```

Tests if  $x < y$ .

## Parameters

<i>x</i>	The first of two numbers to test.
<i>y</i>	The second of two numbers to test.
<i>file</i>	The file in which the test is applied (you should be able to just pass in "__FILE__").
<i>line</i>	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```

323 {
324     if (x < y) {
325         return;
326     }
327
328     std::string error_str = "ERROR: testLessThan():\t in ";
329     error_str += file;
330     error_str += "\tline ";
331     error_str += std::to_string(line);
332     error_str += ":\t\n";
333     error_str += std::to_string(x);
334     error_str += " is not less than ";
335     error_str += std::to_string(y);
336     error_str += "\n";
337
338     #ifdef _WIN32
339         std::cout << error_str << std::endl;
340     #endif
341
342     throw std::runtime_error(error_str);
343     return;

```

```
344 }    /* testLessThan() */
```

### 5.9.2.9 testLessThanOrEqualTo()

```
void testLessThanOrEqualTo (
    double x,
    double y,
    std::string file,
    int line )
```

Tests if  $x \leq y$ .

#### Parameters

<i>x</i>	The first of two numbers to test.
<i>y</i>	The second of two numbers to test.
<i>file</i>	The file in which the test is applied (you should be able to just pass in "__FILE__").
<i>line</i>	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```
374 {
375     if (x <= y) {
376         return;
377     }
378
379     std::string error_str = "ERROR: testLessThanOrEqualTo():\t in ";
380     error_str += file;
381     error_str += "\tline ";
382     error_str += std::to_string(line);
383     error_str += ":\t\n";
384     error_str += std::to_string(x);
385     error_str += " is not less than or equal to ";
386     error_str += std::to_string(y);
387     error_str += "\n";
388
389     #ifdef _WIN32
390         std::cout << error_str << std::endl;
391     #endif
392
393     throw std::runtime_error(error_str);
394     return;
395 }    /* testLessThanOrEqualTo() */
```

### 5.9.2.10 testTruth()

```
void testTruth (
    bool statement,
    std::string file,
    int line )
```

Tests if the given statement is true.

#### Parameters

<i>statement</i>	The statement whose truth is to be tested ("1 == 0", for example).
<i>file</i>	The file in which the test is applied (you should be able to just pass in "__FILE__").
<i>line</i>	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```

422 {
423     if (statement) {
424         return;
425     }
426
427     std::string error_str = "ERROR: testTruth():\t in ";
428     error_str += file;
429     error_str += "\tline ";
430     error_str += std::to_string(line);
431     error_str += ":\t\n";
432     error_str += "Given statement is not true";
433
434     #ifdef _WIN32
435         std::cout << error_str << std::endl;
436     #endif
437
438     throw std::runtime_error(error_str);
439     return;
440 } /* testTruth() */

```

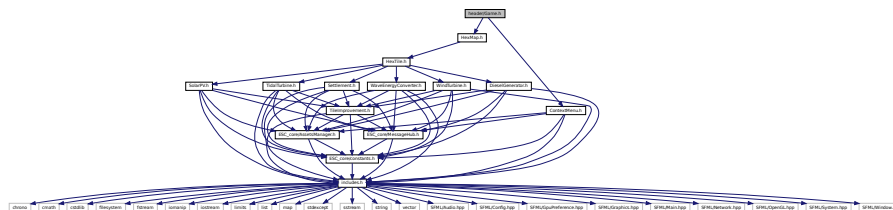
## 5.10 header/Game.h File Reference

```

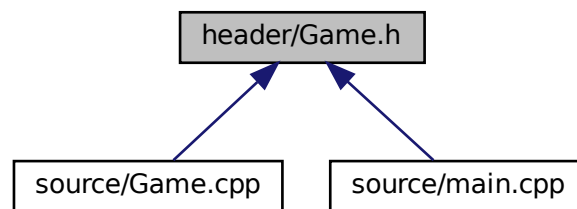
#include "HexMap.h"
#include "ContextMenu.h"

```

Include dependency graph for Game.h:



This graph shows which files directly or indirectly include this file:



## Classes

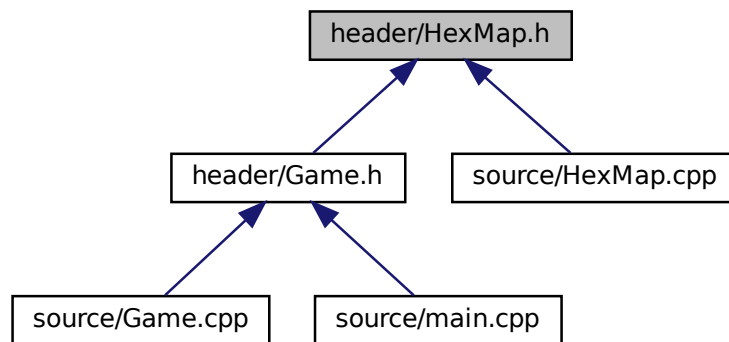
- class [Game](#)

*A class which acts as the central class for the game, by containing all other classes and implementing the game loop.*





This graph shows which files directly or indirectly include this file:



## Classes

- class [HexMap](#)

*A class which defines a hex map of hex tiles.*

### 5.11.1 Detailed Description

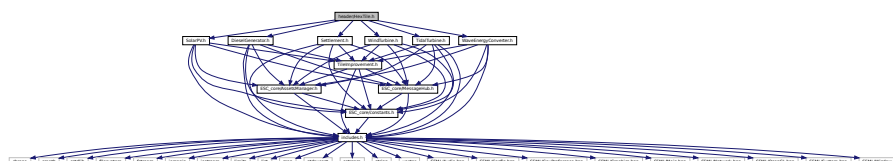
Header file for the [HexMap](#) class.

## 5.12 header/HexTile.h File Reference

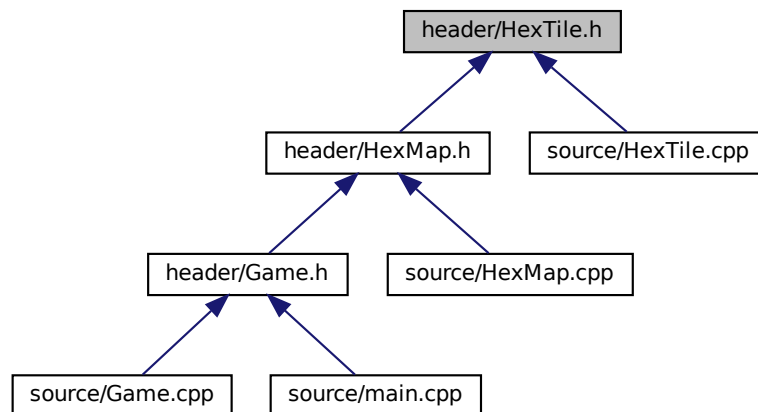
Header file for the [Game](#) class.

```
#include "DieselGenerator.h"
#include "Settlement.h"
#include "SolarPV.h"
#include "TidalTurbine.h"
#include "WaveEnergyConverter.h"
#include "WindTurbine.h"
```

Include dependency graph for HexTile.h:



This graph shows which files directly or indirectly include this file:



## Classes

- class [HexTile](#)  
A class which defines a hex tile of the hex map.

## Enumerations

- enum [TileType](#) {  
NONE\_TYPE , FOREST , LAKE , MOUNTAINS ,  
OCEAN , PLAINS , N\_TILE\_TYPES }  
An enumeration of the different tile types.
- enum [TileResource](#) {  
POOR , BELOW\_AVERAGE , AVERAGE , ABOVE\_AVERAGE ,  
GOOD , N\_TILE\_RESOURCES }  
An enumeration of the different tile resource values.

### 5.12.1 Detailed Description

Header file for the [Game](#) class.

Header file for the [HexTile](#) class.

### 5.12.2 Enumeration Type Documentation

#### 5.12.2.1 TileResource

enum [TileResource](#)

An enumeration of the different tile resource values.

## Enumerator

POOR	A poor resource value.
BELOW_AVERAGE	A below average resource value.
AVERAGE	An average resource value.
ABOVE_AVERAGE	An above average resource value.
GOOD	A good resource value.
N_TILE_RESOURCES	A simple hack to get the number of elements in TileResource.

```

88         {
89     POOR,
90     BELOW_AVERAGE,
91     AVERAGE,
92     ABOVE_AVERAGE,
93     GOOD,
94     N_TILE_RESOURCES
95 }; /* TileResource */

```

## 5.12.2.2 TileType

```
enum TileType
```

An enumeration of the different tile types.

## Enumerator

NONE_TYPE	A dummy tile (for initialization).
FOREST	A forest tile.
LAKE	A lake tile.
MOUNTAINS	A mountains tile.
OCEAN	An ocean tile.
PLAINS	A plains tile.
N_TILE_TYPES	A simple hack to get the number of elements in TileType.

```

71         {
72     NONE_TYPE,
73     FOREST,
74     LAKE,
75     MOUNTAINS,
76     OCEAN,
77     PLAINS,
78     N_TILE_TYPES
79 }; /* TileType */

```

## 5.13 header/Settlement.h File Reference

Header file for the [Settlement](#) class.

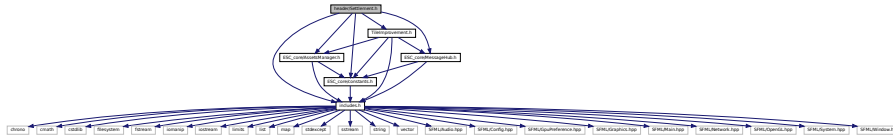
```

#include "ESC_core/constants.h"
#include "ESC_core/includes.h"
#include "ESC_core/AssetsManager.h"
#include "ESC_core/MessageHub.h"

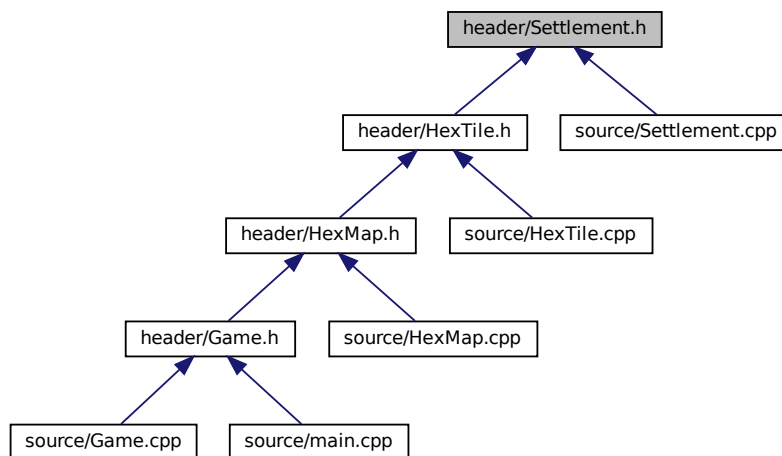
```

```
#include "TileImprovement.h"
```

Include dependency graph for Settlement.h:



This graph shows which files directly or indirectly include this file:



## Classes

- class [Settlement](#)  
A settlement class (child class of [TileImprovement](#)).

### 5.13.1 Detailed Description

Header file for the [Settlement](#) class.

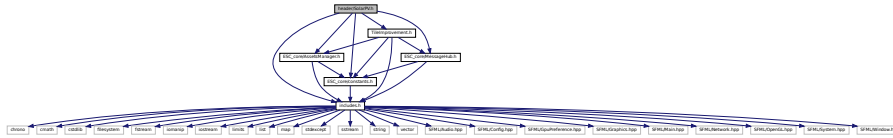
## 5.14 header/SolarPV.h File Reference

Header file for the [SolarPV](#) class.

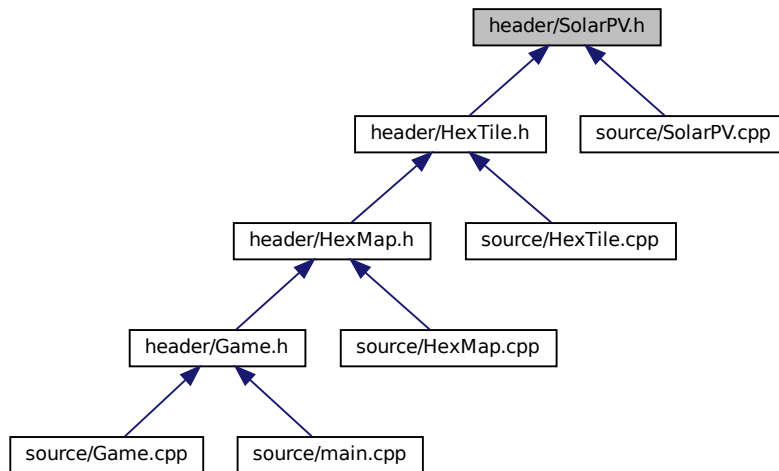
```
#include "ESC_core/constants.h"
#include "ESC_core/includes.h"
#include "ESC_core/AssetsManager.h"
#include "ESC_core/MessageHub.h"
```

```
#include "TileImprovement.h"
```

Include dependency graph for SolarPV.h:



This graph shows which files directly or indirectly include this file:



## Classes

- class [SolarPV](#)  
A settlement class (child class of [TileImprovement](#)).

### 5.14.1 Detailed Description

Header file for the [SolarPV](#) class.

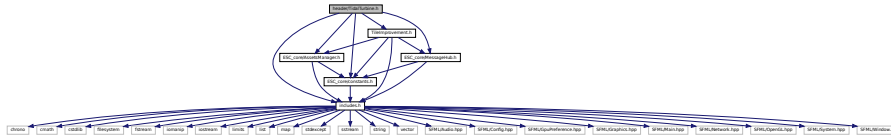
## 5.15 header/TidalTurbine.h File Reference

Header file for the [TidalTurbine](#) class.

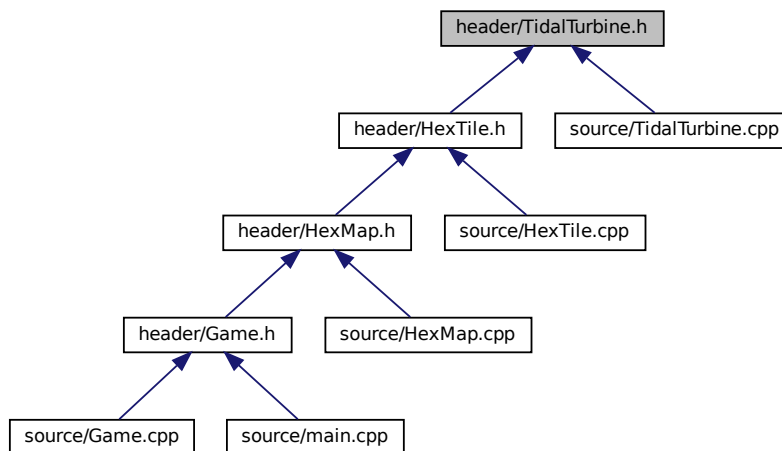
```
#include "ESC_core/constants.h"
#include "ESC_core/includes.h"
#include "ESC_core/AssetsManager.h"
#include "ESC_core/MessageHub.h"
```

```
#include "TileImprovement.h"
```

Include dependency graph for TidalTurbine.h:



This graph shows which files directly or indirectly include this file:



## Classes

- class [TidalTurbine](#)  
A settlement class (child class of [TileImprovement](#)).

### 5.15.1 Detailed Description

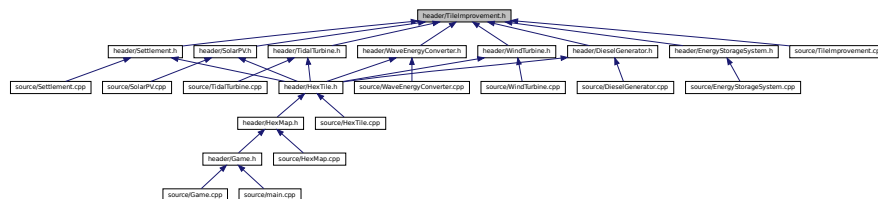
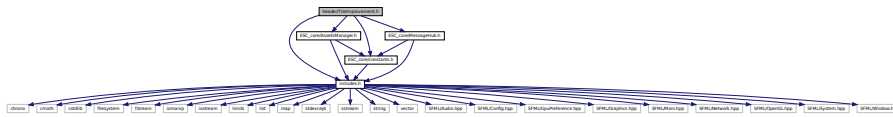
Header file for the [TidalTurbine](#) class.

## 5.16 header/TileImprovement.h File Reference

Header file for the [TileImprovement](#) class.

```
#include "ESC_core/constants.h"
#include "ESC_core/includes.h"
#include "ESC_core/AssetsManager.h"
```

Include dependency graph for TileImprovement.h:



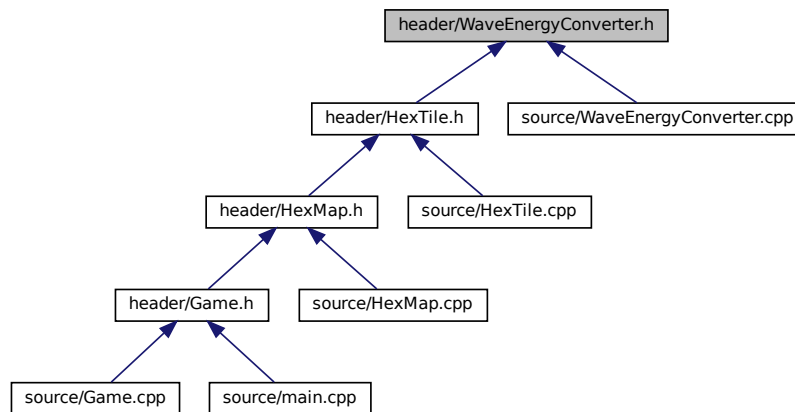
- A base class for the t*

- An enumeration of the different tile improvement types.*





This graph shows which files directly or indirectly include this file:



## Classes

- class [WaveEnergyConverter](#)  
A settlement class (child class of [TileImprovement](#)).

### 5.17.1 Detailed Description

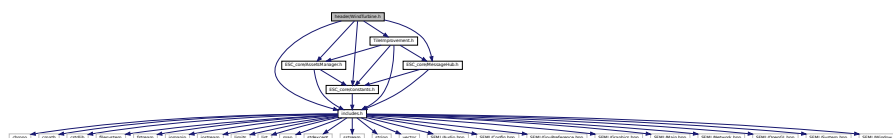
Header file for the [WaveEnergyConverter](#) class.

## 5.18 header/WindTurbine.h File Reference

Header file for the [WindTurbine](#) class.

```
#include "ESC_core/constants.h"
#include "ESC_core/includes.h"
#include "ESC_core/AssetsManager.h"
#include "ESC_core/MessageHub.h"
#include "TileImprovement.h"
```

Include dependency graph for WindTurbine.h:









## Functions

- void `printGreen` (std::string input\_str)  
A function that sends green text to std::cout.
- void `printGold` (std::string input\_str)  
A function that sends gold text to std::cout.
- void `printRed` (std::string input\_str)  
A function that sends red text to std::cout.
- void `testFloatEquals` (double x, double y, std::string file, int line)  
Tests for the equality of two floating point numbers x and y (to within `FLOAT_TOLERANCE`).
- void `testGreaterThan` (double x, double y, std::string file, int line)  
Tests if  $x > y$ .
- void `testGreaterThanOrEqualTo` (double x, double y, std::string file, int line)  
Tests if  $x \geq y$ .
- void `testLessThan` (double x, double y, std::string file, int line)  
Tests if  $x < y$ .
- void `testLessThanOrEqualTo` (double x, double y, std::string file, int line)  
Tests if  $x \leq y$ .
- void `testTruth` (bool statement, std::string file, int line)  
Tests if the given statement is true.
- void `expectedErrorNotDetected` (std::string file, int line)  
A utility function to print out a meaningful error message whenever an expected error fails to be thrown/caught/detected.

### 5.24.1 Detailed Description

Implementation file for various testing utilities.

This is a library of utility functions used throughout the various test suites.

### 5.24.2 Function Documentation

#### 5.24.2.1 `expectedErrorNotDetected()`

```
void expectedErrorNotDetected (
    std::string file,
    int line )
```

A utility function to print out a meaningful error message whenever an expected error fails to be thrown/caught/detected.

#### Parameters

<i>file</i>	The file in which the test is applied (you should be able to just pass in " <code>__FILE__</code> ").
<i>line</i>	The line of the file in which the test is applied (you should be able to just pass in " <code>__LINE__</code> ").

```
462 {
463     std::string error_str = "\n ERROR   failed to throw expected error prior to line ";
464     error_str += std::to_string(line);
```

```

465     error_str += " of ";
466     error_str += file;
467
468     #ifdef _WIN32
469         std::cout << error_str << std::endl;
470     #endif
471
472     throw std::runtime_error(error_str);
473     return;
474 } /* expectedErrorNotDetected() */

```

### 5.24.2.2 printGold()

```

void printGold (
    std::string input_str )

```

A function that sends gold text to std::cout.

#### Parameters

<i>input_str</i>	The text of the string to be sent to std::cout.
------------------	---

```

114 {
115     std::cout << "\x1B[33m" << input_str << "\033[0m";
116     return;
117 } /* printGold() */

```

### 5.24.2.3 printGreen()

```

void printGreen (
    std::string input_str )

```

A function that sends green text to std::cout.

#### Parameters

<i>input_str</i>	The text of the string to be sent to std::cout.
------------------	---

```

94 {
95     std::cout << "\x1B[32m" << input_str << "\033[0m";
96     return;
97 } /* printGreen() */

```

### 5.24.2.4 printRed()

```

void printRed (
    std::string input_str )

```

A function that sends red text to std::cout.

## Parameters

<i>input_str</i>	The text of the string to be sent to <code>std::cout</code> .
------------------	---

```

134 {
135     std::cout << "\x1B[31m" << input_str << "\033[0m";
136     return;
137 } /* printRed() */

```

## 5.24.2.5 testFloatEquals()

```

void testFloatEquals (
    double x,
    double y,
    std::string file,
    int line )

```

Tests for the equality of two floating point numbers  $x$  and  $y$  (to within `FLOAT_TOLERANCE`).

## Parameters

<i>x</i>	The first of two numbers to test.
<i>y</i>	The second of two numbers to test.
<i>file</i>	The file in which the test is applied (you should be able to just pass in " <code>__FILE__</code> ").
<i>line</i>	The line of the file in which the test is applied (you should be able to just pass in " <code>__LINE__</code> ").

```

168 {
169     if (fabs(x - y) <= FLOAT_TOLERANCE) {
170         return;
171     }
172
173     std::string error_str = "ERROR: testFloatEquals():\t in ";
174     error_str += file;
175     error_str += "\tline ";
176     error_str += std::to_string(line);
177     error_str += ":\t\n";
178     error_str += std::to_string(x);
179     error_str += " and ";
180     error_str += std::to_string(y);
181     error_str += " are not equal to within +/- ";
182     error_str += std::to_string(FLOAT_TOLERANCE);
183     error_str += "\n";
184
185     #ifdef _WIN32
186         std::cout << error_str << std::endl;
187     #endif
188
189     throw std::runtime_error(error_str);
190     return;
191 } /* testFloatEquals() */

```

## 5.24.2.6 testGreaterThan()

```

void testGreaterThan (
    double x,
    double y,
    std::string file,
    int line )

```

Tests if  $x > y$ .

## Parameters

<i>x</i>	The first of two numbers to test.
<i>y</i>	The second of two numbers to test.
<i>file</i>	The file in which the test is applied (you should be able to just pass in "__FILE__").
<i>line</i>	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```

221 {
222     if (x > y) {
223         return;
224     }
225
226     std::string error_str = "ERROR: testGreaterThan():\t in ";
227     error_str += file;
228     error_str += "\tline ";
229     error_str += std::to_string(line);
230     error_str += ":\t\n";
231     error_str += std::to_string(x);
232     error_str += " is not greater than ";
233     error_str += std::to_string(y);
234     error_str += "\n";
235
236     #ifdef _WIN32
237         std::cout << error_str << std::endl;
238     #endif
239
240     throw std::runtime_error(error_str);
241     return;
242 } /* testGreaterThan() */

```

## 5.24.2.7 testGreaterThanOrEqualTo()

```

void testGreaterThanOrEqualTo (
    double x,
    double y,
    std::string file,
    int line )

```

Tests if  $x \geq y$ .

## Parameters

<i>x</i>	The first of two numbers to test.
<i>y</i>	The second of two numbers to test.
<i>file</i>	The file in which the test is applied (you should be able to just pass in "__FILE__").
<i>line</i>	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```

272 {
273     if (x >= y) {
274         return;
275     }
276
277     std::string error_str = "ERROR: testGreaterThanOrEqualTo():\t in ";
278     error_str += file;
279     error_str += "\tline ";
280     error_str += std::to_string(line);
281     error_str += ":\t\n";
282     error_str += std::to_string(x);
283     error_str += " is not greater than or equal to ";
284     error_str += std::to_string(y);
285     error_str += "\n";
286
287     #ifdef _WIN32
288         std::cout << error_str << std::endl;
289     #endif
290
291     throw std::runtime_error(error_str);

```



```

292     return;
293 } /* testGreaterThanOrEqualTo() */

```

### 5.24.2.8 testLessThan()

```

void testLessThan (
    double x,
    double y,
    std::string file,
    int line )

```

Tests if  $x < y$ .

#### Parameters

<i>x</i>	The first of two numbers to test.
<i>y</i>	The second of two numbers to test.
<i>file</i>	The file in which the test is applied (you should be able to just pass in "__FILE__").
<i>line</i>	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```

323 {
324     if (x < y) {
325         return;
326     }
327
328     std::string error_str = "ERROR: testLessThan():\t in ";
329     error_str += file;
330     error_str += "\tline ";
331     error_str += std::to_string(line);
332     error_str += ":\t\n";
333     error_str += std::to_string(x);
334     error_str += " is not less than ";
335     error_str += std::to_string(y);
336     error_str += "\n";
337
338     #ifdef _WIN32
339         std::cout << error_str << std::endl;
340     #endif
341
342     throw std::runtime_error(error_str);
343     return;
344 } /* testLessThan() */

```

### 5.24.2.9 testLessThanOrEqualTo()

```

void testLessThanOrEqualTo (
    double x,
    double y,
    std::string file,
    int line )

```

Tests if  $x \leq y$ .

#### Parameters

<i>x</i>	The first of two numbers to test.
<i>y</i>	The second of two numbers to test.
<i>file</i>	The file in which the test is applied (you should be able to just pass in "__FILE__").
<i>line</i>	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```

374 {
375     if (x <= y) {
376         return;
377     }
378
379     std::string error_str = "ERROR: testLessThanOrEqualTo():\t in ";
380     error_str += file;
381     error_str += "\tline ";
382     error_str += std::to_string(line);
383     error_str += ":\t\n";
384     error_str += std::to_string(x);
385     error_str += " is not less than or equal to ";
386     error_str += std::to_string(y);
387     error_str += "\n";
388
389     #ifdef _WIN32
390         std::cout << error_str << std::endl;
391     #endif
392
393     throw std::runtime_error(error_str);
394     return;
395 } /* testLessThanOrEqualTo() */

```

#### 5.24.2.10 testTruth()

```

void testTruth (
    bool statement,
    std::string file,
    int line )

```

Tests if the given statement is true.

##### Parameters

<i>statement</i>	The statement whose truth is to be tested ("1 == 0", for example).
<i>file</i>	The file in which the test is applied (you should be able to just pass in "__FILE__").
<i>line</i>	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```

422 {
423     if (statement) {
424         return;
425     }
426
427     std::string error_str = "ERROR: testTruth():\t in ";
428     error_str += file;
429     error_str += "\tline ";
430     error_str += std::to_string(line);
431     error_str += ":\t\n";
432     error_str += "Given statement is not true";
433
434     #ifdef _WIN32
435         std::cout << error_str << std::endl;
436     #endif
437
438     throw std::runtime_error(error_str);
439     return;
440 } /* testTruth() */

```

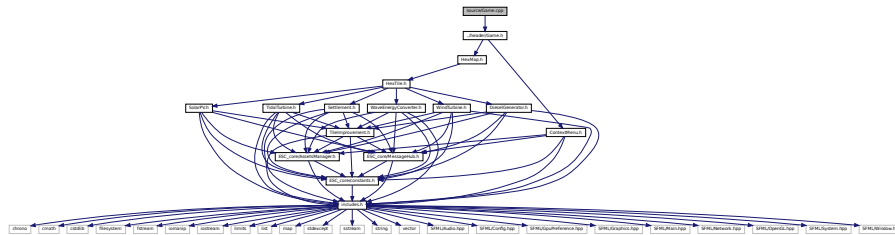
## 5.25 source/Game.cpp File Reference

Implementation file for the [Game](#) class.

```
#include "../header/Game.h"
```

Include dependency graph for Game.cpp

Include dependency graph for Game.cpp:



### 5.25.1 Detailed Description

Implementation file for the `Game` class.

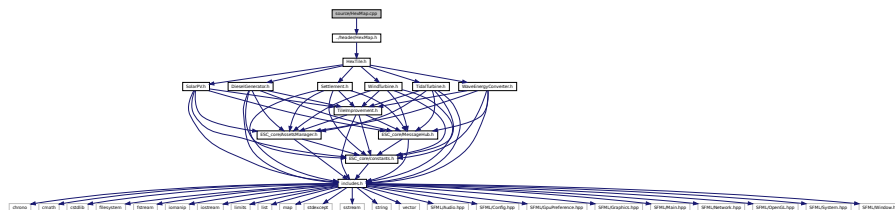
A class which defines a tile of a hex map.

## 5.26 source/HexMap.cpp File Reference

Implementation file for the [HexMap](#) class.

```
#include "../header/HexMap.h"
```

Include dependency graph for HexMap.cpp:



### 5.26.1 Detailed Description

Implementation file for the [HexMap](#) class.

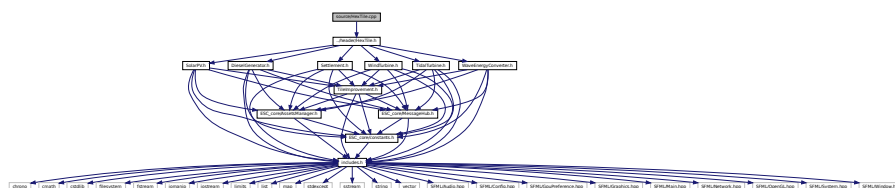
A class which defines a hex map of hex tiles.

## 5.27 source/HexTile.cpp File Reference

Implementation file for the [HexTile](#) class.

```
#include "../header/HexTile.h"
```

Include dependency graph for HexTile.cpp:



### 5.27.1 Detailed Description

Implementation file for the [HexTile](#) class.

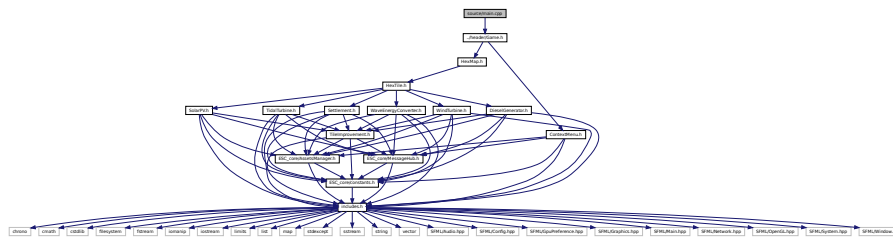
A class which defines a tile of a hex map.

## 5.28 source/main.cpp File Reference

Implementation file for [main\(\)](#) for Road To Zero.

```
#include "../header/Game.h"
```

Include dependency graph for main.cpp:



### Functions

- void [loadAssets](#) ([AssetsManager](#) \*assets\_manager\_ptr)  
*Helper function to load game assets.*
- sf::RenderWindow \* [constructRenderWindow](#) (void)  
*Helper function to construct render window.*
- int [main](#) (int argc, char \*\*argv)

### 5.28.1 Detailed Description

Implementation file for [main\(\)](#) for Road To Zero.

### 5.28.2 Function Documentation

#### 5.28.2.1 constructRenderWindow()

```
sf::RenderWindow * constructRenderWindow (
    void )
```

Helper function to construct render window.

#### Returns

Pointer to the render window.

```
309 {
310     sf::RenderWindow* render_window_ptr = new sf::RenderWindow(
311         sf::VideoMode(GAME_WIDTH, GAME_HEIGHT),
312         "Road To Zero"
313     );
314     return render_window_ptr;
315 }
316 /* constructRenderWindow() */
```

### 5.28.2.2 loadAssets()

```
void loadAssets (
    AssetsManager * assets_manager_ptr )
```

Helper function to load game assets.

#### Parameters

<code>assets_manager_ptr</code>	Pointer to the assets manager.
---------------------------------	--------------------------------

```
66 {
67     // 1. load font assets
68     assets_manager_ptr->loadFont("assets/fonts/DroidSansMono.ttf", "DroidSansMono");
69     assets_manager_ptr->loadFont("assets/fonts/Glass_TTY_VT220.ttf", "Glass_TTY_VT220");
70
71
72     // 2. load tile sheets
73     assets_manager_ptr->loadTexture(
74         "assets/tile_sheets/pine_tree_64x64_1_CC-BY.png",
75         "pine_tree_64x64_1"
76     );
77
78     assets_manager_ptr->loadTexture(
79         "assets/tile_sheets/wheat_64x64_1_CC-BY.png",
80         "wheat_64x64_1"
81     );
82
83     assets_manager_ptr->loadTexture(
84         "assets/tile_sheets/mountain_64x64_1_CC-BY.png",
85         "mountain_64x64_1"
86     );
87
88     assets_manager_ptr->loadTexture(
89         "assets/tile_sheets/water_waves_64x64_1_CC-BY.png",
90         "water_waves_64x64_1"
91     );
92
93     assets_manager_ptr->loadTexture(
94         "assets/tile_sheets/water_shimmer_64x64_1_CC-BY.png",
95         "water_shimmer_64x64_1"
96     );
97
98     assets_manager_ptr->loadTexture(
99         "assets/tile_sheets/brick_house_64x64_1_CC-BY.png",
100         "brick_house_64x64_1"
101     );
102
103     assets_manager_ptr->loadTexture(
104         "assets/tile_sheets/magnifying_glass_64x64_1_CC-BY.png",
105         "magnifying_glass_64x64_1"
106     );
107
108     assets_manager_ptr->loadTexture(
109         "assets/tile_sheets/exp2_0_CC0.png",
110         "tile clear explosion"
111     );
112
113     assets_manager_ptr->loadTexture(
114         "assets/tile_sheets/emissions_8x8_1_CC-BY.png",
115         "emissions"
116     );
117
118     assets_manager_ptr->loadTexture(
119         "assets/tile_sheets/diesel_generator_64x64_2_CC-BY.png",
120         "diesel generator"
121     );
122
123     assets_manager_ptr->loadTexture(
124         "assets/tile_sheets/solar_PV_64x64_1_CC-BY.png",
125         "solar PV array"
126     );
127
128     assets_manager_ptr->loadTexture(
129         "assets/tile_sheets/wind_turbine_64x64_2_CC-BY.png",
130         "wind turbine"
131     );
132
133     assets_manager_ptr->loadTexture(
134         "assets/tile_sheets/energy_storage_system_64x64_1_CC-BY.png",
135         "energy storage system"
```

```
136     );
137
138     assets_manager_ptr->loadTexture(
139         "assets/tile_sheets/tidal_turbine_64x64_2_CC-BY.png",
140         "tidal turbine"
141     );
142
143     assets_manager_ptr->loadTexture(
144         "assets/tile_sheets/wave_energy_converter_64x64_2_CC-BY.png",
145         "wave energy converter"
146     );
147
148     assets_manager_ptr->loadTexture(
149         "assets/tile_sheets/upgrade_arrow_16x16_1_CC-BY.png",
150         "upgrade arrow"
151     );
152
153     assets_manager_ptr->loadTexture(
154         "assets/tile_sheets/upgrade_plus_16x16_1_CC-BY.png",
155         "upgrade plus"
156     );
157
158
159     // 3. load sounds
160     assets_manager_ptr->loadSound(
161         "assets/audio/samples/mixkit-magical-coin-win-1936_MixkitFree.ogg",
162         "coin ring"
163     );
164
165     assets_manager_ptr->loadSound(
166         "assets/audio/samples/mixkit-positive-notification-951_MixkitFree.ogg",
167         "positive notification"
168     );
169
170     assets_manager_ptr->loadSound(
171         "assets/audio/samples/mixkit-sci-fi-click-900_MixkitFree.ogg",
172         "sci-fi click"
173     );
174
175     assets_manager_ptr->loadSound(
176         "assets/audio/samples/mixkit-apartment-buzzer-bell-press-932_MixkitFree.ogg",
177         "insufficient credits"
178     );
179
180     assets_manager_ptr->loadSound(
181         "assets/audio/samples/mixkit-data-scanner-2487_MixkitFree.ogg",
182         "resource assessment"
183     );
184
185     assets_manager_ptr->loadSound(
186         "assets/audio/samples/mixkit-interface-click-1126_MixkitFree.ogg",
187         "console string print"
188     );
189
190     assets_manager_ptr->loadSound(
191         "assets/audio/samples/mixkit-video-game-retro-click-237_MixkitFree.ogg",
192         "resource overlay toggle on"
193     );
194
195     assets_manager_ptr->loadSound(
196         "assets/audio/samples/mixkit-video-game-retro-click-237_REVERSED_MixkitFree.ogg",
197         "resource overlay toggle off"
198     );
199
200     assets_manager_ptr->loadSound(
201         "assets/audio/samples/mixkit-explosion-with-rocks-debris-1703_MixkitFree.ogg",
202         "clear mountains tile"
203     );
204
205     assets_manager_ptr->loadSound(
206         "assets/audio/samples/mixkit-arcade-game-explosion-2759_MixkitFree.ogg",
207         "clear non-mountains tile"
208     );
209
210     assets_manager_ptr->loadSound(
211         "assets/audio/samples/mixkit-electronic-retro-block-hit-2185_MixkitFree.ogg",
212         "place improvement"
213     );
214
215     assets_manager_ptr->loadSound(
216         "assets/audio/samples/mixkit-video-game-lock-2851_REVERSED_MixkitFree.ogg",
217         "build menu open"
218     );
219
220     assets_manager_ptr->loadSound(
221         "assets/audio/samples/mixkit-video-game-lock-2851_MixkitFree.ogg",
222         "build menu close"
```

```

223     );
224
225     assets_manager_ptr->loadSound(
226         "assets/audio/samples/mixkit-jump-into-the-water-1180_MixkitFree.ogg",
227         "splash"
228     );
229
230     assets_manager_ptr->loadSound(
231         "assets/audio/samples/505316__nuncaconoci__diesel_CC0.ogg",
232         "diesel running"
233     );
234
235     assets_manager_ptr->loadSound(
236         "assets/audio/samples/33460__pempi__320d_2_CC-BY.ogg",
237         "diesel start"
238     );
239
240     assets_manager_ptr->loadSound(
241         "assets/audio/samples/132724__andy_gardner__wind-turbine-blades_CC-BY.ogg",
242         "wind turbine running"
243     );
244
245     assets_manager_ptr->loadSound(
246         "assets/audio/samples/58416__darren1979__oceanwaves_CC-SAMPLING.ogg",
247         "ocean waves"
248     );
249
250     assets_manager_ptr->loadSound(
251         "assets/audio/samples/369927__mephisto_egmont__water-flowing-in-tubes_CC-BY.ogg",
252         "water flow"
253     );
254
255     assets_manager_ptr->loadSound(
256         "assets/audio/samples/647663__jotraing__electric-train-motor-idle-loop-new-generation-rollingstock_CC0.ogg",
257         "energy storage system"
258     );
259
260     assets_manager_ptr->loadSound(
261         "assets/audio/samples/mixkit-epic-futuristic-movie-accent-2913_MixkitFree.ogg",
262         "game title screen"
263     );
264
265     assets_manager_ptr->loadSound(
266         "assets/audio/samples/mixkit-calm-park-with-people-and-children_MixkitFree.ogg",
267         "people and children"
268     );
269
270     assets_manager_ptr->loadSound(
271         "assets/audio/samples/mixkit-magical-coin-win-1936_MixkitFree.ogg",
272         "upgrade"
273     );
274
275
276     // 4. load tracks
277     assets_manager_ptr->loadTrack(
278         "assets/audio/tracks/TreeStarMoon_Dobranoc_CC0.ogg",
279         "Tree Star Moon - Dobranoc"
280     );
281
282     assets_manager_ptr->loadTrack(
283         "assets/audio/tracks/TreeStarMoon_Lighthouse_CC0.ogg",
284         "Tree Star Moon - Lighthouse"
285     );
286
287     assets_manager_ptr->loadTrack(
288         "assets/audio/tracks/TreeStarMoon_SkyFarm_CC0.ogg",
289         "Tree Star Moon - Sky Farm"
290     );
291
292     return;
293 } /* loadAssets() */

```

### 5.28.2.3 main()

```

int main (
    int argc,
    char ** argv )
325 {

```





### 5.30.1 Detailed Description

Implementation file for the **SolarPV** class.

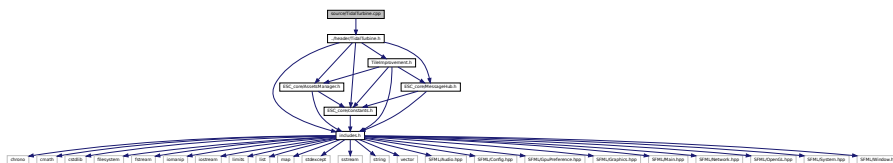
A base class for the tile improvement hierarchy.

### 5.31 source/TidalTurbine.cpp File Reference

Implementation file for the `TidalTurbine` class.

```
#include "../header/TidalTurbine.h"
```

Include dependency graph for TidalTurbine.cpp:



### 5.31.1 Detailed Description

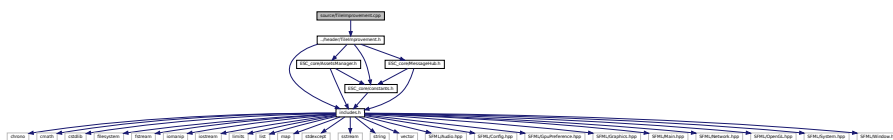
Implementation file for the `TidalTurbine` class.

A base class for the tile improvement hierarchy.

### 5.32 source/TileImprovement.cpp File Reference

Implementation file for the `TileImprovement` class.

```
#include "../header/TileImprovement.h"
Include dependency graph for TileImprovement.cpp:
```



### 5.32.1 Detailed Description

Implementation file for the `TileImprovement` class.

A base class for the tile improvement hierarchy.



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