# Road To Zero - The Microgrid Management Game

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# Chapter 1

# Hierarchical Index

## 1.1 Class Hierarchy

This inheritance list is sorted roughly, but not completely, alphabetically:

# Chapter 2

# Class Index

## 2.1 Class List

Here are the classes, structs, unions and interfaces with brief descriptions:

# Chapter 3

# File Index

## 3.1 File List

Here is a list of all files with brief descriptions:

# 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**

| | |
|---|---|
| *path_2_sound* | A path (either relative or absolute) to the sound file. |
| *sound_key* | 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
694     //  2. clear textures
695     std::map<std::string, sf::Texture*>::iterator texture_iter;
696     for (
697         texture_iter = this->texture_map.begin();
698         texture_iter != this->texture_map.end();
699         texture_iter++
700     ) {
701         delete texture_iter->second;
702
703         std::cout « "Texture " « texture_iter->first « " deleted from texture map" «
704             std::endl;
705     }
706     this->texture_map.clear();
707
708
709     //  3. clear sound buffers
710     std::map<std::string, sf::SoundBuffer*>::iterator soundbuffer_iter;
711     for (
712         soundbuffer_iter = this->soundbuffer_map.begin();
713         soundbuffer_iter != this->soundbuffer_map.end();
714         soundbuffer_iter++
715     ) {
716         delete soundbuffer_iter->second;
717
718         std::cout « "SoundBuffer " « soundbuffer_iter->first «
719             " deleted from soundbuffer map" « std::endl;
720     }
721     this->soundbuffer_map.clear();
722
723
724     //  4. clear sounds
725     std::map<std::string, sf::Sound*>::iterator sound_iter;
726     for (
727         sound_iter = this->sound_map.begin();
728         sound_iter != this->sound_map.end();
729         sound_iter++
730     ) {
731         sound_iter->second->stop();
732         delete sound_iter->second;
733
734         std::cout « "Sound " « sound_iter->first « " deleted from sound map" «
735             std::endl;
736     }
737     this->sound_map.clear();
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**

| | |
|---|---|
| *font_key* | 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**

| | |
|---|---|
| *sound_key* | 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**

| | |
|---|---|
| *sound_key* | 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**

| | |
|---|---|
| *texture_key* | 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**

| | |
|---|---|
| *path_2_font* | A path (either relative or absolute) to the font file. |
| *font_key* | 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**

| | |
|---|---|
| *path_2_sound* | A path (either relative or absolute) to the sound file. |
| *sound_key* | 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**

| | |
|---|---|
| *path_2_texture* | A path (either relative or absolute) to the texture file. |
| *texture_key* | 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 
245     //  2. load from file, throw error on fail
246     sf::Texture* texture_ptr = new sf::Texture();
247 
248     if (not texture_ptr->loadFromFile(path_2_texture)) {
249         std::string error_str = "ERROR  AssetsManager::loadTexture()  could not load ";
250         error_str += "texture at ";
251         error_str += path_2_texture;
252 
253         this->clear();
254 
255         #ifdef _WIN32
256             std::cout « error_str « std::endl;
```

```
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**

| | |
|---|---|
| *path_2_track* | A path (either relative or absolute) to the track file. |
| *track_key* | 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:

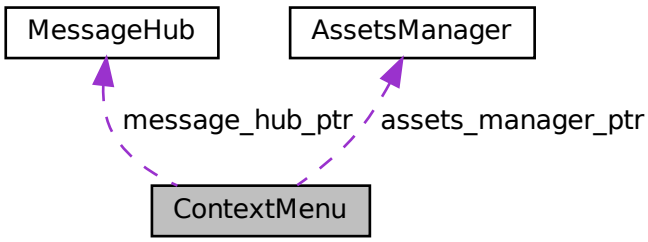
- header/ESC_core/AssetsManager.h
- source/ESC_core/AssetsManager.cpp

## 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**

| | |
|---|---|
| *event_ptr* | Pointer to the event class. |
| *render_window_ptr* | Pointer to the render window. |
| *assets_manager_ptr* | Pointer to the assets manager. |
| *message_hub_ptr* | 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(MONOCHROME_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(MONOCHROME_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(MONOCHROME_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
701         case (sf::Keyboard::Q): {
702             if (this->console_state == ConsoleState :: MENU) {
703                 this->__sendQuitGameMessage();
704             }
705         }
706
707
708         case (sf::Keyboard::R): {
709             if (this->console_state == ConsoleState :: MENU) {
710                 this->__sendRestartGameMessage();
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
747         case (sf::Mouse::Right): {
748             //...
749
750             break;
751         }
752
753
754         default: {
755             // do nothing!
756
757             break;
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**

| | |
|---|---|
| *console_state* | 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             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 
547         case (ConsoleState :: TILE): {
548             // take console string from tile state message
549 
550             break;
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.setFillColor(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.setFillColor(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 
412     //  4. right framing
413     this->console_screen_frame_right.setPointCount(n_points);
414 
415     this->console_screen_frame_right.setPoint(
416         0,
417         sf::Vector2f(
418             this->position_x - 50,
419             this->position_y + GAME_HEIGHT - 50
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:

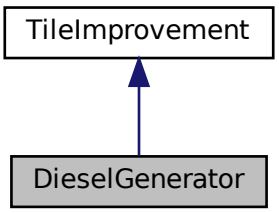
- header/ContextMenu.h
- source/ContextMenu.cpp

## 4.3 DieselGenerator Class Reference

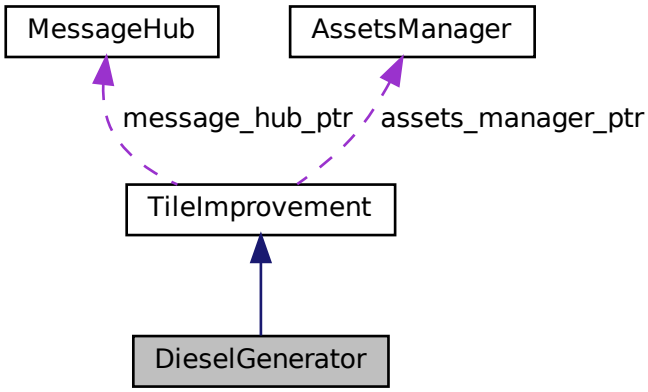
A settlement class (child class of TileImprovement).

```
#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 __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**

| | |
|---|---|
| *position_x* | The x position of the tile. |
| *position_y* | The y position of the tile. |
| *event_ptr* | Pointer to the event class. |
| *render_window_ptr* | Pointer to the render window. |
| *assets_manager_ptr* | Pointer to the assets manager. |
| *message_hub_ptr* | Pointer to the message hub. |

```
222   :
223 TileImprovement(
224     position_x,
225     position_y,
226     event_ptr,
227     render_window_ptr,
228     assets_manager_ptr,
229     message_hub_ptr
230 )
```

```
231 {
232     //  1. set attributes
233
234     //  1.1. private
235     //...
236
237     //  1.2. public
238     this->tile_improvement_type = TileImprovementType :: DIESEL_GENERATOR;
239
240     this->is_running = false;
241
242     this->health = 100;
243
244     this->capacity_kW = 100;
245
246     this->production_MWh = 0;
247     this->max_production_MWh = 72;
248
249     this->smoke_da = 1e-8 * SECONDS_PER_FRAME;
250     this->smoke_dx = 5 * SECONDS_PER_FRAME;
251     this->smoke_dy = -10 * SECONDS_PER_FRAME;
252     this->smoke_prob = 8 * SECONDS_PER_FRAME;
253
254     this->smoke_sprite_list = {};
255
256     this->tile_improvement_string = "DIESEL GEN";
257
258     this->__setUpTileImprovementSpriteAnimated();
259
260     std::cout « "DieselGenerator constructed at " « this « std::endl;
261
262     return;
263 }   /* DieselGenerator() */
```

#### 4.3.2.2 ~DieselGenerator()

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

Destructor for the DieselGenerator class.

```
432 {
433     std::cout « "DieselGenerator at " « this « " destroyed" « std::endl;
434
435     return;
436 }   /* ~DieselGenerator() */
```

### 4.3.3 Member Function Documentation

#### 4.3.3.1 __handleKeyPressEvents()

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

Helper method to handle key press events.

```
114 {
115     if (this->just_built) {
116         return;
117     }
118
119     switch (this->event_ptr->key.code) {
120         //...
121
122
123         default: {
124             // do nothing!
```

```
125
126             break;
127         }
128     }
129
130     return;
131 }   /* __handleKeyPressEvents() */
```

#### 4.3.3.2 __handleMouseButtonEvents()

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

Helper method to handle mouse button events.

```
146 {
147     if (this->just_built) {
148         return;
149     }
150
151     switch (this->event_ptr->mouseButton.button) {
152         case (sf::Mouse::Left): {
153             //...
154
155             break;
156         }
157
158
159         case (sf::Mouse::Right): {
160             //...
161
162             break;
163         }
164
165
166         default: {
167             // do nothing!
168
169             break;
170         }
171     }
172
173     return;
174 }   /* __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 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.

```
376 {
377     //  1. if just built, call base method and return
378     if (this->just_built) {
379         TileImprovement :: draw();
380
381         return;
382     }
383
384
385     //  2. draw first element of animated sprite
386     this->render_window_ptr->draw(this->tile_improvement_sprite_animated[0]);
387
388
389     //  3. draw second element of animated sprite
390     if (this->is_running) {
391         //...
392     }
393
394     else {
395         //...
396     }
397
398     this->render_window_ptr->draw(this->tile_improvement_sprite_animated[1]);
399
400
401     //  4. draw smoke effects
402     if (this->is_running) {
403         //...
404     }
405
406
407     //  5. draw production menu
408     if (this->production_menu_open) {
409         this->render_window_ptr->draw(this->production_menu_backing);
410         this->render_window_ptr->draw(this->production_menu_backing_text);
411
412         //...
413     }
414
415     this->frame++;
416     return;
417 }   /* draw() */
```

#### 4.3.3.5 getTileOptionsSubstring()

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

Helper method to assemble and return tile options substring.

**Returns**

Tile options substring.

Reimplemented from TileImprovement.

```
280 {
281     int upgrade_cost = DIESEL_GENERATOR_BUILD_COST;
282 
283     //                  32 char x 17 line console "--------------------------------\n";
284     std::string options_substring                = "CAPACITY:    ";
285     options_substring                           += std::to_string(this->capacity_kW);
286     options_substring                           += " kW\n";
287 
288     options_substring                           += "PRODUCTION:  ";
289     options_substring                           += std::to_string(this->production_MWh);
290     options_substring                           += " MWh (MAX ";
291     options_substring                           += std::to_string(this->max_production_MWh);
292     options_substring                           += ")\n";
293 
294     options_substring                           += "HEALTH:      ";
295     options_substring                           += std::to_string(this->health);
296     options_substring                           += "/100\n";
297 
298     options_substring                           += "                                \n";
299     options_substring                           += "  **** DIESEL GEN OPTIONS ****  \n";
300     options_substring                           += "                                \n";
301     options_substring                           += "[E]:  OPEN PRODUCTION MENU      \n";
302 
303     options_substring                           += "[U]:  UPGRADE (";
304     options_substring                           += std::to_string(upgrade_cost);
305     options_substring                           +=" K)\n";
306 
307     options_substring                           += "[P]:  SCRAP (";
308     options_substring                           += std::to_string(SCRAP_COST);
309     options_substring                           += " K)";
310 
311     return options_substring;
312 }   /* getTileOptionsSubstring() */
```

#### 4.3.3.6 processEvent()

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

Method to process DieselGenerator. To be called once per event.

Reimplemented from TileImprovement.

```
327 {
328     TileImprovement :: processEvent();
329 
330     if (this->event_ptr->type == sf::Event::KeyPressed) {
331         this->__handleKeyPressEvents();
332     }
333 
334     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
335         this->__handleMouseButtonEvents();
336     }
337 
338     return;
339 }   /* processEvent() */
```

#### 4.3.3.7 processMessage()

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

Method to process DieselGenerator. To be called once per message.

Reimplemented from TileImprovement.

```
354 {
355     TileImprovement :: processMessage();
356 
357     //...
358 
359     return;
360 }   /* 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:

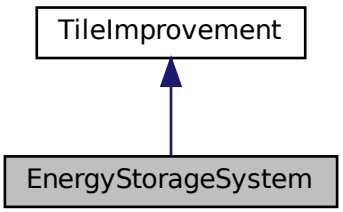
- header/DieselGenerator.h
- source/DieselGenerator.cpp

## 4.4 EnergyStorageSystem Class Reference

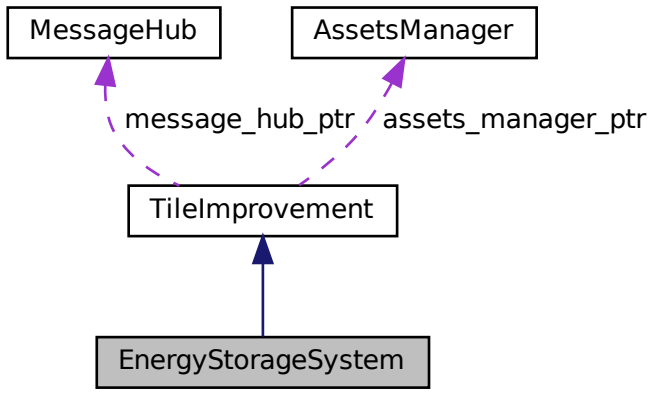
A settlement class (child class of TileImprovement).

```
#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.*
- 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.*

## 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

### 4.4.1 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**

| | |
|---|---|
| *position_x* | The x position of the tile. |
| *position_y* | The y position of the tile. |
| *event_ptr* | Pointer to the event class. |
| *render_window_ptr* | Pointer to the render window. |
| *assets_manager_ptr* | Pointer to the assets manager. |
| *message_hub_ptr* | 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 :: ENERGY_STORAGE_SYSTEM;
226
227     this->is_running = false;
228
229     this->health = 100;
230
231     this->tile_improvement_string = "ENERGY STORAGE";
232
233     this->__setUpTileImprovementSpriteStatic();
234
235     std::cout « "EnergyStorageSystem constructed at " « this « std::endl;
236
237     return;
238 }   /* EnergyStorageSystem() */
```

### 4.4.2.2 ~EnergyStorageSystem()

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

Destructor for the EnergyStorageSystem class.

```
373 {
374     std::cout « "EnergyStorageSystem at " « this « " destroyed" « std::endl;
375 
376     return;
377 }   /* ~EnergyStorageSystem() */
```

### 4.4.3 Member Function Documentation

#### 4.4.3.1 __handleKeyPressEvents()

```
void EnergyStorageSystem::__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 
112         default: {
113             // do nothing!
114 
115             break;
116         }
117     }
118 
119     return;
120 }   /* __handleKeyPressEvents() */
```

#### 4.4.3.2 __handleMouseButtonEvents()

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

Helper method to handle mouse button events.

```
135 {
136     if (this->just_built) {
137         return;
138     }
139 
140     switch (this->event_ptr->mouseButton.button) {
141         case (sf::Mouse::Left): {
142             //...
143 
144             break;
145         }
146 
147 
148         case (sf::Mouse::Right): {
149             //...
150 
151             break;
152         }
153 
154 
155         default: {
156             // do nothing!
157 
158             break;
159         }
160     }
161 
162     return;
163 }   /* __handleMouseButtonEvents() */
```

#### 4.4.3.3 __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() */
```

#### 4.4.3.4 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.

```
335 {
336     //  1. if just built, call base method and return
337     if (this->just_built) {
338         TileImprovement :: draw();
339 
340         return;
341     }
342 
343 
344     //  2. draw static sprite
345     this->render_window_ptr->draw(this->tile_improvement_sprite_static);
346 
347 
348     //  3. draw production menu
349     if (this->production_menu_open) {
350         this->render_window_ptr->draw(this->production_menu_backing);
351         this->render_window_ptr->draw(this->production_menu_backing_text);
352 
353         //...
354     }
355 
356     this->frame++;
357     return;
358 }   /* draw() */
```

#### 4.4.3.5 getTileOptionsSubstring()

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

Helper method to assemble and return tile options substring.

**Returns**

Tile options substring.

Reimplemented from TileImprovement.

```
255 {
256     //                  32 char x 17 line console "--------------------------------\n";
257     std::string options_substring                = "**** ENERGY STORAGE OPTIONS ****\n";
258     options_substring                           += "                                \n";
259     options_substring                           += "                                \n";
260     options_substring                           += "                                \n";
261     options_substring                           += "                                \n";
262     options_substring                           += "                                \n";
263     options_substring                           += "                                \n";
264     options_substring                           += "                                \n";
265
266     options_substring                           += "[P]:  SCRAP (";
267     options_substring                           += std::to_string(SCRAP_COST);
268     options_substring                           += " K)";
269
270     return options_substring;
271 }   /* getTileOptionsSubstring() */
```

#### 4.4.3.6 processEvent()

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

Method to process EnergyStorageSystem. To be called once per event.

Reimplemented from TileImprovement.

```
286 {
287     TileImprovement :: processEvent();
288
289     if (this->event_ptr->type == sf::Event::KeyPressed) {
290         this->__handleKeyPressEvents();
291     }
292
293     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
294         this->__handleMouseButtonEvents();
295     }
296
297     return;
298 }   /* processEvent() */
```

#### 4.4.3.7 processMessage()

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

Method to process EnergyStorageSystem. To be called once per message.

Reimplemented from TileImprovement.

```
313 {
314     TileImprovement :: processMessage();
315
316     //...
317
318     return;
319 }   /* processMessage() */
```

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

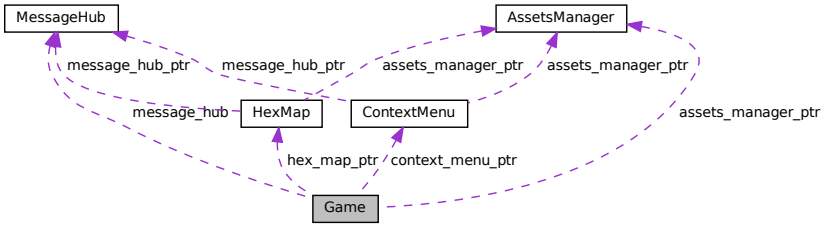
- header/EnergyStorageSystem.h
- source/EnergyStorageSystem.cpp

# 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(MONOCHROME_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 
599         case (GamePhase :: SYSTEM_MANAGEMENT): {
600             HUD_string += "SYSTEM MANAGEMENT";
601 
602             break;
603         }
604 
605 
606         case (GamePhase :: LOSS_EMISSIONS): {
607             HUD_string += "LOSS (EMISSIONS)";
608 
609             break;
610         }
611 
```

```
612
613         case (GamePhase :: LOSS_DEMAND): {
614             HUD_string += "LOSS (DEMAND)";
615
616             break;
617         }
618
619
620         case (GamePhase :: LOSS_CREDITS): {
621             HUD_string += "LOSS (CREDITS)";
622
623             break;
624         }
625
626
627         case (GamePhase :: VICTORY): {
628             HUD_string += "VICTORY";
629
630             break;
631         }
632
633
634         default: {
635             HUD_string += "???";
636
637             break;
638         }
639     }
640
641     HUD_string += "    TURN: ";
642     HUD_string += std::to_string(this->turn);
643
644     HUD_text.setString(HUD_string);
645
646     HUD_text.setPosition(
647         (800 - HUD_text.getLocalBounds().width) / 2,
648         GAME_HEIGHT - 35
649     );
650
651     this->render_window_ptr->draw(HUD_text);
652
653     return;
654 }   /* __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
432         time_since_alarm_s = alarm_clock.getElapsedTime().asSeconds();
433
434         if (time_since_alarm_s >= (alarm_frame + 1) * SECONDS_PER_FRAME) {
435             while (this->render_window_ptr->pollEvent(this->event)) {
436                 // do nothing!
437             }
438
439             this->render_window_ptr->clear();
440
441             this->hex_map_ptr->draw();
442             this->context_menu_ptr->draw();
443             this->__draw();
444
445             if (alarm_frame % (FRAMES_PER_SECOND / 3) == 0) {
446                 if (red_flag) {
447                     red_flag = false;
448                 }
449
450                 else {
451                     red_flag = true;
452                 }
453             }
454
455             if (red_flag) {
456                 insufficient_credits_text.setFillColor(MONOCHROME_TEXT_RED);
457             }
458
459             else {
460                 insufficient_credits_text.setFillColor(sf::Color(255, 255, 255));
461             }
462
463             this->render_window_ptr->draw(backing_rectangle);
464             this->render_window_ptr->draw(insufficient_credits_text);
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 
224         case (GamePhase :: SYSTEM_MANAGEMENT): {
225             game_state_message.string_payload["game phase"] = "system management";
226 
227             break;
228         }
229 
230 
231         case (GamePhase :: LOSS_EMISSIONS): {
232             game_state_message.string_payload["game phase"] = "loss emissions";
233 
234             break;
235         }
236 
237 
238         case (GamePhase :: LOSS_DEMAND): {
239             game_state_message.string_payload["game phase"] = "loss demand";
240 
241             break;
242         }
243 
244 
245         case (GamePhase :: LOSS_CREDITS): {
246             game_state_message.string_payload["game phase"] = "loss credits";
247 
248             break;
249         }
250 
251 
252         case (GamePhase :: VICTORY): {
253             game_state_message.string_payload["game phase"] = "victory";
254 
255             break;
256         }
257 
258 
259         default: {
260             // do nothing!
261 
```

```
262             break;
263         }
264     }
265
266     this->message_hub.sendMessage(game_state_message);
267
268     std::cout « "Game state message sent by " « this « std::endl;
269     return;
270 }   /* __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
791             //  6.2. process messages
792             while (this->message_hub.hasTraffic()) {
793                 this->hex_map_ptr->processMessage();
794                 this->context_menu_ptr->processMessage();
795                 this->__processMessage();
796             }
797
798
```

```
799             //  6.3. draw frame
800             this->render_window_ptr->clear();
801 
802             this->hex_map_ptr->draw();
803             this->context_menu_ptr->draw();
804             this->__draw();
805 
806             this->render_window_ptr->display();
807 
808 
809             //  6.4. increment frame
810             this->frame++;
811         }
812 
813         // check track status, move to next if stopped
814         if (this->assets_manager_ptr->getTrackStatus() == sf::SoundSource::Stopped) {
815             this->assets_manager_ptr->nextTrack();
816             this->assets_manager_ptr->playTrack();
817         }
818 
819     }
820 
821     return this->quit_game;
822 }   /* 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:

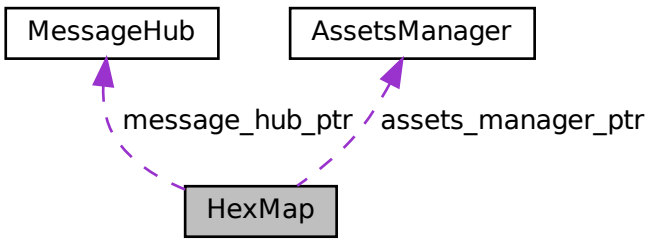
- header/Game.h
- source/Game.cpp

## 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**

| | |
|---|---|
| *n_layers* | The number of layers in the HexMap. |
| *event_ptr* | Pointer to the event class. |
| *render_window_ptr* | Pointer to the render window. |
| *assets_manager_ptr* | Pointer to the assets manager. |
| *message_hub_ptr* | 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**

| | |
|---|---|
| *Pointer* | 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 
319             else {
320                 list_iter++;
321             }
322         }
323     }
324 
325     return;
326 }   /* __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**

| | |
|---|---|
| *hex_ptr* | 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**

| | |
|---|---|
| *hex_ptr* | 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**

| | |
|---|---|
| *n_elements* | The number of elements in the generated noise vector. |
| *n_components* | 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**

| | |
|---|---|
| *potential_x* | The potential x position of the tile. |
| *potential_y* | 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 
147     //  3. fill out subsequent rows (reflect across first row)
148     HexTile* first_row_left_tile = hex_ptr;
149 
150     int offset_count = 1;
151 
152     double x_offset = 0;
153     double y_offset = 0;
154 
155     for (
156         int row_width = 2 * this->n_layers;
157         row_width > this->n_layers;
158         row_width--
159     ) {
160         //  3.1. upper row
161         x_offset = first_row_left_tile->position_x +
162             2 * offset_count * first_row_left_tile->minor_radius *
163             cos(60 * (M_PI / 180));
164 
165         y_offset = first_row_left_tile->position_y -
166             2 * offset_count * first_row_left_tile->minor_radius *
167             sin(60 * (M_PI / 180));
168 
169         hex_ptr = new HexTile(
170             x_offset,
171             y_offset,
172             this->event_ptr,
173             this->render_window_ptr,
174             this->assets_manager_ptr,
175             this->message_hub_ptr
176         );
177 
178         this->hex_map[hex_ptr->position_x][hex_ptr->position_y] = hex_ptr;
179         this->tile_position_x_vec.push_back(hex_ptr->position_x);
180         this->tile_position_y_vec.push_back(hex_ptr->position_y);
181         this->n_tiles++;
182 
183         this->border_tiles_vec.push_back(hex_ptr);
184 
185         for (int i = 1; i < row_width; i++) {
186             x_offset += 2 * first_row_left_tile->minor_radius;
187 
188             hex_ptr = new HexTile(
189                 x_offset,
190                 y_offset,
191                 this->event_ptr,
192                 this->render_window_ptr,
193                 this->assets_manager_ptr,
194                 this->message_hub_ptr
195             );
196 
197             this->hex_map[hex_ptr->position_x][hex_ptr->position_y] = hex_ptr;
198             this->tile_position_x_vec.push_back(hex_ptr->position_x);
199             this->tile_position_y_vec.push_back(hex_ptr->position_y);
200             this->n_tiles++;
201 
202             if (row_width == this->n_layers + 1 or i == row_width - 1) {
203                 this->border_tiles_vec.push_back(hex_ptr);
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(MONOCHROME_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:

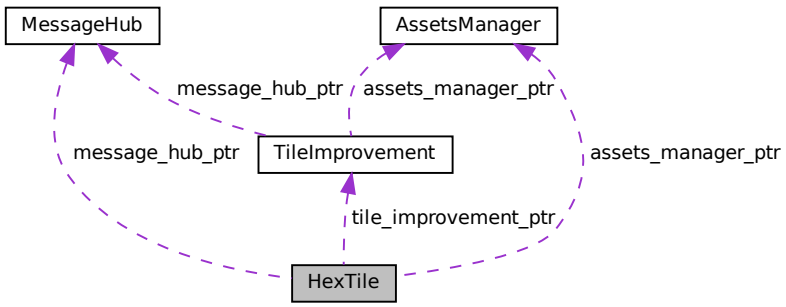
- header/HexMap.h
- source/HexMap.cpp

## 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.*
- 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 postion 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 __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).*
- 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**

| | |
|---|---|
| *position_x* | The x position of the tile. |
| *position_y* | The y position of the tile. |
| *event_ptr* | Pointer to the event class. |
| *render_window_ptr* | Pointer to the render window. |
| *assets_manager_ptr* | Pointer to the assets manager. |
| *message_hub_ptr* | Pointer to the message hub. |

```
2227 {
2228     //  1. set attributes
2229
2230     //  1.1. private
2231     this->event_ptr = event_ptr;
2232     this->render_window_ptr = render_window_ptr;
2233
2234     this->assets_manager_ptr = assets_manager_ptr;
2235     this->message_hub_ptr = message_hub_ptr;
2236
2237     //  1.2. public
2238     this->show_node = false;
2239     this->show_resource = false;
2240     this->resource_assessed = false;
2241     this->resource_assessment = false;
2242     this->is_selected = false;
2243     this->draw_explosion = false;
2244
2245     this->decoration_cleared = false;
2246     this->has_improvement = false;
2247     this->tile_improvement_ptr = NULL;
2248
2249     this->build_menu_open = false;
2250
2251     this->explosion_frame = 0;
2252
2253     this->frame = 0;
2254     this->credits = 0;
2255
2256     this->position_x = position_x;
2257     this->position_y = position_y;
2258
2259     this->major_radius = 32;
2260     this->minor_radius = (sqrt(3) / 2) * this->major_radius;
2261
2262     this->game_phase = "build settlement";
2263
2264     //  2. set up and position drawable attributes
2265     this->__setUpNodeSprite();
2266     this->__setUpTileSprite();
2267     this->__setUpSelectOutlineSprite();
2268     this->__setUpResourceChipSprite();
2269     this->__setResourceText();
2270     this->__setUpMagnifyingGlassSprite();
2271     this->__setUpTileExplosionReel();
2272
2273     //  3. set tile type and resource (default to none type and average)
2274     this->setTileType(TileType :: NONE_TYPE);
2275     this->setTileResource(TileResource :: AVERAGE);
2276
2277     std::cout « "HexTile constructed at " « this « std::endl;
2278
2279     return;
2280 }   /* HexTile() */
```

#### 4.7.2.2 ~HexTile()

```
HexTile::~HexTile (
            void  )
```

Destructor for the HexTile class.

```
2812 {
2813     if (this->tile_improvement_ptr != NULL) {
```

```
2814         delete this->tile_improvement_ptr;
2815     }
2816
2817     std::cout « "HexTile at " « this « " destroyed" « std::endl;
2818
2819     return;
2820 }   /* ~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.

```
1373 {
1374     int build_cost = DIESEL_GENERATOR_BUILD_COST;
1375
1376     if (this->credits < build_cost) {
1377         std::cout « "Cannot build diesel generator: insufficient credits (need "
1378             « build_cost « " K)" « std::endl;
1379
1380         this->__sendInsufficientCreditsMessage();
1381         return;
1382     }
1383
1384     this->tile_improvement_ptr = new DieselGenerator(
1385         this->position_x,
1386         this->position_y,
1387         this->event_ptr,
1388         this->render_window_ptr,
1389         this->assets_manager_ptr,
1390         this->message_hub_ptr
1391     );
1392
1393     this->has_improvement = true;
1394     this->__closeBuildMenu();
1395
1396     this->__sendCreditsSpentMessage(build_cost);
1397     this->__sendTileStateMessage();
1398     this->__sendGameStateRequest();
1399
1400     return;
1401 }   /* __buildDieselGenerator() */
```

#### 4.7.3.2 __buildEnergyStorage()

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

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

```
1616 {
1617     int build_cost = ENERGY_STORAGE_SYSTEM_BUILD_COST;
1618
1619     if (this->credits < build_cost) {
1620         std::cout « "Cannot build energy storage system: insufficient credits (need "
1621             « build_cost « " K)" « std::endl;
1622
1623         this->__sendInsufficientCreditsMessage();
1624         return;
1625     }
1626
1627     this->tile_improvement_ptr = new EnergyStorageSystem(
1628         this->position_x,
```

```
1629         this->position_y,
1630         this->event_ptr,
1631         this->render_window_ptr,
1632         this->assets_manager_ptr,
1633         this->message_hub_ptr
1634     );
1635 
1636     this->has_improvement = true;
1637     this->__closeBuildMenu();
1638 
1639     this->__sendCreditsSpentMessage(build_cost);
1640     this->__sendTileStateMessage();
1641     this->__sendGameStateRequest();
1642 
1643     return;
1644 }   /* __buildEnergyStorage() */
```

#### 4.7.3.3 __buildSettlement()

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

Helper method to build a settlement on this tile.

```
1327 {
1328     if (this->credits < BUILD_SETTLEMENT_COST) {
1329         std::cout « "Cannot build settlement: insufficient credits (need "
1330             « BUILD_SETTLEMENT_COST « " K)" « std::endl;
1331 
1332         this->__sendInsufficientCreditsMessage();
1333         return;
1334     }
1335 
1336     this->__clearDecoration();
1337 
1338     this->tile_improvement_ptr = new Settlement(
1339         this->position_x,
1340         this->position_y,
1341         this->event_ptr,
1342         this->render_window_ptr,
1343         this->assets_manager_ptr,
1344         this->message_hub_ptr
1345     );
1346 
1347     this->has_improvement = true;
1348 
1349     this->assess();
1350     this->__sendAssessNeighboursMessage();
1351 
1352     this->__sendUpdateGamePhaseMessage("system management");
1353     this->__sendCreditsSpentMessage(BUILD_SETTLEMENT_COST);
1354     this->__sendTileStateMessage();
1355     this->__sendGameStateRequest();
1356 
1357     return;
1358 }   /* __buildSettlement() */
```

#### 4.7.3.4 __buildSolarPV()

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

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

```
1416 {
1417     int build_cost = SOLAR_PV_BUILD_COST;
1418 
1419     if (this->tile_type == TileType :: LAKE) {
1420         build_cost *= SOLAR_PV_WATER_BUILD_MULTIPLIER;
1421     }
1422 
```

```
1423     if (this->credits < build_cost) {
1424         std::cout « "Cannot build solar PV array: insufficient credits (need "
1425             « build_cost « " K)" « std::endl;
1426 
1427         this->__sendInsufficientCreditsMessage();
1428         return;
1429     }
1430 
1431     this->tile_improvement_ptr = new SolarPV(
1432         this->position_x,
1433         this->position_y,
1434         this->event_ptr,
1435         this->render_window_ptr,
1436         this->assets_manager_ptr,
1437         this->message_hub_ptr
1438     );
1439 
1440     this->has_improvement = true;
1441     this->__closeBuildMenu();
1442 
1443     if (this->tile_type == TileType :: LAKE) {
1444         this->decoration_cleared = true;
1445         this->assets_manager_ptr->getSound("splash")->play();
1446     }
1447 
1448     this->__sendCreditsSpentMessage(build_cost);
1449     this->__sendTileStateMessage();
1450     this->__sendGameStateRequest();
1451 
1452     return;
1453 }   /* __buildSolarPV() */
```

#### 4.7.3.5 __buildTidalTurbine()

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

Helper method to build a tidal turbine on this tile.

```
1526 {
1527     int build_cost = TIDAL_TURBINE_BUILD_COST;
1528 
1529     if (this->credits < build_cost) {
1530         std::cout « "Cannot build tidal turbine: insufficient credits (need "
1531             « build_cost « " K)" « std::endl;
1532 
1533         this->__sendInsufficientCreditsMessage();
1534         return;
1535     }
1536 
1537     this->tile_improvement_ptr = new TidalTurbine(
1538         this->position_x,
1539         this->position_y,
1540         this->event_ptr,
1541         this->render_window_ptr,
1542         this->assets_manager_ptr,
1543         this->message_hub_ptr
1544     );
1545 
1546     this->has_improvement = true;
1547     this->decoration_cleared = true;
1548     this->assets_manager_ptr->getSound("splash")->play();
1549     this->__closeBuildMenu();
1550 
1551     this->__sendCreditsSpentMessage(build_cost);
1552     this->__sendTileStateMessage();
1553     this->__sendGameStateRequest();
1554 
1555     return;
1556 }   /* __buildTidalTurbine() */
```

#### 4.7.3.6 __buildWaveEnergyConverter()

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

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

```
1571 {
1572     int build_cost = WAVE_ENERGY_CONVERTER_BUILD_COST;
1573
1574     if (this->credits < build_cost) {
1575         std::cout « "Cannot build wave energy converter: insufficient credits (need "
1576             « build_cost « " K)" « std::endl;
1577
1578         this->__sendInsufficientCreditsMessage();
1579         return;
1580     }
1581
1582     this->tile_improvement_ptr = new WaveEnergyConverter(
1583         this->position_x,
1584         this->position_y,
1585         this->event_ptr,
1586         this->render_window_ptr,
1587         this->assets_manager_ptr,
1588         this->message_hub_ptr
1589     );
1590
1591     this->has_improvement = true;
1592     this->decoration_cleared = true;
1593     this->assets_manager_ptr->getSound("splash")->play();
1594     this->__closeBuildMenu();
1595
1596     this->__sendCreditsSpentMessage(build_cost);
1597     this->__sendTileStateMessage();
1598     this->__sendGameStateRequest();
1599
1600     return;
1601 }   /* __buildWaveEnergyConverter() */
```

#### 4.7.3.7 __buildWindTurbine()

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

Helper method to build a wind turbine on this tile.

```
1468 {
1469     int build_cost = WIND_TURBINE_BUILD_COST;
1470
1471     if (
1472         (this->tile_type == TileType :: LAKE) or
1473         (this->tile_type == TileType :: OCEAN)
1474     ) {
1475         build_cost *= WIND_TURBINE_WATER_BUILD_MULTIPLIER;
1476     }
1477
1478     if (this->credits < build_cost) {
1479         std::cout « "Cannot build wind turbine: insufficient credits (need "
1480             « build_cost « " K)" « std::endl;
1481
1482         this->__sendInsufficientCreditsMessage();
1483         return;
1484     }
1485
1486     this->tile_improvement_ptr = new WindTurbine(
1487         this->position_x,
1488         this->position_y,
1489         this->event_ptr,
1490         this->render_window_ptr,
1491         this->assets_manager_ptr,
1492         this->message_hub_ptr
1493     );
1494
1495     this->has_improvement = true;
1496     this->__closeBuildMenu();
1497
1498     if (
```

```
1499         (this->tile_type == TileType :: LAKE) or
1500         (this->tile_type == TileType :: OCEAN)
1501     ) {
1502         this->decoration_cleared = true;
1503         this->assets_manager_ptr->getSound("splash")->play();
1504     }
1505
1506     this->__sendCreditsSpentMessage(build_cost);
1507     this->__sendTileStateMessage();
1508     this->__sendGameStateRequest();
1509
1510     return;
1511 }   /* __buildWindTurbine() */
```

#### 4.7.3.8 __clearDecoration()

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

Helper method to clear tile decoration.

```
807 {
808     this->decoration_cleared = true;
809     this->draw_explosion = true;
810
811     switch (this->tile_type) {
812         case (TileType :: FOREST): {
813             this->assets_manager_ptr->getSound("clear non-mountains tile")->play();
814
815             break;
816         }
817
818
819         case (TileType :: MOUNTAINS): {
820             this->assets_manager_ptr->getSound("clear mountains tile")->play();
821
822             break;
823         }
824
825
826         case (TileType :: PLAINS): {
827             this->assets_manager_ptr->getSound("clear non-mountains tile")->play();
828
829             break;
830         }
831
832
833         default: {
834             // do nothing!
835
836             break;
837         }
838     }
839
840     return;
841 }   /* __clearDecoration() */
```

#### 4.7.3.9 __closeBuildMenu()

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

Helper method to close the tile improvement build menu.

```
1302 {
1303     if (not this->build_menu_open) {
1304         return;
1305     }
1306
1307     this->build_menu_open = false;
1308     this->assets_manager_ptr->getSound("build menu close")->play();
1309
1310     return;
1311 }   /* __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.

```
1721 {
1722     std::string coords_substring = "TILE COORDS:  (";
1723     coords_substring += std::to_string(int(this->position_x - 400));
1724     coords_substring += ", ";
1725     coords_substring += std::to_string(int(this->position_y - 400));
1726     coords_substring += ")\n";
1727 
1728     return coords_substring;
1729 }   /* __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.

```
1880 {
1881     std::string improvement_substring = "TILE IMPROVEMENT:  ";
1882 
1883     if (this->has_improvement) {
1884         improvement_substring += this->tile_improvement_ptr->tile_improvement_string;
1885         improvement_substring += "\n";
1886     }
1887 
1888     else {
1889         improvement_substring += "NONE\n";
1890     }
1891 
1892     return improvement_substring;
1893 }   /* __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.

```
1910 {
1911     //                  32 char x 17 line console "--------------------------------\n";
1912     std::string options_substring                = "     **** TILE OPTIONS ****     \n";
1913     options_substring                           += "                                \n";
1914 
1915     if (this->game_phase == "build settlement") {
1916         if (
1917             (this->tile_type != TileType :: OCEAN) and
1918             (this->tile_type != TileType :: LAKE)
1919         ) {
1920             options_substring += "[B]:  BUILD SETTLEMENT (";
1921             options_substring += std::to_string(BUILD_SETTLEMENT_COST);
1922             options_substring += " K)\n";
1923         }
1924     }
1925 
1926 
1927     else if (this->game_phase == "system management") {
1928         if (this->has_improvement) {
1929             options_substring.clear();
1930             options_substring = this->tile_improvement_ptr->getTileOptionsSubstring();
1931         }
1932 
1933 
1934         else if (not this->resource_assessed) {
1935             options_substring += "[A]:  ASSESS RESOURCE (";
1936             options_substring += std::to_string(RESOURCE_ASSESSMENT_COST);
1937             options_substring += " K)\n";
1938         }
1939 
1940 
1941         else if (
1942             (not this->decoration_cleared) and
1943             (this->tile_type != TileType :: OCEAN) and
1944             (this->tile_type != TileType :: LAKE)
1945         ) {
1946             options_substring += "[C]:  CLEAR TILE (";
1947 
1948             switch (this->tile_type) {
1949                 case (TileType :: FOREST): {
1950                     options_substring += std::to_string(CLEAR_FOREST_COST);
1951 
1952                     break;
1953                 }
1954 
1955 
1956                 case (TileType :: MOUNTAINS): {
1957                     options_substring += std::to_string(CLEAR_MOUNTAINS_COST);
1958 
1959                     break;
1960                 }
1961 
1962 
1963                 case (TileType :: PLAINS): {
1964                     options_substring += std::to_string(CLEAR_PLAINS_COST);
1965 
1966                     break;
1967                 }
1968 
1969 
1970                 default: {
1971                     //do nothing!
1972 
1973                     break;
1974                 }
1975             }
1976 
1977             options_substring += " K)\n";
1978         }
1979 
1980 
1981         else if (
1982             (this->decoration_cleared) or
1983             (this->tile_type == TileType :: OCEAN) or
1984             (this->tile_type == TileType :: LAKE)
1985         ) {
1986             options_substring += "[B]: OPEN BUILD MENU\n";
1987         }
1988     }
1989 
1990 
1991     else if (this->game_phase == "victory") {
1992         options_substring                       += "       **** VICTORY ****        \n";
1993     }
```

```
1994
1995
1996     else {
1997         options_substring                          += "        **** LOSS ****          \n";
1998     }
1999
2000     return options_substring;
2001 }   /* __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.

```
1810 {
1811     std::string resource_substring = "TILE RESOURCE:     ";
1812
1813     if (this->resource_assessed) {
1814         switch (this->tile_resource) {
1815             case (TileResource :: POOR): {
1816                 resource_substring += "POOR\n";
1817
1818                 break;
1819             }
1820
1821
1822             case (TileResource ::BELOW_AVERAGE): {
1823                 resource_substring += "BELOW AVERAGE\n";
1824
1825                 break;
1826             }
1827
1828
1829             case (TileResource :: AVERAGE): {
1830                 resource_substring += "AVERAGE\n";
1831
1832                 break;
1833             }
1834
1835
1836             case (TileResource :: ABOVE_AVERAGE): {
1837                 resource_substring += "ABOVE AVERAGE\n";
1838
1839                 break;
1840             }
1841
1842
1843             case (TileResource :: GOOD): {
1844                 resource_substring += "GOOD\n";
1845
1846                 break;
1847             }
1848
1849
1850             default: {
1851                 resource_substring += "???\n";
1852
1853                 break;
1854             }
1855         }
1856     }
1857
1858     else {
1859         resource_substring += "???\n";
1860     }
1861
1862     return resource_substring;
1863 }   /* __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.

```
1746 {
1747     std::string type_substring = "TILE TYPE:         ";
1748
1749     switch (this->tile_type) {
1750         case (TileType :: FOREST): {
1751             type_substring += "FOREST\n";
1752
1753             break;
1754         }
1755
1756
1757         case (TileType :: LAKE): {
1758             type_substring += "LAKE\n";
1759
1760             break;
1761         }
1762
1763
1764         case (TileType :: MOUNTAINS): {
1765             type_substring += "MOUNTAINS\n";
1766
1767             break;
1768         }
1769
1770
1771         case (TileType :: OCEAN): {
1772             type_substring += "OCEAN\n";
1773
1774             break;
1775         }
1776
1777
1778         case (TileType :: PLAINS): {
1779             type_substring += "PLAINS\n";
1780
1781             break;
1782         }
1783
1784
1785         default: {
1786             type_substring += "???\n";
1787
1788             break;
1789         }
1790     }
1791
1792     return type_substring;
1793 }   /* __getTileTypeSubstring() */
```

#### 4.7.3.15 __handleKeyPressEvents()

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

Helper method to handle key press events.

```
890 {
891     if (not this->is_selected) {
892         return;
893     }
894
895
896     if (this->event_ptr->key.code == sf::Keyboard::Escape) {
```

```
897         this->__setIsSelected(false);
898     }
899 
900 
901     if (this->build_menu_open) {
902         switch (this->tile_type) {
903             case (TileType :: FOREST): {
904                 switch (this->event_ptr->key.code) {
905                     case (sf::Keyboard::D): {
906                         this->__buildDieselGenerator();
907 
908                         break;
909                     }
910 
911 
912                     case (sf::Keyboard::S): {
913                         this->__buildSolarPV();
914 
915                         break;
916                     }
917 
918 
919                     case (sf::Keyboard::W): {
920                         this->__buildWindTurbine();
921 
922                         break;
923                     }
924 
925 
926                     case (sf::Keyboard::E): {
927                         this->__buildEnergyStorage();
928 
929                         break;
930                     }
931 
932 
933                     default: {
934                         // do nothing!
935 
936                         break;
937                     }
938                 }
939 
940                 break;
941             }
942 
943 
944             case (TileType :: LAKE): {
945                 switch (this->event_ptr->key.code) {
946                     case (sf::Keyboard::S): {
947                         this->__buildSolarPV();
948 
949                         break;
950                     }
951 
952 
953                     case (sf::Keyboard::W): {
954                         this->__buildWindTurbine();
955 
956                         break;
957                     }
958 
959 
960                     default: {
961                         // do nothing!
962 
963                         break;
964                     }
965                 }
966 
967                 break;
968             }
969 
970 
971             case (TileType :: MOUNTAINS): {
972                 switch (this->event_ptr->key.code) {
973                     case (sf::Keyboard::D): {
974                         this->__buildDieselGenerator();
975 
976                         break;
977                     }
978 
979 
980                     case (sf::Keyboard::S): {
981                         this->__buildSolarPV();
982 
983                         break;
```

```
984                     }
985
986
987                     case (sf::Keyboard::W): {
988                         this->__buildWindTurbine();
989
990                         break;
991                     }
992
993
994                     case (sf::Keyboard::E): {
995                         this->__buildEnergyStorage();
996
997                         break;
998                     }
999
1000
1001                    default: {
1002                        // do nothing!
1003
1004                        break;
1005                    }
1006                }
1007
1008                break;
1009            }
1010
1011
1012            case (TileType :: OCEAN): {
1013                switch (this->event_ptr->key.code) {
1014                    case (sf::Keyboard::W): {
1015                        this->__buildWindTurbine();
1016
1017                        break;
1018                    }
1019
1020
1021                    case (sf::Keyboard::T): {
1022                        this->__buildTidalTurbine();
1023
1024                        break;
1025                    }
1026
1027
1028                    case (sf::Keyboard::A): {
1029                        this->__buildWaveEnergyConverter();
1030
1031                        break;
1032                    }
1033
1034
1035                    default: {
1036                        // do nothing!
1037
1038                        break;
1039                    }
1040                }
1041
1042                break;
1043            }
1044
1045
1046            case (TileType :: PLAINS): {
1047                switch (this->event_ptr->key.code) {
1048                    case (sf::Keyboard::D): {
1049                        this->__buildDieselGenerator();
1050
1051                        break;
1052                    }
1053
1054
1055                    case (sf::Keyboard::S): {
1056                        this->__buildSolarPV();
1057
1058                        break;
1059                    }
1060
1061
1062                    case (sf::Keyboard::W): {
1063                        this->__buildWindTurbine();
1064
1065                        break;
1066                    }
1067
1068
1069                    case (sf::Keyboard::E): {
1070                        this->__buildEnergyStorage();
```

```
1071
1072                        break;
1073                    }
1074
1075
1076                    default: {
1077                        // do nothing!
1078
1079                        break;
1080                    }
1081                }
1082
1083                break;
1084            }
1085
1086
1087            default: {
1088                //do nothing!
1089
1090                break;
1091            }
1092        }
1093    }
1094
1095
1096    if (this->game_phase == "build settlement") {
1097        if (
1098            (this->tile_type != TileType :: OCEAN) and
1099            (this->tile_type != TileType :: LAKE)
1100        ) {
1101            if (this->event_ptr->key.code == sf::Keyboard::B) {
1102                this->__buildSettlement();
1103            }
1104        }
1105    }
1106
1107
1108    else if (this->game_phase == "system management") {
1109        if (this->has_improvement) {
1110            if (
1111                this->tile_improvement_ptr->tile_improvement_type != TileImprovementType :: SETTLEMENT
    and
1112                not this->tile_improvement_ptr->production_menu_open
1113            ) {
1114                if (this->event_ptr->key.code == sf::Keyboard::P) {
1115                    this->__scrapImprovement();
1116                }
1117            }
1118
1119            /*
1120             * All other inputs will be caught and handled by
1121             *   this->tile_improvement_ptr->processEvent()
1122             */
1123        }
1124
1125
1126        else if (not this->resource_assessed) {
1127            if (this->event_ptr->key.code == sf::Keyboard::A) {
1128                if (this->credits < RESOURCE_ASSESSMENT_COST) {
1129                    std::cout « "Cannot assess resource: insufficient credits (need "
1130                        « RESOURCE_ASSESSMENT_COST « " K)" « std::endl;
1131
1132                    this->__sendInsufficientCreditsMessage();
1133                }
1134
1135                else {
1136                    this->assess();
1137                    this->__sendCreditsSpentMessage(RESOURCE_ASSESSMENT_COST);
1138                    this->__sendTileStateMessage();
1139                    this->__sendGameStateRequest();
1140                }
1141            }
1142        }
1143
1144
1145        else if (
1146            (not this->decoration_cleared) and
1147            (this->tile_type != TileType :: OCEAN) and
1148            (this->tile_type != TileType :: LAKE)
1149        ) {
1150            if (this->event_ptr->key.code == sf::Keyboard::C) {
1151                int clear_cost = 0;
1152
1153                switch (this->tile_type) {
1154                    case (TileType :: FOREST): {
1155                        clear_cost = CLEAR_FOREST_COST;
1156
```

```
1157                         break;
1158                     }
1159 
1160 
1161                     case (TileType :: MOUNTAINS): {
1162                         clear_cost = CLEAR_MOUNTAINS_COST;
1163 
1164                         break;
1165                     }
1166 
1167 
1168                     case (TileType :: PLAINS): {
1169                         clear_cost = CLEAR_PLAINS_COST;
1170 
1171                         break;
1172                     }
1173 
1174 
1175                     default: {
1176                         // do nothing!
1177 
1178                         break;
1179                     }
1180                 }
1181 
1182                 if (this->credits < clear_cost) {
1183                     std::cout << "Cannot clear tile: insufficient credits (need "
1184                         << clear_cost << " K)" << std::endl;
1185 
1186                     this->__sendInsufficientCreditsMessage();
1187                 }
1188 
1189                 else {
1190                     this->__clearDecoration();
1191                     this->__sendCreditsSpentMessage(clear_cost);
1192                     this->__sendTileStateMessage();
1193                     this->__sendGameStateRequest();
1194                 }
1195             }
1196         }
1197 
1198 
1199         else if (
1200             (this->decoration_cleared) or
1201             (this->tile_type == TileType :: OCEAN) or
1202             (this->tile_type == TileType :: LAKE)
1203         ) {
1204             if (this->event_ptr->key.code == sf::Keyboard::B) {
1205                 this->__openBuildMenu();
1206             }
1207         }
1208     }
1209 
1210     return;
1211 }   /* __handleKeyPressEvents() */
```

#### 4.7.3.16 __handleMouseButtonEvents()

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

Helper method to handle mouse button events.

```
1226 {
1227     switch (this->event_ptr->mouseButton.button) {
1228         case (sf::Mouse::Left): {
1229             if (this->__isClicked()) {
1230                 std::cout << "Tile (" << this->position_x << ", " <<
1231                     this->position_y << ") was selected" << std::endl;
1232 
1233                 this->__setIsSelected(true);
1234 
1235                 this->__sendTileSelectedMessage();
1236                 this->__sendTileStateMessage();
1237                 this->__sendGameStateRequest();
1238             }
1239 
1240             else {
1241                 this->__setIsSelected(false);
```

```
1242             }
1243
1244             break;
1245         }
1246
1247
1248         case (sf::Mouse::Right): {
1249             this->__setIsSelected(false);
1250
1251             break;
1252         }
1253
1254
1255         default: {
1256             // do nothing!
1257
1258             break;
1259         }
1260     }
1261
1262     return;
1263 }   /* __handleMouseButtonEvents() */
```

#### 4.7.3.17 __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.

```
858 {
859     sf::Vector2i mouse_position = sf::Mouse::getPosition(*render_window_ptr);
860
861     double mouse_x = mouse_position.x;
862     double mouse_y = mouse_position.y;
863
864     double distance = sqrt(
865         pow(this->position_x - mouse_x, 2) +
866         pow(this->position_y - mouse_y, 2)
867     );
868
869     if (distance < this->minor_radius) {
870         return true;
871     }
872     else {
873         return false;
874     }
875 }   /* __isClicked() */
```

#### 4.7.3.18 __openBuildMenu()

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

Helper method to open the tile improvement build menu.

```
1278 {
1279     if (this->build_menu_open) {
1280         return;
1281     }
1282
1283     this->build_menu_open = true;
1284     this->assets_manager_ptr->getSound("build menu open")->play();
1285
1286     return;
1287 }   /* __openBuildMenu() */
```

#### 4.7.3.19 __scrapImprovement()

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

Helper method to scrap the tile improvement (Settlement cannot be scrapped).

```
1659 {
1660     this->draw_explosion = true;
1661     this->assets_manager_ptr->getSound("clear non-mountains tile")->play();
1662 
1663     delete this->tile_improvement_ptr;
1664     this->tile_improvement_ptr = NULL;
1665 
1666     this->has_improvement = false;
1667 
1668     if (
1669         (this->tile_type == TileType :: LAKE) or
1670         (this->tile_type == TileType :: OCEAN)
1671     ) {
1672         this->decoration_cleared = false;
1673     }
1674 
1675     this->__sendCreditsSpentMessage(SCRAP_COST);
1676     this->__sendTileStateMessage();
1677     this->__sendGameStateRequest();
1678 
1679     return;
1680 }   /* __scrapImprovement() */
```

#### 4.7.3.20 __sendAssessNeighboursMessage()

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

Helper method to format and send assess neighbours message.

```
2058 {
2059     Message assess_neighbours_message;
2060 
2061     assess_neighbours_message.channel = HEX_MAP_CHANNEL;
2062     assess_neighbours_message.subject = "assess neighbours";
2063 
2064     this->message_hub_ptr->sendMessage(assess_neighbours_message);
2065 
2066     std::cout « "Assess neighbours message sent by " « this « std::endl;
2067 
2068     return;
2069 }   /* __sendAssessNeighboursMessage() */
```

#### 4.7.3.21 __sendCreditsSpentMessage()

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

Helper method to format and send a credits spent message.

**Parameters**

| | |
|---|---|
| *credits_spent* | The number of credits that were spent. |

```
2141 {
2142     Message credits_spent_message;
```

```
2143
2144     credits_spent_message.channel = GAME_CHANNEL;
2145     credits_spent_message.subject = "credits spent";
2146
2147     credits_spent_message.int_payload["credits spent"] = credits_spent;
2148
2149     this->message_hub_ptr->sendMessage(credits_spent_message);
2150
2151     std::cout << "Credits spent (" << credits_spent << ") message sent by " << this
2152         << std::endl;
2153     return;
2154 }   /* __sendCreditsSpentMessage() */
```

#### 4.7.3.22 __sendGameStateRequest()

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

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

```
2084 {
2085     Message game_state_request;
2086
2087     game_state_request.channel = GAME_CHANNEL;
2088     game_state_request.subject = "state request";
2089
2090     this->message_hub_ptr->sendMessage(game_state_request);
2091
2092     std::cout << "Game state request message sent by " << this << std::endl;
2093     return;
2094 }   /* __sendGameStateRequest() */
```

#### 4.7.3.23 __sendInsufficientCreditsMessage()

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

Helper method to format and send an insufficient credits message.

```
2169 {
2170     Message insufficient_credits_message;
2171
2172     insufficient_credits_message.channel = GAME_CHANNEL;
2173     insufficient_credits_message.subject = "insufficient credits";
2174
2175     this->message_hub_ptr->sendMessage(insufficient_credits_message);
2176
2177     std::cout << "Insufficient credits message sent by " << this << std::endl;
2178
2179     return;
2180 }   /* __sendInsufficientCreditsMessage() */
```

#### 4.7.3.24 __sendTileSelectedMessage()

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

Helper method to format and send message on tile selection.

```
1695 {
1696     Message tile_selected_message;
1697
1698     tile_selected_message.channel = TILE_SELECTED_CHANNEL;
1699     tile_selected_message.subject = "tile selected";
1700
1701     this->message_hub_ptr->sendMessage(tile_selected_message);
1702
1703     return;
1704 }   /* __sendTileSelectedMessage() */
```

#### 4.7.3.25 __sendTileStateMessage()

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

Helper method to format and send tile state message.

```
2016 {
2017     Message tile_state_message;
2018 
2019     tile_state_message.channel = TILE_STATE_CHANNEL;
2020     tile_state_message.subject = "tile state";
2021 
2022 
2023     //                  32 char x 17 line console "--------------------------------\n";
2024     std::string console_string                   = "      **** TILE INFO ****       \n";
2025     console_string                              += "                                \n";
2026 
2027     console_string                              += this->__getTileCoordsSubstring();
2028     console_string                              += "                                \n";
2029 
2030     console_string                              += this->__getTileTypeSubstring();
2031     console_string                              += this->__getTileResourceSubstring();
2032     console_string                              += this->__getTileImprovementSubstring();
2033     console_string                              += "                                \n";
2034 
2035     console_string                              += this->__getTileOptionsSubstring();
2036 
2037     tile_state_message.string_payload["console string"] = console_string;
2038 
2039     this->message_hub_ptr->sendMessage(tile_state_message);
2040 
2041     std::cout « "Tile state message sent by " « this « std::endl;
2042     return;
2043 }   /* __sendTileStateMessage() */
```

#### 4.7.3.26 __sendUpdateGamePhaseMessage()

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

Helper method to format and send update game phase message.

**Parameters**

| | |
|---|---|
| *game_phase* | The updated game phase. |

```
2111 {
2112     Message update_game_phase_message;
2113 
2114     update_game_phase_message.channel = GAME_CHANNEL;
2115     update_game_phase_message.subject = "update game phase";
2116 
2117     update_game_phase_message.string_payload["game phase"] = game_phase;
2118 
2119     this->message_hub_ptr->sendMessage(update_game_phase_message);
2120 
2121     std::cout « "Update game phase message sent by " « this « std::endl;
2122 
2123     return;
2124 }   /* __sendUpdateGamePhaseMessage() */
```

#### 4.7.3.27 __setIsSelected()

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

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

**Parameters**

| | |
|---|---|
| *is_selected* | The value to set the is selected attribute to. |

```
763 {
764     this->is_selected = is_selected;
765 
766     if (this->tile_improvement_ptr != NULL) {
767         this->tile_improvement_ptr->setIsSelected(is_selected);
768 
769         if (is_selected) {
770             switch (this->tile_improvement_ptr->tile_improvement_type) {
771                 case (TileImprovementType :: SETTLEMENT): {
772                     this->assets_manager_ptr->getSound("people and children")->play();
773 
774                     break;
775                 }
776 
777 
778                 default: {
779                     // do nothing!
780 
781                     break;
782                 }
783             }
784         }
785     }
786 
787     if ((not is_selected) and this->build_menu_open) {
788         this->__closeBuildMenu();
789     }
790 
791     return;
792 }   /* __setIsSelected() */
```

#### 4.7.3.28 __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(MONOCHROME_TEXT_RED);
203 
204                 break;
205             }
206 
207             case (TileResource :: BELOW_AVERAGE): {
208                 this->resource_text.setString("-1");
209                 this->resource_text.setFillColor(MONOCHROME_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(MONOCHROME_TEXT_GREEN);
223 
224                 break;
```

```
225             }
226
227             case (TileResource :: GOOD): {
228                 this->resource_text.setString("+2");
229                 this->resource_text.setFillColor(MONOCHROME_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() */
```

#### 4.7.3.29 __setUpBuildMenu()

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

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

```
666 {
667     this->build_menu_options_vec.clear();
668     this->build_menu_options_text_vec.clear();
669
670     //  1. set up and place build menu backing and text
671     this->build_menu_backing.setSize(sf::Vector2f(600, 256));
672     this->build_menu_backing.setOrigin(300, 128);
673     this->build_menu_backing.setPosition(400, 400);
674     this->build_menu_backing.setFillColor(MONOCHROME_SCREEN_BACKGROUND);
675     this->build_menu_backing.setOutlineColor(MENU_FRAME_GREY);
676     this->build_menu_backing.setOutlineThickness(4);
677
678     this->build_menu_backing_text.setString("**** BUILD MENU ****");
679     this->build_menu_backing_text.setFont(
680         *(this->assets_manager_ptr->getFont("Glass_TTY_VT220"))
681     );
682     this->build_menu_backing_text.setCharacterSize(16);
683     this->build_menu_backing_text.setFillColor(MONOCHROME_TEXT_GREEN);
684     this->build_menu_backing_text.setOrigin(
685         this->build_menu_backing_text.getLocalBounds().width / 2, 0
686     );
687     this->build_menu_backing_text.setPosition(400, 400 - 128 + 4);
688
689     //  2. set up and place build menu option sprites and text
690     switch (this->tile_type) {
691         case (TileType :: FOREST): {
692             this->__setUpDieselGeneratorBuildOption();
693             this->__setUpSolarPVBuildOption();
694             this->__setUpWindTurbineBuildOption();
695             this->__setUpEnergyStorageSystemBuildOption();
696
697             break;
698         }
```

```
699
700
701         case (TileType :: LAKE): {
702             this->__setUpSolarPVBuildOption(true);
703             this->__setUpWindTurbineBuildOption(true);
704
705             break;
706         }
707
708
709         case (TileType :: MOUNTAINS): {
710             this->__setUpDieselGeneratorBuildOption();
711             this->__setUpSolarPVBuildOption();
712             this->__setUpWindTurbineBuildOption();
713             this->__setUpEnergyStorageSystemBuildOption();
714
715             break;
716         }
717
718
719         case (TileType :: OCEAN): {
720             this->__setUpWindTurbineBuildOption(false, true);
721             this->__setUpTidalTurbineBuildOption();
722             this->__setUpWaveEnergyConverterBuildOption();
723
724             break;
725         }
726
727
728         case (TileType :: PLAINS): {
729             this->__setUpDieselGeneratorBuildOption();
730             this->__setUpSolarPVBuildOption();
731             this->__setUpWindTurbineBuildOption();
732             this->__setUpEnergyStorageSystemBuildOption();
733
734             break;
735         }
736
737
738         default: {
739             // do nothing!
740
741             break;
742         }
743     }
744
745     return;
746 }   /* __setUpBuildMenu() */
```

#### 4.7.3.30 __setUpBuildOption()

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

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

**Parameters**

| | |
|---|---|
| *texture_key* | The key for the appropriate illustration asset for the build option. |
| *option_string* | 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() */
```

#### 4.7.3.31 __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\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() */
```

#### 4.7.3.32 __setUpEnergyStorageSystemBuildOption()

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

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

```
633 {
634     //  1. set up option sprite(s)
635     std::string texture_key = "energy storage system";
636 
637     //  2. set up option string (up to 16 chars wide)
638     //                                          "----------------\n"
639     std::string energy_storage_system_string    = " ENERGY STORAGE \n";
640     energy_storage_system_string               += "                \n";
641     energy_storage_system_string               += "CAPCTY:  500 kWh\n";
642     energy_storage_system_string               += "COST:      ";
643     energy_storage_system_string               += std::to_string(ENERGY_STORAGE_SYSTEM_BUILD_COST);
644     energy_storage_system_string               += " K\n\n\n";
645     energy_storage_system_string               += "BUILD:    [E]   \n";
646 
647     //  3. call general method
648     this->__setUpBuildOption(texture_key, energy_storage_system_string);
649 
650     return;
651 }   /* __setUpEnergyStorageSystemBuildOption() */
```

#### 4.7.3.33 __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() */
```

#### 4.7.3.34 __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() */
```

#### 4.7.3.35 __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() */
```

#### 4.7.3.36 __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() */
```

#### 4.7.3.37 __setUpSolarPVBuildOption()

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

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

**Parameters**

| | |
|---|---|
| *is_lake* | 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() */
```

#### 4.7.3.38 __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() */
```

#### 4.7.3.39 __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 
318             this->explosion_sprite_reel.back().setOrigin(
319                 this->explosion_sprite_reel.back().getLocalBounds().width / 2,
320                 this->explosion_sprite_reel.back().getLocalBounds().height / 2
321             );
322 
323             this->explosion_sprite_reel.back().setPosition(
324                 this->position_x,
325                 this->position_y
326             );
327         }
328     }
329 
330     return;
331 }   /* __setUpTileExplosionReel() */
```

#### 4.7.3.40 __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() */
```

#### 4.7.3.41 __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     //                                          "----------------\n"
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\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() */
```

#### 4.7.3.42 __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**

| | |
|---|---|
| *is_lake* | If being built on a lake tile. |
| *is_ocean* | 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     //                                  "----------------\n"
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() */
```

#### 4.7.3.43 assess()

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

Method to assess the tile's resource.

```
2601 {
2602     this->resource_assessed = true;
2603     this->resource_assessment = true;
2604 
2605     this->assets_manager_ptr->getSound("resource assessment")->play();
2606 
2607     this->__setResourceText();
2608     this->__sendTileStateMessage();
2609 
2610     return;
2611 }   /* assess() */
```

#### 4.7.3.44 decorateTile()

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

Method to decorate tile.

```
2479 {
2480     switch (this->tile_type) {
2481         case (TileType :: FOREST): {
2482             this->tile_decoration_sprite.setTexture(
2483                 *(this->assets_manager_ptr->getTexture("pine_tree_64x64_1"))
2484             );
2485 
2486             break;
2487         }
2488 
2489         case (TileType :: LAKE): {
2490             this->tile_decoration_sprite.setTexture(
2491                 *(this->assets_manager_ptr->getTexture("water_shimmer_64x64_1"))
2492             );
2493 
2494             break;
2495         }
2496 
2497         case (TileType :: MOUNTAINS): {
2498             this->tile_decoration_sprite.setTexture(
2499                 *(this->assets_manager_ptr->getTexture("mountain_64x64_1"))
2500             );
2501 
2502             break;
2503         }
2504 
2505         case (TileType :: OCEAN): {
2506             this->tile_decoration_sprite.setTexture(
2507                 *(this->assets_manager_ptr->getTexture("water_waves_64x64_1"))
2508             );
2509 
2510             break;
2511         }
2512 
2513         case (TileType :: PLAINS): {
2514             this->tile_decoration_sprite.setTexture(
2515                 *(this->assets_manager_ptr->getTexture("wheat_64x64_1"))
2516             );
2517 
2518             break;
2519         }
2520 
2521         default: {
2522             // do nothing!
2523 
2524             break;
2525         }
2526     }
2527 
2528 
2529     if (this->tile_type == TileType :: OCEAN or this->tile_type == TileType :: LAKE) {
2530         this->tile_decoration_sprite.setOrigin(
2531             this->tile_decoration_sprite.getLocalBounds().width / 2,
2532             this->tile_decoration_sprite.getLocalBounds().height / 2
2533         );
2534 
2535         this->tile_decoration_sprite.setPosition(
2536             this->position_x,
2537             this->position_y
2538         );
2539 
2540         if ((double)rand() / RAND_MAX > 0.5) {
2541             this->tile_decoration_sprite.setScale(sf::Vector2f(-1, 1));
2542         }
2543     }
2544 
2545     else {
2546         this->tile_decoration_sprite.setOrigin(
2547             this->tile_decoration_sprite.getLocalBounds().width / 2,
2548             this->tile_decoration_sprite.getLocalBounds().height
2549         );
2550 
2551         this->tile_decoration_sprite.setPosition(
2552             this->position_x,
2553             this->position_y + 12
2554         );
2555 
2556         if ((double)rand() / RAND_MAX > 0.5) {
```

```
2557             this->tile_decoration_sprite.setScale(sf::Vector2f(-1, 1));
2558         }
2559     }
2560
2561     return;
2562 }   /* decorateTile(void) */
```

#### 4.7.3.45 draw()

```
void HexTile::draw (
             void  )
```

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

```
2706 {
2707     //  1. draw hex
2708     this->render_window_ptr->draw(this->tile_sprite);
2709
2710     //  2. draw node
2711     if (this->show_node) {
2712         this->render_window_ptr->draw(this->node_sprite);
2713     }
2714
2715     //  3. draw tile decoration
2716     if (not this->decoration_cleared) {
2717         this->render_window_ptr->draw(this->tile_decoration_sprite);
2718     }
2719
2720     //  4. draw selection outline
2721     if (this->is_selected) {
2722         sf::Color outline_colour = this->select_outline_sprite.getOutlineColor();
2723
2724         outline_colour.a =
2725             255 * pow(cos((M_PI * this->frame) / FRAMES_PER_SECOND), 2);
2726
2727         this->select_outline_sprite.setOutlineColor(outline_colour);
2728
2729         this->render_window_ptr->draw(this->select_outline_sprite);
2730     }
2731
2732     //  5. draw tile improvement
2733     if (this->has_improvement) {
2734         if (not this->tile_improvement_ptr->just_built) {
2735             this->tile_improvement_ptr->draw();
2736         }
2737     }
2738
2739     //  6. draw resource
2740     if (this->show_resource) {
2741         this->render_window_ptr->draw(this->resource_chip_sprite);
2742         this->render_window_ptr->draw(this->resource_text);
2743     }
2744
2745     //  7. draw resource assessment notification
2746     if (this->resource_assessment) {
2747         int alpha = this->magnifying_glass_sprite.getColor().a;
2748
2749         alpha -= 0.05 * FRAMES_PER_SECOND;
2750         if (alpha < 0) {
2751             alpha = 0;
2752             this->resource_assessment = false;
2753         }
2754
2755         this->magnifying_glass_sprite.setColor(
2756             sf::Color(255, 255, 255, alpha)
2757         );
2758
2759         this->render_window_ptr->draw(this->magnifying_glass_sprite);
2760     }
2761
2762     //  8. draw explosion, then settlement placement
2763     if (this->draw_explosion) {
2764         this->render_window_ptr->draw(this->explosion_sprite_reel[this->explosion_frame]);
2765
2766         if (this->frame % (FRAMES_PER_SECOND / 20) == 0) {
2767             this->explosion_frame++;
2768         }
2769
2770         if (this->explosion_frame >= this->explosion_sprite_reel.size()) {
```

```
2771             this->draw_explosion = false;
2772             this->explosion_frame = 0;
2773         }
2774     }
2775
2776     else if (this->has_improvement) {
2777         if (this->tile_improvement_ptr->just_built) {
2778             this->tile_improvement_ptr->draw();
2779         }
2780     }
2781
2782     //  9. build menu
2783     if (this->build_menu_open) {
2784         this->render_window_ptr->draw(this->build_menu_backing);
2785         this->render_window_ptr->draw(this->build_menu_backing_text);
2786
2787         for (size_t i = 0; i < this->build_menu_options_vec.size(); i++) {
2788             for (size_t j = 0; j < this->build_menu_options_vec[i].size(); j++) {
2789                 this->render_window_ptr->draw(this->build_menu_options_vec[i][j]);
2790             }
2791             this->render_window_ptr->draw(this->build_menu_options_text_vec[i]);
2792         }
2793     }
2794
2795     this->frame++;
2796     return;
2797 }   /* draw() */
```

#### 4.7.3.46 processEvent()

```
void HexTile::processEvent (
              void  )
```

Method to process HexTile. To be called once per event.

```
2626 {
2627     //  1. process TileImprovement events
2628     if (this->tile_improvement_ptr != NULL) {
2629         this->tile_improvement_ptr->processEvent();
2630     }
2631
2632     //  2. process HexTile events
2633     if (this->event_ptr->type == sf::Event::KeyPressed) {
2634         this->__handleKeyPressEvents();
2635     }
2636
2637     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
2638         this->__handleMouseButtonEvents();
2639     }
2640
2641     return;
2642 }   /* processEvent() */
```

#### 4.7.3.47 processMessage()

```
void HexTile::processMessage (
              void  )
```

Method to process HexTile. To be called once per message.

```
2657 {
2658     //  1. process TileImprovement messages
2659     if (this->tile_improvement_ptr != NULL) {
2660         this->tile_improvement_ptr->processMessage();
2661     }
2662
2663     //  2. process HexTile messages
2664     if (this->is_selected) {
2665         if (not this->message_hub_ptr->isEmpty(GAME_STATE_CHANNEL)) {
2666             Message game_state_message = this->message_hub_ptr->receiveMessage(
2667                 GAME_STATE_CHANNEL
```

```
2668             );
2669
2670             if (game_state_message.subject == "game state") {
2671                 this->credits = game_state_message.int_payload["credits"];
2672                 this->game_phase = game_state_message.string_payload["game phase"];
2673
2674                 if (this->tile_improvement_ptr != NULL) {
2675                     this->tile_improvement_ptr->credits = this->credits;
2676                     this->tile_improvement_ptr->game_phase = this->game_phase;
2677                 }
2678
2679                 std::cout « "Game state message received by " « this « std::endl;
2680                 this->__sendTileStateMessage();
2681                 this->message_hub_ptr->popMessage(GAME_STATE_CHANNEL);
2682             }
2683         }
2684
2685         std::cout « "Current credits (HexTile): " « this->credits « " K" «
2686             std::endl;
2687     }
2688
2689     return;
2690 }   /* processMessage() */
```

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

```
void HexTile::setTileResource (
            double input_value )
```

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

**Parameters**

| | |
|---|---|
| *input_value* | A numerical input in the closed interval [0, 1]. |

```
2428 {
2429     //  1. check input
2430     if (input_value < 0 or input_value > 1) {
2431         std::string error_str = "ERROR  HexTile::setTileResource()  given input value is ";
2432         error_str += "not in the closed interval [0, 1]";
2433
2434         #ifdef _WIN32
2435             std::cout « error_str « std::endl;
2436         #endif  /* _WIN32 */
2437
2438         throw std::runtime_error(error_str);
2439     }
2440
2441     //  2. convert input value to tile resource
2442     TileResource tile_resource;
2443
2444     if (input_value <= TILE_RESOURCE_CUMULATIVE_PROBABILITIES[0]) {
2445         tile_resource = TileResource :: POOR;
2446     }
2447     else if (input_value <= TILE_RESOURCE_CUMULATIVE_PROBABILITIES[1]) {
2448         tile_resource = TileResource :: BELOW_AVERAGE;
2449     }
2450     else if (input_value <= TILE_RESOURCE_CUMULATIVE_PROBABILITIES[2]) {
2451         tile_resource = TileResource :: AVERAGE;
2452     }
2453     else if (input_value <= TILE_RESOURCE_CUMULATIVE_PROBABILITIES[3]) {
2454         tile_resource = TileResource :: ABOVE_AVERAGE;
2455     }
2456     else {
2457         tile_resource = TileResource :: GOOD;
2458     }
2459
2460     //  3. call alternate method
2461     this->setTileResource(tile_resource);
2462
2463     return;
2464 }   /* setTileResource(double) */
```

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

```
void HexTile::setTileResource (
            TileResource tile_resource )
```

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

**Parameters**

| | |
|---|---|
| *tile_resource* | The resource (TileResource) value to attribute to the tile. |

```
2406 {
2407     this->tile_resource = tile_resource;
2408     this->__setResourceText();
2409
2410     return;
2411 }   /* setTileResource(TileResource) */
```

#### 4.7.3.50 setTileType() [1/2]

```
void HexTile::setTileType (
            double input_value )
```

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

**Parameters**

| | |
|---|---|
| *input_value* | A numerical input in the closed interval [0, 1]. |

```
2356 {
2357     //  1. check input
2358     if (input_value < 0 or input_value > 1) {
2359         std::string error_str = "ERROR  HexTile::setTileType()  given input value is ";
2360         error_str += "not in the closed interval [0, 1]";
2361
2362         #ifdef _WIN32
2363             std::cout « error_str « std::endl;
2364         #endif  /* _WIN32 */
2365
2366         throw std::runtime_error(error_str);
2367     }
2368
2369     //  2. convert input value to tile type
2370     TileType tile_type;
2371
2372     if (input_value <= TILE_TYPE_CUMULATIVE_PROBABILITIES[0]) {
2373         tile_type = TileType :: LAKE;
2374     }
2375     else if (input_value <= TILE_TYPE_CUMULATIVE_PROBABILITIES[1]) {
2376         tile_type = TileType :: PLAINS;
2377     }
2378     else if (input_value <= TILE_TYPE_CUMULATIVE_PROBABILITIES[2]) {
2379         tile_type = TileType :: FOREST;
2380     }
2381     else {
2382         tile_type = TileType :: MOUNTAINS;
2383     }
2384
2385     //  3. call alternate method
2386     this->setTileType(tile_type);
2387
2388     return;
2389 }   /* setTileType(double) */
```

#### 4.7.3.51 setTileType() [2/2]

```
void HexTile::setTileType (
            TileType tile_type )
```

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

**Parameters**

| | |
|---|---|
| *tile_type* | The type (TileType) to set the tile to. |

```
2295 {
2296     this->tile_type = tile_type;
2297 
2298     switch (this->tile_type) {
2299         case (TileType :: FOREST): {
2300             this->tile_sprite.setFillColor(FOREST_GREEN);
2301 
2302             break;
2303         }
2304 
2305         case (TileType :: LAKE): {
2306             this->tile_sprite.setFillColor(LAKE_BLUE);
2307 
2308             break;
2309         }
2310 
2311         case (TileType :: MOUNTAINS): {
2312             this->tile_sprite.setFillColor(MOUNTAINS_GREY);
2313 
2314             break;
2315         }
2316 
2317         case (TileType :: OCEAN): {
2318             this->tile_sprite.setFillColor(OCEAN_BLUE);
2319 
2320             break;
2321         }
2322 
2323         case (TileType :: PLAINS): {
2324             this->tile_sprite.setFillColor(PLAINS_YELLOW);
2325 
2326             break;
2327         }
2328 
2329         default: {
2330             // do nothing!
2331 
2332             break;
2333         }
2334     }
2335 
2336     this->__setUpBuildMenu();
2337 
2338     return;
2339 }   /* setTileType(TileType) */
```

#### 4.7.3.52 toggleResourceOverlay()

```
void HexTile::toggleResourceOverlay (
            void  )
```

Method to toggle the tile resource overlay.

```
2577 {
2578     if (this->show_resource) {
2579         this->show_resource = false;
2580     }
2581     else {
2582         this->show_resource = true;
2583     }
2584 
2585     return;
2586 }   /* 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 select_outline_sprite

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

A convex shape which outlines the tile when selected.

#### 4.7.4.30 show_node

```
bool HexTile::show_node
```

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

#### 4.7.4.31 show_resource

```
bool HexTile::show_resource
```

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

#### 4.7.4.32 tile_decoration_sprite

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

A tile decoration sprite.

#### 4.7.4.33 tile_improvement_ptr

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

A pointer to the improvement for this tile.

#### 4.7.4.34 tile_resource

```
TileResource HexTile::tile_resource
```

#### 4.7.4.35 tile_sprite

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

A convex shape which represents the tile.

#### 4.7.4.36 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**

| | |
|---|---|
| *channel* | 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
111     return false;
112 }   /* hasTraffic() */
```

#### 4.9.3.5 isEmpty()

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

Method to check if channel is empty.

**Parameters**

| | |
|---|---|
| *channel* | 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**

| | |
|---|---|
| *channel* | 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**

| | |
|---|---|
| *channel* | 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**

| | |
|---|---|
| *channel* | 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**

| | |
|---|---|
| *message* | 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:

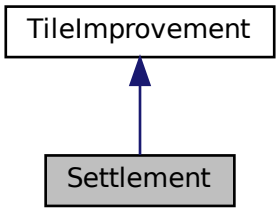
- header/ESC_core/MessageHub.h
- source/ESC_core/MessageHub.cpp

## 4.10 Settlement Class Reference

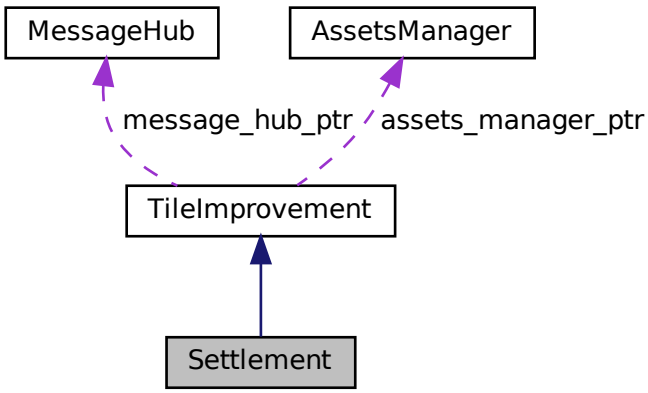
A settlement class (child class of TileImprovement).

`#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.*

- 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**

| | |
|---|---|
| *position_x* | The x position of the tile. |
| *position_y* | The y position of the tile. |
| *event_ptr* | Pointer to the event class. |
| *render_window_ptr* | Pointer to the render window. |
| *assets_manager_ptr* | Pointer to the assets manager. |
| *message_hub_ptr* | 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.

```
415 {
416     std::cout « "Settlement at " « this « " destroyed" « std::endl;
417 
418     return;
419 }   /* ~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 
112         default: {
113             // do nothing!
114 
115             break;
116         }
117     }
118 
119     return;
120 }   /* __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 
140     switch (this->event_ptr->mouseButton.button) {
141         case (sf::Mouse::Left): {
142             //...
143 
144             break;
145         }
146 
147 
148         case (sf::Mouse::Right): {
149             //...
150 
151             break;
152         }
153 
154 
155         default: {
156             // do nothing!
157 
158             break;
159         }
160     }
161 
162     return;
163 }   /* __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 
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() */
```

#### 4.10.3.4 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.

```
334 {
335     //  1. if just built, call base method and return
336     if (this->just_built) {
337         TileImprovement :: draw();
338 
339         return;
340     }
341 
342     //  2. draw static sprite and chimney smoke effects
343     this->render_window_ptr->draw(this->tile_improvement_sprite_static);
344 
345     std::list<sf::Sprite>::iterator iter = this->smoke_sprite_list.begin();
346 
347     double alpha = 255;
348 
349     while (iter != this->smoke_sprite_list.end()) {
350         this->render_window_ptr->draw(*iter);
351 
352         alpha = (*iter).getColor().a;
353 
354         alpha -= this->smoke_da;
355 
356         if (alpha <= 0) {
357             iter = this->smoke_sprite_list.erase(iter);
358             continue;
359         }
360 
361         (*iter).setColor(sf::Color(255, 255, 255, alpha));
362 
363         (*iter).move(
364             this->smoke_dx + 2 * (((double)rand() / RAND_MAX) - 1) / FRAMES_PER_SECOND,
365             this->smoke_dy
366         );
367 
368         (*iter).rotate(((double)rand() / RAND_MAX));
369 
370         iter++;
371     }
```

```
372
373
374     if ((double)rand() / RAND_MAX < smoke_prob) {
375         this->smoke_sprite_list.push_back(
376             sf::Sprite(*(this->assets_manager_ptr->getTexture("emissions")))
377         );
378
379         this->smoke_sprite_list.back().setOrigin(
380             this->smoke_sprite_list.back().getLocalBounds().width / 2,
381             this->smoke_sprite_list.back().getLocalBounds().height / 2
382         );
383
384         this->smoke_sprite_list.back().setPosition(
385             this->position_x + 9 + 4 * ((double)rand() / RAND_MAX) - 2,
386             this->position_y - 33
387         );
388     }
389
390     //  3. draw production menu
391     if (this->production_menu_open) {
392         this->render_window_ptr->draw(this->production_menu_backing);
393         this->render_window_ptr->draw(this->production_menu_backing_text);
394
395         //...
396     }
397
398     this->frame++;
399     return;
400 }   /* 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.

```
258 {
259     //                  32 char x 17 line console "--------------------------------\n";
260     std::string options_substring                = "  **** SETTLEMENT OPTIONS ****  \n";
261     options_substring                           += "                                \n";
262     options_substring                           += "                                \n";
263     options_substring                           += "                                \n";
264     options_substring                           += "                                \n";
265     options_substring                           += "                                \n";
266     options_substring                           += "                                \n";
267     options_substring                           += "                                \n";
268
269     return options_substring;
270 }   /* getTileOptionsSubstring() */
```

#### 4.10.3.6 processEvent()

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

Method to process Settlement. To be called once per event.

Reimplemented from TileImprovement.

```
285 {
286     TileImprovement :: processEvent();
287 
288     if (this->event_ptr->type == sf::Event::KeyPressed) {
289         this->__handleKeyPressEvents();
290     }
291 
292     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
293         this->__handleMouseButtonEvents();
294     }
295 
296     return;
297 }   /* processEvent() */
```

#### 4.10.3.7 processMessage()

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

Method to process Settlement. To be called once per message.

Reimplemented from TileImprovement.

```
312 {
313     TileImprovement :: processMessage();
314 
315     //...
316 
317     return;
318 }   /* processMessage() */
```

### 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:

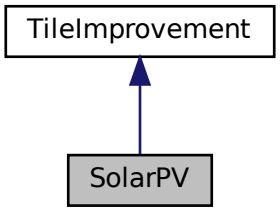
- header/Settlement.h
- source/Settlement.cpp

## 4.11 SolarPV Class Reference

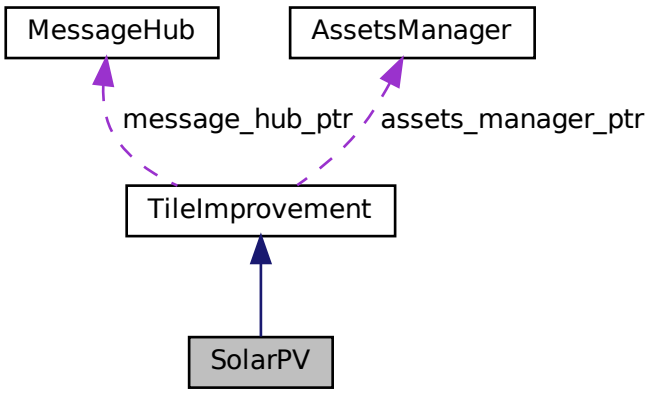
A settlement class (child class of TileImprovement).

```
#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.*

## 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

### 4.11.1 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**

| | |
|---|---|
| *position_x* | The x position of the tile. |
| *position_y* | The y position of the tile. |
| *event_ptr* | Pointer to the event class. |
| *render_window_ptr* | Pointer to the render window. |
| *assets_manager_ptr* | Pointer to the assets manager. |
| *message_hub_ptr* | 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 :: SOLAR_PV;
226
227     this->is_running = false;
228
229     this->health = 100;
230
231     this->tile_improvement_string = "SOLAR PV ARRAY";
232
233     this->__setUpTileImprovementSpriteStatic();
234
235     std::cout « "SolarPV constructed at " « this « std::endl;
236
237     return;
238 }   /* SolarPV() */
```

### 4.11.2.2 ~SolarPV()

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

Destructor for the SolarPV class.

```
364 {
365     std::cout « "SolarPV at " « this « " destroyed" « std::endl;
366 
367     return;
368 }   /* ~SolarPV() */
```

### 4.11.3 Member Function Documentation

#### 4.11.3.1 __handleKeyPressEvents()

```
void SolarPV::__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 
112         default: {
113             // do nothing!
114 
115             break;
116         }
117     }
118 
119     return;
120 }   /* __handleKeyPressEvents() */
```

#### 4.11.3.2 __handleMouseButtonEvents()

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

Helper method to handle mouse button events.

```
135 {
136     if (this->just_built) {
137         return;
138     }
139 
140     switch (this->event_ptr->mouseButton.button) {
141         case (sf::Mouse::Left): {
142             //...
143 
144             break;
145         }
146 
147 
148         case (sf::Mouse::Right): {
149             //...
150 
151             break;
152         }
153 
154 
155         default: {
156             // do nothing!
157 
158             break;
159         }
160     }
161 
162     return;
163 }   /* __handleMouseButtonEvents() */
```

#### 4.11.3.3 __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() */
```

#### 4.11.3.4 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.

```
335 {
336     //  1. if just built, call base method and return
337     if (this->just_built) {
338         TileImprovement :: draw();
339 
340         return;
341     }
342 
343 
344     //  1. draw static sprite
345     this->render_window_ptr->draw(this->tile_improvement_sprite_static);
346 
347     this->frame++;
348     return;
349 }   /* draw() */
```

#### 4.11.3.5 getTileOptionsSubstring()

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

Helper method to assemble and return tile options substring.

**Returns**

Tile options substring.

Reimplemented from TileImprovement.

```
255 {
256     //                    32 char x 17 line console "--------------------------------\n";
257     std::string options_substring                 = "    **** SOLAR PV OPTIONS ****    \n";
258     options_substring                            += "                                  \n";
259     options_substring                            += "                                  \n";
260     options_substring                            += "                                  \n";
261     options_substring                            += "                                  \n";
262     options_substring                            += "                                  \n";
263     options_substring                            += "                                  \n";
264     options_substring                            += "                                  \n";
265
266     options_substring                            += "[P]:  SCRAP (";
267     options_substring                            += std::to_string(SCRAP_COST);
268     options_substring                            += " K)";
269
270     return options_substring;
271 }   /* getTileOptionsSubstring() */
```

#### 4.11.3.6 processEvent()

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

Method to process SolarPV. To be called once per event.

Reimplemented from TileImprovement.

```
286 {
287     TileImprovement :: processEvent();
288
289     if (this->event_ptr->type == sf::Event::KeyPressed) {
290         this->__handleKeyPressEvents();
291     }
292
293     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
294         this->__handleMouseButtonEvents();
295     }
296
297     return;
298 }   /* processEvent() */
```

#### 4.11.3.7 processMessage()

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

Method to process SolarPV. To be called once per message.

Reimplemented from TileImprovement.

```
313 {
314     TileImprovement :: processMessage();
315
316     //...
317
318     return;
319 }   /* processMessage() */
```

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

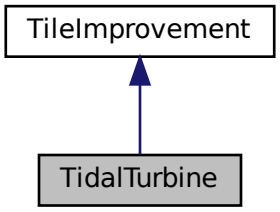
- header/SolarPV.h
- source/SolarPV.cpp

## 4.12 TidalTurbine Class Reference

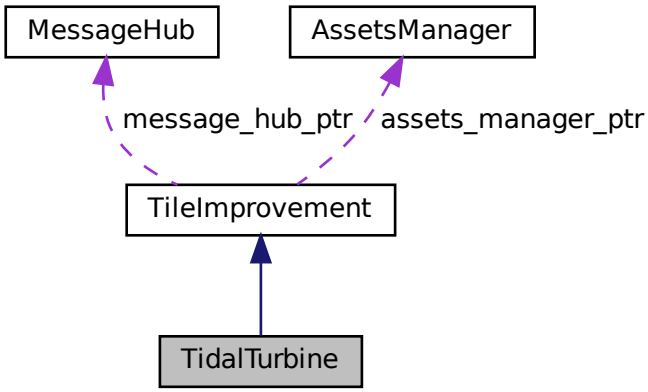
A settlement class (child class of TileImprovement).

`#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.*

## Private Member Functions

- void __setUpTileImprovementSpriteAnimated (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

### 4.12.1 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**

| | |
|---|---|
| *position_x* | The x position of the tile. |
| *position_y* | The y position of the tile. |
| *event_ptr* | Pointer to the event class. |
| *render_window_ptr* | Pointer to the render window. |
| *assets_manager_ptr* | Pointer to the assets manager. |
| *message_hub_ptr* | Pointer to the message hub. |

```
220   :
221 TileImprovement(
222     position_x,
223     position_y,
224     event_ptr,
225     render_window_ptr,
226     assets_manager_ptr,
227     message_hub_ptr
228 )
229 {
230     //  1. set attributes
231
232     //  1.1. private
233     //...
234
235     //  1.2. public
236     this->tile_improvement_type = TileImprovementType :: TIDAL_TURBINE;
237
238     this->is_running = false;
239
240     this->tile_improvement_string = "TIDAL TURBINE";
241
242     this->__setUpTileImprovementSpriteAnimated();
243
244     std::cout « "TidalTurbine constructed at " « this « std::endl;
245
246     return;
247 }   /* TidalTurbine() */
```

#### 4.12.2.2 ~TidalTurbine()

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

Destructor for the TidalTurbine class.

```
393 {
394     std::cout « "TidalTurbine at " « this « " destroyed" « std::endl;
395
396     return;
397 }   /* ~TidalTurbine() */
```

### 4.12.3 Member Function Documentation

#### 4.12.3.1 __handleKeyPressEvents()

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

Helper method to handle key press events.

```
114 {
115     if (this->just_built) {
116         return;
117     }
118
119     switch (this->event_ptr->key.code) {
120         //...
121
122
123         default: {
124             // do nothing!
125
126             break;
127         }
128     }
129
130     return;
131 }   /* __handleKeyPressEvents() */
```

#### 4.12.3.2 __handleMouseButtonEvents()

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

Helper method to handle mouse button events.

```
146 {
147     if (this->just_built) {
148         return;
149     }
150 
151     switch (this->event_ptr->mouseButton.button) {
152         case (sf::Mouse::Left): {
153             //...
154 
155             break;
156         }
157 
158 
159         case (sf::Mouse::Right): {
160             //...
161 
162             break;
163         }
164 
165 
166         default: {
167             // do nothing!
168 
169             break;
170         }
171     }
172 
173     return;
174 }   /* __handleMouseButtonEvents() */
```

#### 4.12.3.3 __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() */
```

#### 4.12.3.4 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.

```
344 {
345     //  1. if just built, call base method and return
346     if (this->just_built) {
347         TileImprovement :: draw();
348 
349         return;
350     }
351 
352 
353     //  2. draw first element of animated sprite
354     this->render_window_ptr->draw(this->tile_improvement_sprite_animated[0]);
355 
356 
357     //  3. draw second element of animated sprite
358     if (this->is_running) {
359         //...
360     }
361 
362     else {
363         //...
364     }
365 
366     this->render_window_ptr->draw(this->tile_improvement_sprite_animated[1]);
367 
368     //  4. draw production menu
369     if (this->production_menu_open) {
370         this->render_window_ptr->draw(this->production_menu_backing);
371         this->render_window_ptr->draw(this->production_menu_backing_text);
372 
373         //...
374     }
375 
376     this->frame++;
377     return;
378 }   /* draw() */
```

#### 4.12.3.5 getTileOptionsSubstring()

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

Helper method to assemble and return tile options substring.

**Returns**

Tile options substring.

Reimplemented from TileImprovement.

```
264 {
265     //                  32 char x 17 line console "--------------------------------\n";
266     std::string options_substring                = "**** TIDAL TURBINE OPTIONS **** \n";
267     options_substring                           += "                                \n";
268     options_substring                           += "                                \n";
269     options_substring                           += "                                \n";
270     options_substring                           += "                                \n";
271     options_substring                           += "                                \n";
272     options_substring                           += "                                \n";
273     options_substring                           += "                                \n";
274 
275     options_substring                           += "[P]:  SCRAP (";
276     options_substring                           += std::to_string(SCRAP_COST);
277     options_substring                           += " K)";
278 
279     return options_substring;
280 }   /* getTileOptionsSubstring() */
```

#### 4.12.3.6 processEvent()

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

Method to process TidalTurbine. To be called once per event.

Reimplemented from TileImprovement.

```
295 {
296     TileImprovement :: processEvent();
297
298     if (this->event_ptr->type == sf::Event::KeyPressed) {
299         this->__handleKeyPressEvents();
300     }
301
302     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
303         this->__handleMouseButtonEvents();
304     }
305
306     return;
307 }   /* processEvent() */
```

#### 4.12.3.7 processMessage()

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

Method to process TidalTurbine. To be called once per message.

Reimplemented from TileImprovement.

```
322 {
323     TileImprovement :: processMessage();
324
325     //...
326
327     return;
328 }   /* processMessage() */
```

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

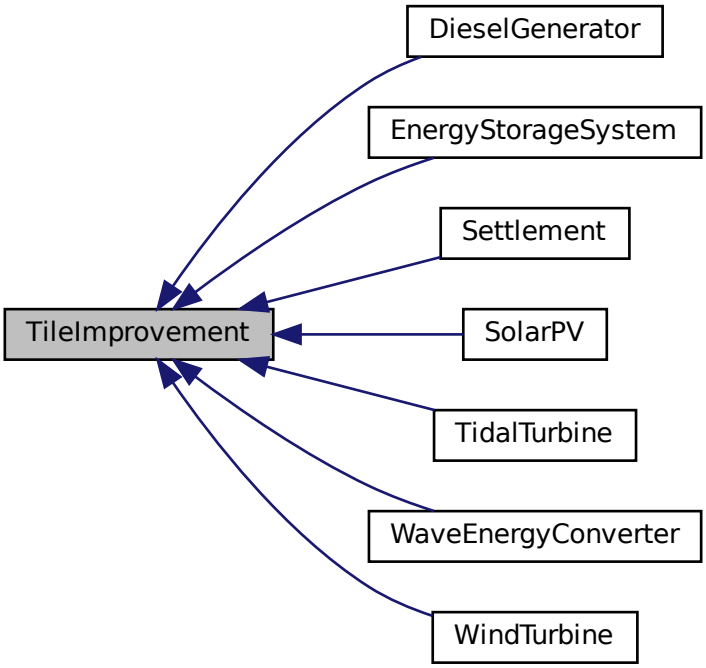
- header/TidalTurbine.h
- source/TidalTurbine.cpp

## 4.13 TileImprovement Class Reference

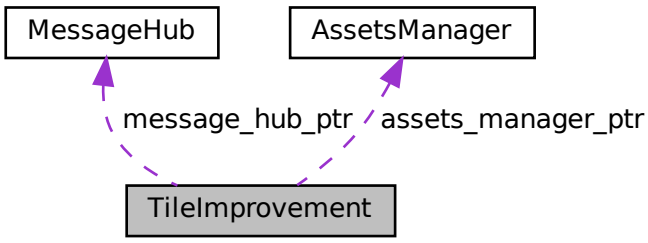
A base class for the tile improvement hierarchy.

```
#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.*
- 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 production_menu_open

  *A boolean which indicates whether or not the production 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.*
- 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 build menu.*
- sf::Text production_menu_backing_text

  *Text for the production menu backing.*

## Protected Member Functions

- void __setUpProductionMenu (void)

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

## 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**

| | |
|---|---|
| *position_x* | The x position of the tile. |
| *position_y* | The y position of the tile. |
| *event_ptr* | Pointer to the event class. |
| *render_window_ptr* | Pointer to the render window. |
| *assets_manager_ptr* | Pointer to the assets manager. |
| *message_hub_ptr* | Pointer to the message hub. |

```
271 {
272     //  1. set attributes
273 
274     //  1.1. protected
275     this->event_ptr = event_ptr;
276     this->render_window_ptr = render_window_ptr;
277 
278     this->assets_manager_ptr = assets_manager_ptr;
279     this->message_hub_ptr = message_hub_ptr;
280 
281     //  1.2. public
282     this->is_selected = true;
283     this->just_built = true;
284     this->production_menu_open = false;
285 
286     this->frame = 0;
287     this->credits = 0;
288 
289     this->position_x = position_x;
290     this->position_y = position_y;
291 
292     this->game_phase = "build settlement";
293 
294     this->__setUpProductionMenu();
295 
296     std::cout « "TileImprovement constructed at " « this « std::endl;
297 
298     return;
299 }   /* TileImprovement() */
```

#### 4.13.2.2 ~TileImprovement()

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

Destructor for the TileImprovement class.

```
531 {
532     std::cout « "TileImprovement at " « this « " destroyed" « std::endl;
533 
534     return;
535 }   /* ~TileImprovement() */
```

### 4.13.3 Member Function Documentation

#### 4.13.3.1 __closeProductionMenu()

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

Helper method to close the production menu.

```
215 {
216     if (not this->production_menu_open) {
217         return;
218     }
219 
220     this->production_menu_open = false;
221     this->assets_manager_ptr->getSound("build menu close")->play();
222 
223     return;
224 }   /* __closeProductionMenu() */
```

#### 4.13.3.2 __handleKeyPressEvents()

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

Helper method to handle key press events.

```
104 {
105     if (this->tile_improvement_type == TileImprovementType :: SETTLEMENT) {
106         return;
107     }
108 
109     if (this->just_built) {
110         return;
111     }
112 
113     switch (this->event_ptr->key.code) {
114         case (sf::Keyboard::E): {
115             this->__openProductionMenu();
116 
117             break;
118         }
119 
120 
121         default: {
122             // do nothing!
123 
124             break;
125         }
126     }
127 
128     return;
129 }   /* __handleKeyPressEvents() */
```

#### 4.13.3.3 __handleMouseButtonEvents()

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

Helper method to handle mouse button events.

```
144 {
145     if (this->tile_improvement_type == TileImprovementType :: SETTLEMENT) {
146         return;
147     }
148 
149     if (this->just_built) {
150         return;
151     }
152 
153     switch (this->event_ptr->mouseButton.button) {
154         case (sf::Mouse::Left): {
155             //...
156 
157             break;
158         }
159 
160 
161         case (sf::Mouse::Right): {
162             //...
```

```
163
164             break;
165         }
166
167
168         default: {
169             // do nothing!
170
171             break;
172         }
173     }
174
175     return;
176 }   /* __handleMouseButtonEvents() */
```

#### 4.13.3.4 __openProductionMenu()

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

Helper method to open the production menu.

```
191 {
192     if (this->production_menu_open) {
193         return;
194     }
195
196     this->production_menu_open = true;
197     this->assets_manager_ptr->getSound("build menu open")->play();
198
199     return;
200 }   /* __openProductionMenu() */
```

#### 4.13.3.5 __setUpProductionMenu()

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

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

```
68 {
69     //  1. set up and place build 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(MONOCHROME_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(MONOCHROME_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() */
```

#### 4.13.3.6 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.

```
402 {
403     if (this->tile_improvement_sprite_static.getTexture() != NULL) {
404         int alpha = this->tile_improvement_sprite_static.getColor().a;
405 
406         alpha += 0.08 * FRAMES_PER_SECOND;
407 
408         this->tile_improvement_sprite_static.setColor(
409             sf::Color(255, 255, 255, alpha)
410         );
411 
412         this->tile_improvement_sprite_static.move(0, 50 * SECONDS_PER_FRAME);
413 
414         if (
415             (alpha >= 255) or
416             (this->tile_improvement_sprite_static.getPosition().y >= this->position_y + 12)
417         ) {
418             this->tile_improvement_sprite_static.setColor(
419                 sf::Color(255, 255, 255, 255)
420             );
421 
422             this->tile_improvement_sprite_static.setPosition(
423                 this->position_x,
424                 this->position_y + 12
425             );
426 
427             this->just_built = false;
428             this->assets_manager_ptr->getSound("place improvement")->play();
429         }
430 
431         this->render_window_ptr->draw(this->tile_improvement_sprite_static);
432     }
433 
434 
435     else {
436         int alpha = 0;
437 
438         for (size_t i = 0; i < this->tile_improvement_sprite_animated.size(); i++) {
439             alpha = this->tile_improvement_sprite_animated[i].getColor().a;
440 
441             alpha += 0.08 * FRAMES_PER_SECOND;
442 
443             this->tile_improvement_sprite_animated[i].setColor(
444                 sf::Color(255, 255, 255, alpha)
445             );
446 
447             this->tile_improvement_sprite_animated[i].move(0, 50 * SECONDS_PER_FRAME);
448 
449             if (
450                 (alpha >= 255) or
451                 (this->tile_improvement_sprite_animated[i].getPosition().y >= this->position_y + 12)
452             ) {
453                 this->tile_improvement_sprite_animated[i].setColor(
454                     sf::Color(255, 255, 255, 255)
455                 );
456 
457                 this->tile_improvement_sprite_animated[i].setPosition(
458                     this->position_x,
459                     this->position_y + 12
460                 );
461             }
462 
463             this->render_window_ptr->draw(this->tile_improvement_sprite_animated[i]);
464         }
465 
466         if (
467             (alpha >= 255) or
468             (this->tile_improvement_sprite_animated[0].getPosition().y >= this->position_y + 12)
469         ) {
470             this->just_built = false;
471             this->assets_manager_ptr->getSound("place improvement")->play();
472 
473             switch (this->tile_improvement_type) {
474                 case (TileImprovementType :: WIND_TURBINE): {
```

```
475                     for (size_t i = 0; i < this->tile_improvement_sprite_animated.size(); i++) {
476                         this->tile_improvement_sprite_animated[i].setOrigin(32, 32);
477                         this->tile_improvement_sprite_animated[i].move(0, -32);
478                     }
479 
480                     break;
481                 }
482 
483 
484                 case (TileImprovementType :: TIDAL_TURBINE): {
485                     for (size_t i = 0; i < this->tile_improvement_sprite_animated.size(); i++) {
486                         this->tile_improvement_sprite_animated[i].setOrigin(32, 45);
487                         this->tile_improvement_sprite_animated[i].move(0, -19);
488                     }
489 
490                     break;
491                 }
492 
493 
494                 case (TileImprovementType :: WAVE_ENERGY_CONVERTER): {
495                     for (size_t i = 0; i < this->tile_improvement_sprite_animated.size(); i++) {
496                         this->tile_improvement_sprite_animated[i].setOrigin(32, 32);
497                         this->tile_improvement_sprite_animated[i].move(0, -32);
498                     }
499 
500                     break;
501                 }
502 
503 
504                 default: {
505                     // do nothing!
506 
507                     break;
508                 }
509             }
510         }
511     }
512 
513 
514     this->frame++;
515     return;
516 }   /* draw() */
```

#### 4.13.3.7 getTileOptionsSubstring()

```
virtual std::string TileImprovement::getTileOptionsSubstring (
              void  )  [inline], [virtual]
```

Reimplemented in WindTurbine, WaveEnergyConverter, TidalTurbine, SolarPV, Settlement, EnergyStorageSystem, and DieselGenerator.

```
143 {return "";}
```

#### 4.13.3.8 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.

```
357 {
358     if (this->event_ptr->type == sf::Event::KeyPressed) {
359         this->__handleKeyPressEvents();
360     }
361 
362     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
363         this->__handleMouseButtonEvents();
364     }
365 
366     return;
367 }   /* processEvent() */
```

#### 4.13.3.9 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.

```
382 {
383     //...
384 
385     return;
386 }   /* processMessage() */
```

#### 4.13.3.10 setIsSelected()

```
void TileImprovement::setIsSelected (
            bool is_selected )
```

Method to set the is selected attribute.

**Parameters**

| | |
|---|---|
| *is_selected* | The value to set the is selected attribute to. |

```
316 {
317     this->is_selected = is_selected;
318 
319     if (is_selected) {
320         switch (this->tile_improvement_type) {
321             /*
322             case (TileImprovementType :: SETTLEMENT): {
323                 this->assets_manager_ptr->getSound("people and children")->play();
324 
325                 break;
326             }
327             */
328 
329             default: {
330                 // do nothing!
331 
332                 break;
333             }
334         }
335     }
336 
337     if ((not is_selected) and this->production_menu_open) {
338         this->__closeProductionMenu();
339     }
340 
341     return;
342 }   /* 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 message_hub_ptr

```
MessageHub* TileImprovement::message_hub_ptr  [protected]
```

A pointer to the message hub.

#### 4.13.4.11 position_x

```
double TileImprovement::position_x
```

The x position of the tile improvement.

#### 4.13.4.12 position_y

```
double TileImprovement::position_y
```

The y position of the tile improvement.

#### 4.13.4.13 production_menu_backing

```
sf::RectangleShape TileImprovement::production_menu_backing
```

A backing for the production build menu.

#### 4.13.4.14 production_menu_backing_text

```
sf::Text TileImprovement::production_menu_backing_text
```

Text for the production menu backing.

#### 4.13.4.15 production_menu_open

```
bool TileImprovement::production_menu_open
```

A boolean which indicates whether or not the production menu is open.

#### 4.13.4.16 render_window_ptr

```
sf::RenderWindow* TileImprovement::render_window_ptr  [protected]
```

A pointer to the render window.

#### 4.13.4.17 tile_improvement_sprite_animated

```
std::vector<sf::Sprite> TileImprovement::tile_improvement_sprite_animated
```

An animated sprite, for the ContextMenu visual screen.

#### 4.13.4.18 tile_improvement_sprite_static

```
sf::Sprite TileImprovement::tile_improvement_sprite_static
```

A static sprite, for decorating the tile.

#### 4.13.4.19 tile_improvement_string

```
std::string TileImprovement::tile_improvement_string
```

A string representation of the tile improvement type.

#### 4.13.4.20 tile_improvement_type

```
TileImprovementType TileImprovement::tile_improvement_type
```

The type of the tile improvement.

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

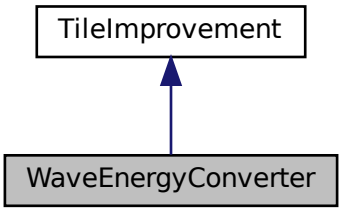
- header/TileImprovement.h
- source/TileImprovement.cpp

## 4.14 WaveEnergyConverter Class Reference

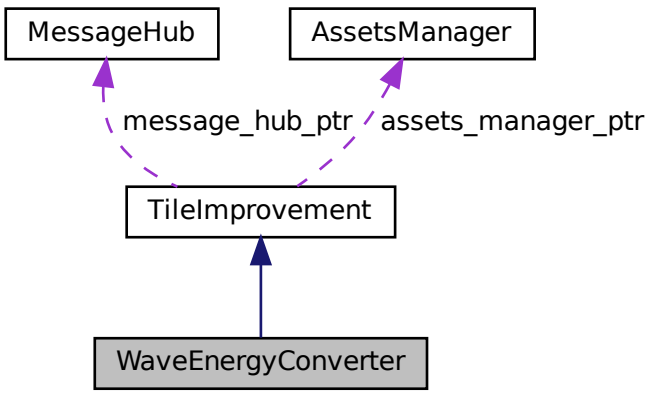
A settlement class (child class of TileImprovement).

```
#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.*

## Private Member Functions

- void __setUpTileImprovementSpriteAnimated (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

### 4.14.1 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**

| | |
|---|---|
| *position_x* | The x position of the tile. |
| *position_y* | The y position of the tile. |
| *event_ptr* | Pointer to the event class. |
| *render_window_ptr* | Pointer to the render window. |
| *assets_manager_ptr* | Pointer to the assets manager. |
| *message_hub_ptr* | Pointer to the message hub. |

```
219   :
220 TileImprovement(
221     position_x,
222     position_y,
223     event_ptr,
224     render_window_ptr,
225     assets_manager_ptr,
226     message_hub_ptr
227 )
228 {
229     //  1. set attributes
230
231     //  1.1. private
232     //...
233
234     //  1.2. public
235     this->tile_improvement_type = TileImprovementType :: WAVE_ENERGY_CONVERTER;
236
237     this->is_running = false;
238
239     this->health = 100;
240
241     this->tile_improvement_string = "WAVE ENERGY";
242
243     this->__setUpTileImprovementSpriteAnimated();
244
245     std::cout « "WaveEnergyConverter constructed at " « this « std::endl;
246
247     return;
248 }   /* WaveEnergyConverter() */
```

#### 4.14.2.2 ~WaveEnergyConverter()

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

Destructor for the WaveEnergyConverter class.

```
394 {
395     std::cout « "WaveEnergyConverter at " « this « " destroyed" « std::endl;
396
397     return;
398 }   /* ~WaveEnergyConverter() */
```

### 4.14.3 Member Function Documentation

#### 4.14.3.1 __handleKeyPressEvents()

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

Helper method to handle key press events.

```
114 {
115     if (this->just_built) {
116         return;
117     }
118 
119     switch (this->event_ptr->key.code) {
120         //...
121 
122 
123         default: {
124             // do nothing!
125 
126             break;
127         }
128     }
129 
130     return;
131 }   /* __handleKeyPressEvents() */
```

#### 4.14.3.2 __handleMouseButtonEvents()

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

Helper method to handle mouse button events.

```
146 {
147     if (this->just_built) {
148         return;
149     }
150     switch (this->event_ptr->mouseButton.button) {
151         case (sf::Mouse::Left): {
152             //...
153 
154             break;
155         }
156 
157 
158         case (sf::Mouse::Right): {
159             //...
160 
161             break;
162         }
163 
164 
165         default: {
166             // do nothing!
167 
168             break;
169         }
170     }
171 
172     return;
173 }   /* __handleMouseButtonEvents() */
```

#### 4.14.3.3 __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() */
```

#### 4.14.3.4 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.

```
345 {
346     //  1. if just built, call base method and return
347     if (this->just_built) {
348         TileImprovement :: draw();
349 
350         return;
351     }
352 
353 
354     //  2. draw first element of animated sprite
355     this->render_window_ptr->draw(this->tile_improvement_sprite_animated[0]);
356 
357 
358     //  3. draw second element of animated sprite
359     if (this->is_running) {
360         //...
361     }
362 
363     else {
364         //...
365     }
366 
367     this->render_window_ptr->draw(this->tile_improvement_sprite_animated[1]);
368 
369     //  4. draw production menu
370     if (this->production_menu_open) {
371         this->render_window_ptr->draw(this->production_menu_backing);
372         this->render_window_ptr->draw(this->production_menu_backing_text);
373 
374         //...
375     }
376 
377     this->frame++;
378     return;
379 }   /* draw() */
```

#### 4.14.3.5 getTileOptionsSubstring()

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

Helper method to assemble and return tile options substring.

**Returns**

Tile options substring.

Reimplemented from TileImprovement.

```
265 {
266     //                  32 char x 17 line console "--------------------------------\n";
267     std::string options_substring                = " **** WAVE ENERGY OPTIONS ****  \n";
268     options_substring                           += "                                  \n";
269     options_substring                           += "                                  \n";
270     options_substring                           += "                                  \n";
271     options_substring                           += "                                  \n";
272     options_substring                           += "                                  \n";
273     options_substring                           += "                                  \n";
274     options_substring                           += "                                  \n";
275
276     options_substring                           += "[P]:  SCRAP (";
277     options_substring                           += std::to_string(SCRAP_COST);
278     options_substring                           += " K)";
279
280     return options_substring;
281 }   /* getTileOptionsSubstring() */
```

#### 4.14.3.6 processEvent()

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

Method to process WaveEnergyConverter. To be called once per event.

Reimplemented from TileImprovement.

```
296 {
297     TileImprovement :: processEvent();
298
299     if (this->event_ptr->type == sf::Event::KeyPressed) {
300         this->__handleKeyPressEvents();
301     }
302
303     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
304         this->__handleMouseButtonEvents();
305     }
306
307     return;
308 }   /* processEvent() */
```

#### 4.14.3.7 processMessage()

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

Method to process WaveEnergyConverter. To be called once per message.

Reimplemented from TileImprovement.

```
323 {
324     TileImprovement :: processMessage();
325
326     //...
327
328     return;
329 }   /* processMessage() */
```

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

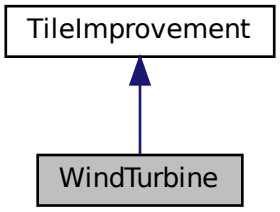
- header/WaveEnergyConverter.h
- source/WaveEnergyConverter.cpp

## 4.15 WindTurbine Class Reference

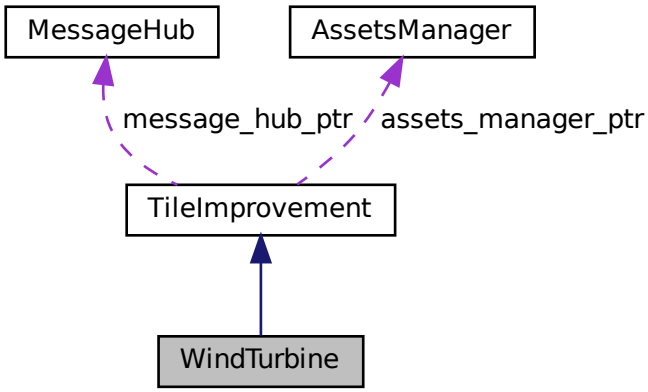
A settlement class (child class of TileImprovement).

`#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.*

## Private Member Functions

- void __setUpTileImprovementSpriteAnimated (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

### 4.15.1 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**

| | |
|---|---|
| *position_x* | The x position of the tile. |
| *position_y* | The y position of the tile. |
| *event_ptr* | Pointer to the event class. |
| *render_window_ptr* | Pointer to the render window. |
| *assets_manager_ptr* | Pointer to the assets manager. |
| *message_hub_ptr* | Pointer to the message hub. |

```
220   :
221 TileImprovement(
222     position_x,
223     position_y,
224     event_ptr,
225     render_window_ptr,
226     assets_manager_ptr,
227     message_hub_ptr
228 )
229 {
230     //  1. set attributes
231
232     //  1.1. private
233     //...
234
235     //  1.2. public
236     this->tile_improvement_type = TileImprovementType :: WIND_TURBINE;
237
238     this->is_running = false;
239
240     this->health = 100;
241
242     this->tile_improvement_string = "WIND TURBINE";
243
244     this->__setUpTileImprovementSpriteAnimated();
245
246     std::cout « "WindTurbine constructed at " « this « std::endl;
247
248     return;
249 }   /* WindTurbine() */
```

#### 4.15.2.2 ~WindTurbine()

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

Destructor for the WindTurbine class.

```
395 {
396     std::cout « "WindTurbine at " « this « " destroyed" « std::endl;
397
398     return;
399 }   /* ~WindTurbine() */
```

### 4.15.3 Member Function Documentation

#### 4.15.3.1 __handleKeyPressEvents()

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

Helper method to handle key press events.

```
114 {
115     if (this->just_built) {
116         return;
117     }
118
119     switch (this->event_ptr->key.code) {
120         //...
121
122
123         default: {
124             // do nothing!
125
126             break;
127         }
128     }
129
130     return;
131 }   /* __handleKeyPressEvents() */
```

#### 4.15.3.2 __handleMouseButtonEvents()

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

Helper method to handle mouse button events.

```
146 {
147     if (this->just_built) {
148         return;
149     }
150 
151     switch (this->event_ptr->mouseButton.button) {
152         case (sf::Mouse::Left): {
153             //...
154 
155             break;
156         }
157 
158 
159         case (sf::Mouse::Right): {
160             //...
161 
162             break;
163         }
164 
165 
166         default: {
167             // do nothing!
168 
169             break;
170         }
171     }
172 
173     return;
174 }   /* __handleMouseButtonEvents() */
```

#### 4.15.3.3 __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() */
```

#### 4.15.3.4 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.

```
346 {
347     //  1. if just built, call base method and return
348     if (this->just_built) {
349         TileImprovement :: draw();
350 
351         return;
352     }
353 
354 
355     //  2. draw first element of animated sprite
356     this->render_window_ptr->draw(this->tile_improvement_sprite_animated[0]);
357 
358 
359     //  3. draw second element of animated sprite
360     if (this->is_running) {
361         //...
362     }
363 
364     else {
365         //...
366     }
367 
368     this->render_window_ptr->draw(this->tile_improvement_sprite_animated[1]);
369 
370     //  4. draw production menu
371     if (this->production_menu_open) {
372         this->render_window_ptr->draw(this->production_menu_backing);
373         this->render_window_ptr->draw(this->production_menu_backing_text);
374 
375         //...
376     }
377 
378     this->frame++;
379     return;
380 }   /* draw() */
```

#### 4.15.3.5 getTileOptionsSubstring()

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

Helper method to assemble and return tile options substring.

**Returns**

Tile options substring.

Reimplemented from TileImprovement.

```
266 {
267     //                  32 char x 17 line console "--------------------------------\n";
268     std::string options_substring                = " **** WIND TURBINE OPTIONS **** \n";
269     options_substring                           += "                                \n";
270     options_substring                           += "                                \n";
271     options_substring                           += "                                \n";
272     options_substring                           += "                                \n";
273     options_substring                           += "                                \n";
274     options_substring                           += "                                \n";
275     options_substring                           += "                                \n";
276 
277     options_substring                           += "[P]:  SCRAP (";
278     options_substring                           += std::to_string(SCRAP_COST);
279     options_substring                           += " K)";
280 
281     return options_substring;
282 }   /* getTileOptionsSubstring() */
```

#### 4.15.3.6 processEvent()

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

Method to process WindTurbine. To be called once per event.

Reimplemented from TileImprovement.

```
297 {
298     TileImprovement :: processEvent();
299
300     if (this->event_ptr->type == sf::Event::KeyPressed) {
301         this->__handleKeyPressEvents();
302     }
303
304     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
305         this->__handleMouseButtonEvents();
306     }
307
308     return;
309 }   /* processEvent() */
```

#### 4.15.3.7 processMessage()

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

Method to process WindTurbine. To be called once per message.

Reimplemented from TileImprovement.

```
324 {
325     TileImprovement :: processMessage();
326
327     //...
328
329     return;
330 }   /* processMessage() */
```

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

- header/WindTurbine.h
- source/WindTurbine.cpp

# Chapter 5

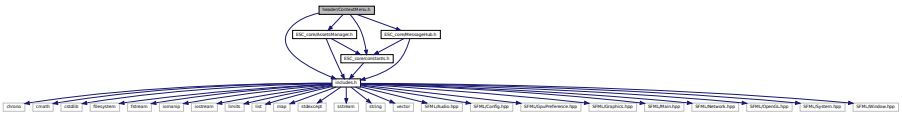
# File Documentation

## 5.1 header/ContextMenu.h File Reference

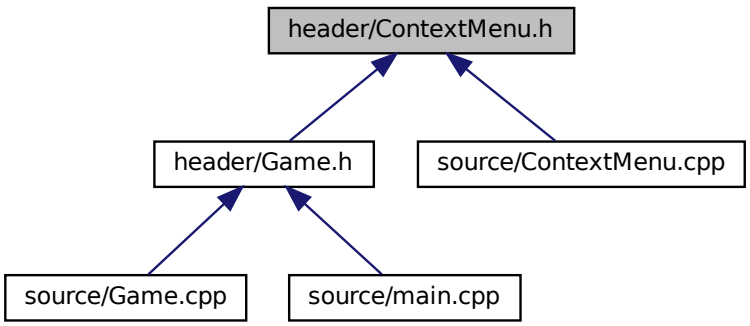
Header file for the ContextMenu class.

```
#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 | Game 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 };
```

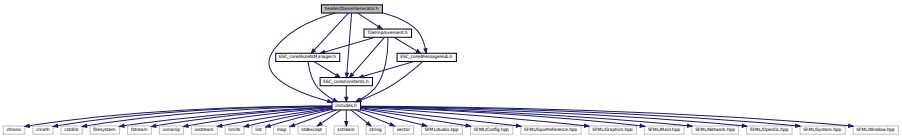
## 5.2 header/DieselGenerator.h File Reference

Header file for the DieselGenerator class.

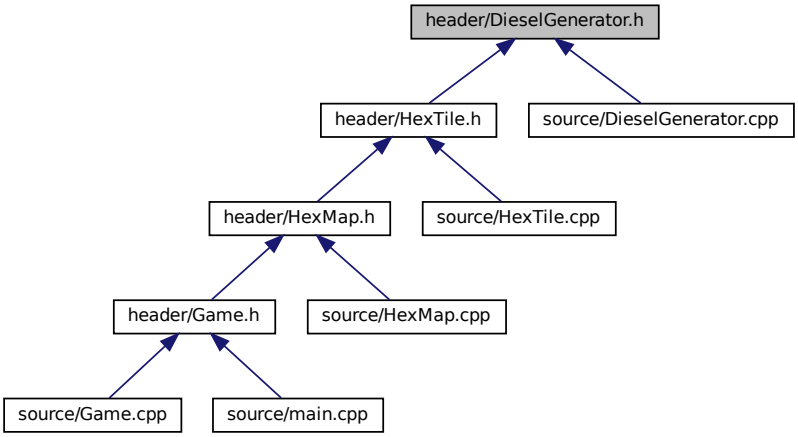
```
#include "ESC_core/constants.h"
#include "ESC_core/includes.h"
#include "ESC_core/AssetsManager.h"
```

```
#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

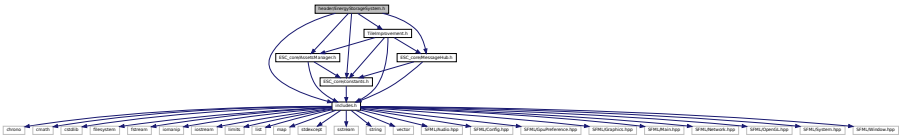
Header file for the DieselGenerator class.

## 5.3 header/EnergyStorageSystem.h File Reference

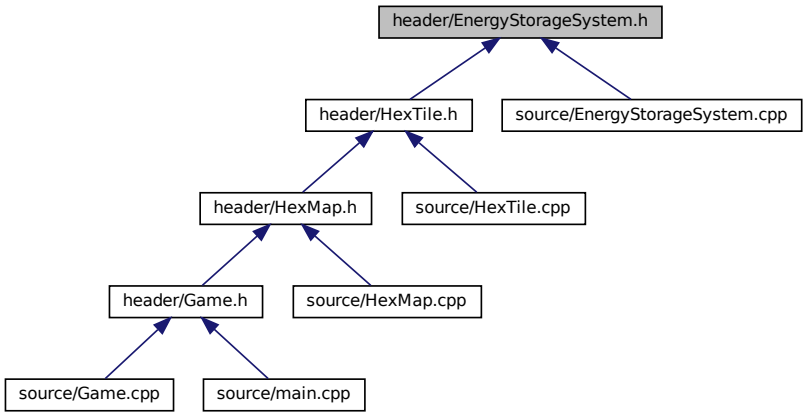
Header file for the EnergyStorageSystem class.

```
#include "ESC_core/constants.h"
#include "ESC_core/includes.h"
#include "ESC_core/AssetsManager.h"
#include "ESC_core/MessageHub.h"
```

```
#include "TileImprovement.h"
```
Include dependency graph for EnergyStorageSystem.h:



This graph shows which files directly or indirectly include this file:




## Classes

- class EnergyStorageSystem

  *A settlement class (child class of TileImprovement).*

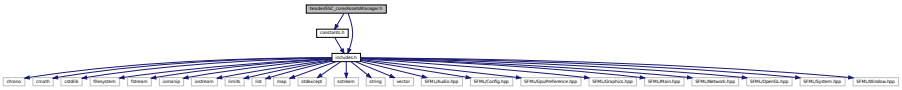
### 5.3.1 Detailed Description

Header file for the EnergyStorageSystem class.

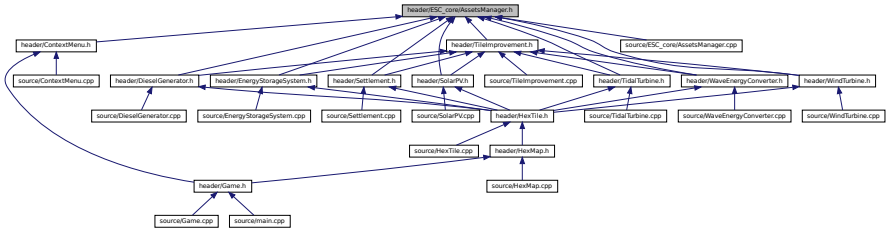
## 5.4 header/ESC_core/AssetsManager.h File Reference

Header file for the AssetsManager class.

```
#include "constants.h"
#include "includes.h"
```
Include dependency graph for AssetsManager.h:



This graph shows which files directly or indirectly include this file:




## Classes

- class AssetsManager

  *A class which manages visual and sound assets.*

### 5.4.1 Detailed Description

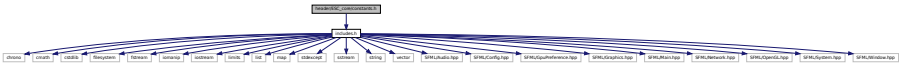
Header file for the AssetsManager class.

## 5.5 header/ESC_core/constants.h File Reference

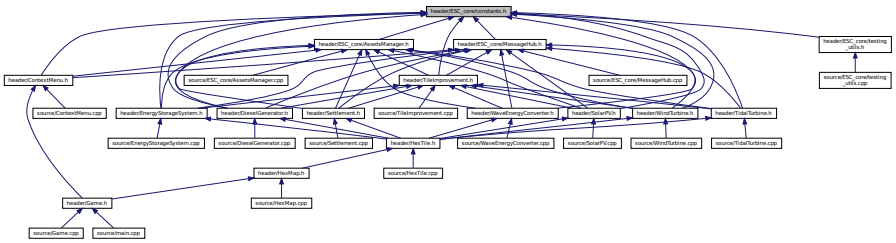
Header file for various constants.

```
#include "includes.h"
```

Include dependency graph for constants.h:



This graph shows which files directly or indirectly include this file:



## 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 ugrading) a diesel generator.*
- const int WIND_TURBINE_BUILD_COST = 400

  *The cost of building (or upgrading) a wind turbine.*
- 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.*
- 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.*
- const int WAVE_ENERGY_CONVERTER_BUILD_COST = 800

  *The cost of building (or upgrading) a wave energy converter.*
- const int ENERGY_STORAGE_SYSTEM_BUILD_COST = 400

  *The cost of building (or upgrading) an energy storage system.*
- const int SCRAP_COST = 50

  *The cost of scrapping a tile improvement (other than settlement).*
- 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 ugrading) a diesel generator.

#### 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 = 400
```

The cost of building (or upgrading) an energy storage system.

#### 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 NO_TILE_SELECTED_CHANNEL

```
const std::string NO_TILE_SELECTED_CHANNEL = "NO TILE SELECTED CHANNEL"
```

A message channel for no tile selected messages.

#### 5.5.3.17 RESOURCE_ASSESSMENT_COST

```
const int RESOURCE_ASSESSMENT_COST = 20
```

The cost of doing a resource assessment.

#### 5.5.3.18 SCRAP_COST

```
const int SCRAP_COST = 50
```

The cost of scrapping a tile improvement (other than settlement).

#### 5.5.3.19 SECONDS_PER_FRAME

```
const double SECONDS_PER_FRAME = 1.0 / 60
```

Target seconds per frame (just reciprocal of target frames per second).

#### 5.5.3.20 SECONDS_PER_MONTH

```
const unsigned long long int SECONDS_PER_MONTH = 2628164
```

#### 5.5.3.21 SECONDS_PER_YEAR

```
const unsigned long long int SECONDS_PER_YEAR = 31537970
```

#### 5.5.3.22 SOLAR_PV_BUILD_COST

```
const int SOLAR_PV_BUILD_COST = 300
```

The cost of building (or upgrading) a solar PV array.

#### 5.5.3.23 SOLAR_PV_WATER_BUILD_MULTIPLIER

```
const double SOLAR_PV_WATER_BUILD_MULTIPLIER = 1.5
```

The additional cost of building on water.

#### 5.5.3.24 STARTING_CREDITS

```
const int STARTING_CREDITS = 99999
```

The starting balance of credits.

#### 5.5.3.25 STARTING_POPULATION

```
const int STARTING_POPULATION = 100
```

The starting population of a settlement.

#### 5.5.3.26 TIDAL_TURBINE_BUILD_COST

```
const int TIDAL_TURBINE_BUILD_COST = 600
```

The cost of building (or upgrading) a tidal turbine.

#### 5.5.3.27 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).

#### 5.5.3.28 TILE_SELECTED_CHANNEL

```
const std::string TILE_SELECTED_CHANNEL = "TILE SELECTED CHANNEL"
```

A message channel for tile selection messages.

#### 5.5.3.29 TILE_STATE_CHANNEL

```
const std::string TILE_STATE_CHANNEL = "TILE STATE CHANNEL"
```

A message channel for tile state messages.

#### 5.5.3.30 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).

#### 5.5.3.31 WAVE_ENERGY_CONVERTER_BUILD_COST

```
const int WAVE_ENERGY_CONVERTER_BUILD_COST = 800
```

The cost of building (or upgrading) a wave energy converter.

#### 5.5.3.32 WIND_TURBINE_BUILD_COST

```
const int WIND_TURBINE_BUILD_COST = 400
```

The cost of building (or upgrading) a wind turbine.

#### 5.5.3.33 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]

## 5.7 header/ESC_core/includes.h File Reference

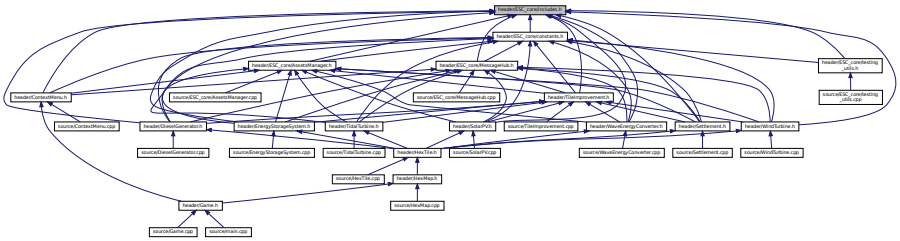
Header file for various includes.

```
#include <chrono>
#include <cmath>
#include <cstdlib>
#include <filesystem>
#include <fstream>
#include <iomanip>
#include <iostream>
#include <limits>
#include <list>
#include <map>
#include <stdexcept>
#include <sstream>
#include <string>
#include <vector>
#include <SFML/Audio.hpp>
#include <SFML/Config.hpp>
#include <SFML/GpuPreference.hpp>
#include <SFML/Graphics.hpp>
#include <SFML/Main.hpp>
#include <SFML/Network.hpp>
```

```
#include <SFML/OpenGL.hpp>
#include <SFML/System.hpp>
#include <SFML/Window.hpp>
```

Include dependency graph for includes.h:

This graph shows which files directly or indirectly include this file:



### 5.7.1 Detailed Description

Header file for various includes.

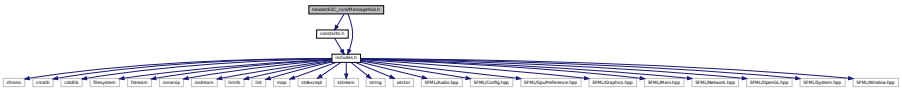
Ref: Gomila [2023]

## 5.8 header/ESC_core/MessageHub.h File Reference

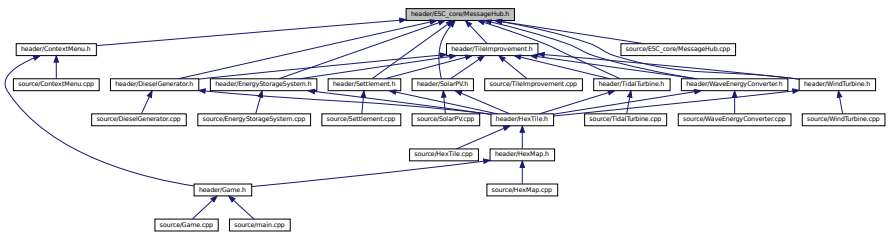
Header file for the MessageHub class.

```
#include "constants.h"
#include "includes.h"
```

Include dependency graph for MessageHub.h:



This graph shows which files directly or indirectly include this file:



### Classes

- struct Message

  *A structure which defines a standard message format.*
- class MessageHub

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

### 5.8.1 Detailed Description

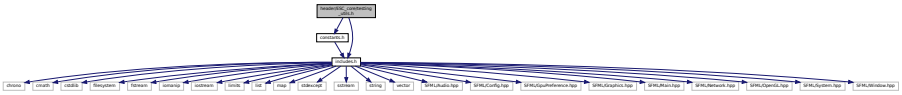
Header file for the MessageHub class.

## 5.9 header/ESC_core/testing_utils.h File Reference

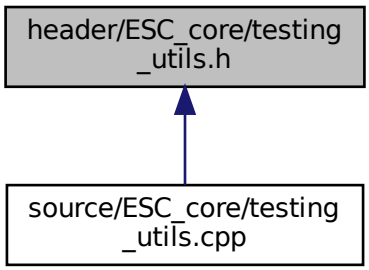
Header file for various testing utilities.

```
#include "constants.h"
#include "includes.h"
```

Include dependency graph for testing_utils.h:



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 >= y.*
- void testLessThan (double, double, std::string, int)

  *Tests if x < y.*
- void testLessThanOrEqualTo (double, double, std::string, int)

  *Tests if x <= 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**

| | |
|---|---|
| *file* | The file in which the test is applied (you should be able to just pass in "__FILE__"). |
| *line* | 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**

| | |
|---|---|
| *input_str* | 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**

| | |
|---|---|
| *input_str* | 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**

| | |
|---|---|
| *input_str* | 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**

| | |
|---|---|
| *x* | The first of two numbers to test. |
| *y* | The second of two numbers to test. |
| *file* | The file in which the test is applied (you should be able to just pass in "__FILE__"). |
| *line* | 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 testGreaterThan()

```
void testGreaterThan (
            double x,
            double y,
            std::string file,
            int line )
```

Tests if x $>$ y.

**Parameters**

| | |
|---|---|
| *x* | The first of two numbers to test. |
| *y* | The second of two numbers to test. |
| *file* | The file in which the test is applied (you should be able to just pass in "__FILE__"). |
| *line* | 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() */
```

#### 5.9.2.7 testGreaterThanOrEqualTo()

```
void testGreaterThanOrEqualTo (
              double x,
              double y,
              std::string file,
              int line )
```

Tests if x >= y.

**Parameters**

| | |
|---|---|
| *x* | The first of two numbers to test. |
| *y* | The second of two numbers to test. |
| *file* | The file in which the test is applied (you should be able to just pass in "__FILE__"). |
| *line* | 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**

| | |
|---|---|
| *x* | The first of two numbers to test. |
| *y* | The second of two numbers to test. |
| *file* | The file in which the test is applied (you should be able to just pass in "__FILE__"). |
| *line* | 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 <= y.

**Parameters**

| | |
|---|---|
| *x* | The first of two numbers to test. |
| *y* | The second of two numbers to test. |
| *file* | The file in which the test is applied (you should be able to just pass in "__FILE__"). |
| *line* | 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**

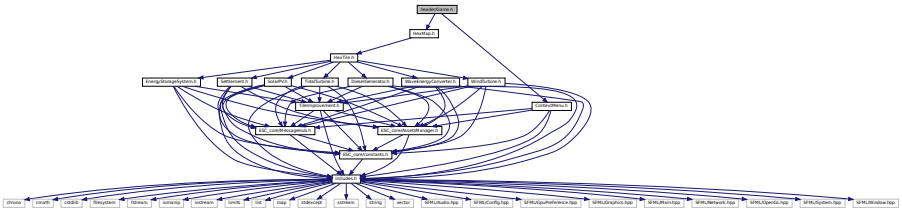
| | |
|---|---|
| *statement* | The statement whose truth is to be tested ("1 == 0", for example). |
| *file* | The file in which the test is applied (you should be able to just pass in "__FILE__"). |
| *line* | The line of the file in which the test is applied (you should be able to just pass in "__LINE__"). |

```
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() */
```

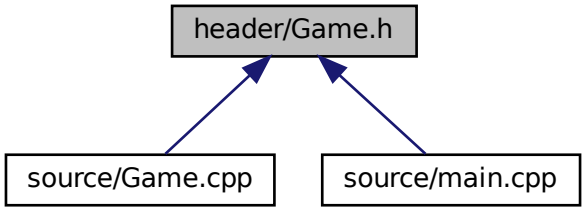
## 5.10 header/Game.h File Reference

```
#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.*

## Enumerations

- enum GamePhase {
  BUILD_SETTLEMENT , SYSTEM_MANAGEMENT , LOSS_EMISSIONS , LOSS_DEMAND ,
  LOSS_CREDITS , VICTORY , N_GAME_PHASES }

  *An enumeration of the various game phases.*

### 5.10.1 Enumeration Type Documentation

#### 5.10.1.1 GamePhase

```
enum GamePhase
```

An enumeration of the various game phases.

**Enumerator**

| | |
|---|---|
| BUILD_SETTLEMENT | The settlement building phase. |
| SYSTEM_MANAGEMENT | The system management phase (main phase of play). |
| LOSS_EMISSIONS | A loss due to excessive emissions. |
| LOSS_DEMAND | A loss due to failing to meet the demand. |
| LOSS_CREDITS | A loss due to running out of credits. |
| VICTORY | A victory (12 consecutive months of zero emissions). |
| N_GAME_PHASES | A simple hack to get the number of elements in GamePhase. |

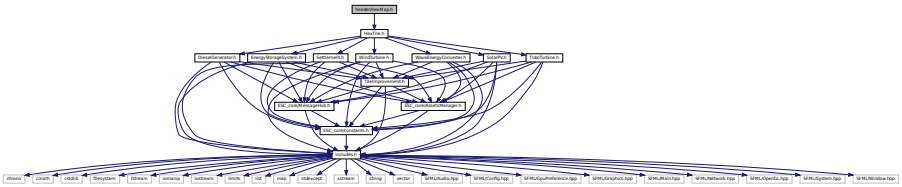
```
66                {
67      BUILD_SETTLEMENT,
68      SYSTEM_MANAGEMENT,
69      LOSS_EMISSIONS,
70      LOSS_DEMAND,
71      LOSS_CREDITS,
72      VICTORY,
73      N_GAME_PHASES
74  };  /* GamePhase */
```

## 5.11 header/HexMap.h File Reference

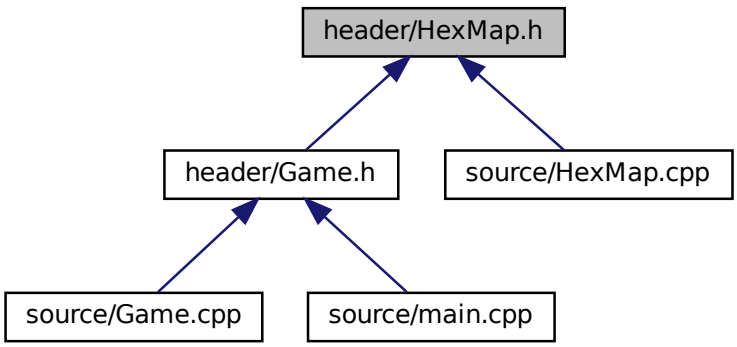
Header file for the HexMap class.

```
#include "HexTile.h"
```

Include dependency graph for HexMap.h:



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

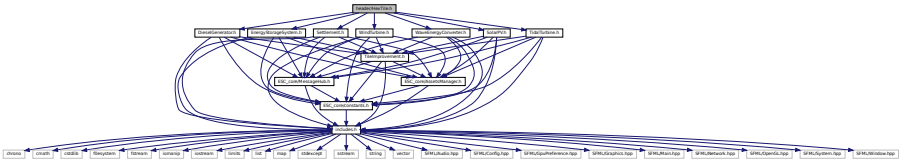
Header file for the HexMap class.

## 5.12 header/HexTile.h File Reference

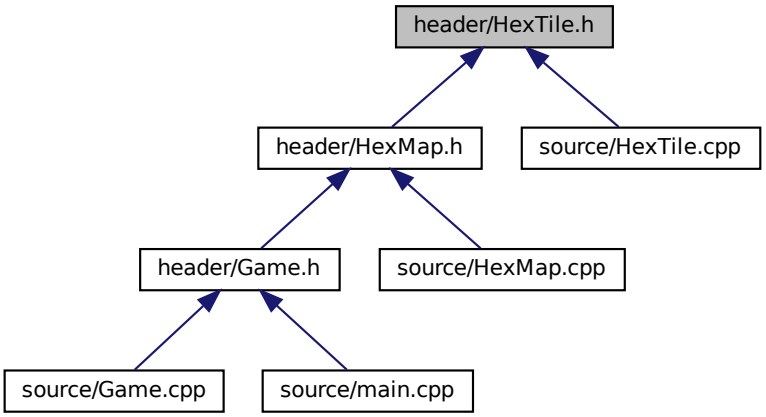
Header file for the Game class.

```
#include "DieselGenerator.h"
#include "EnergyStorageSystem.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. |

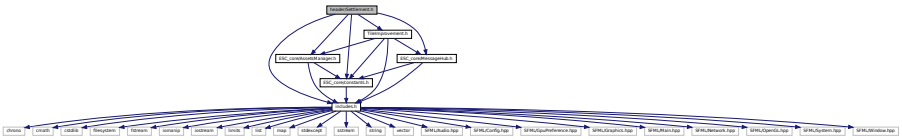
```
71              {
72     NONE_TYPE,
73     FOREST,
74     LAKE,
75     MOUNTAINS,
76     OCEAN,
77     PLAINS,
78     N_TILE_TYPES
79 }; /* TileType */
```

## 5.13 header/Settlement.h File Reference

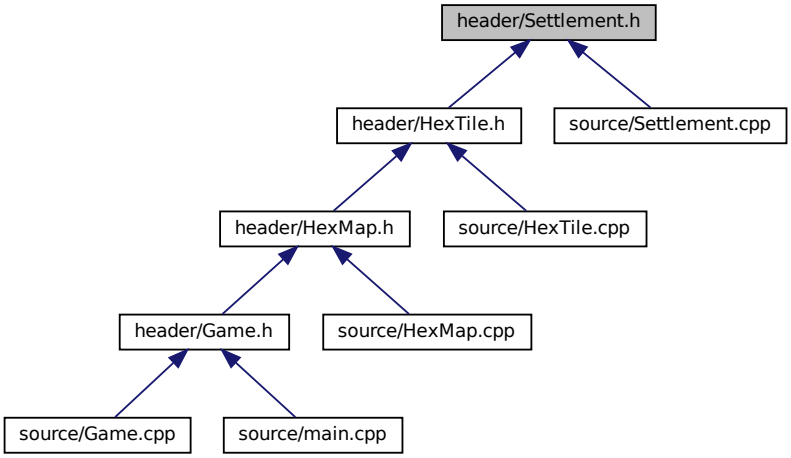
Header file for the Settlement class.

```
#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

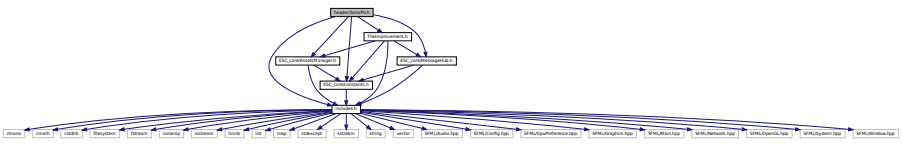
Header file for the Settlement class.

## 5.14 header/SolarPV.h File Reference

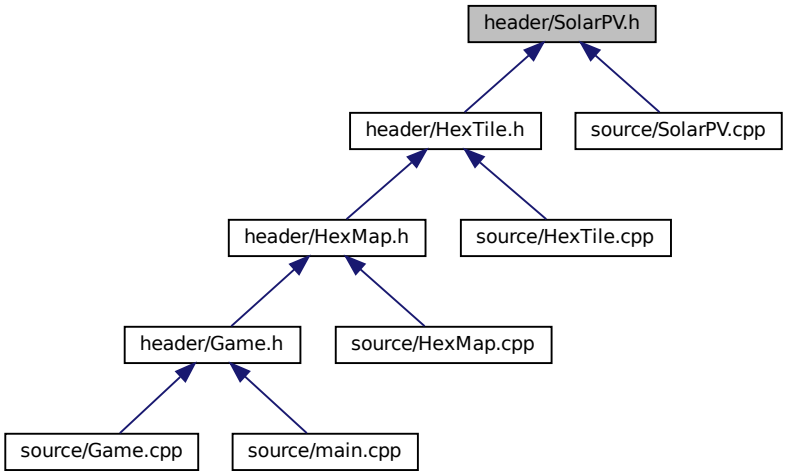
Header file for the SolarPV class.

```
#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

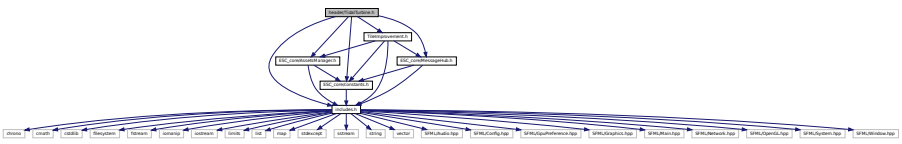
Header file for the SolarPV class.

## 5.15 header/TidalTurbine.h File Reference

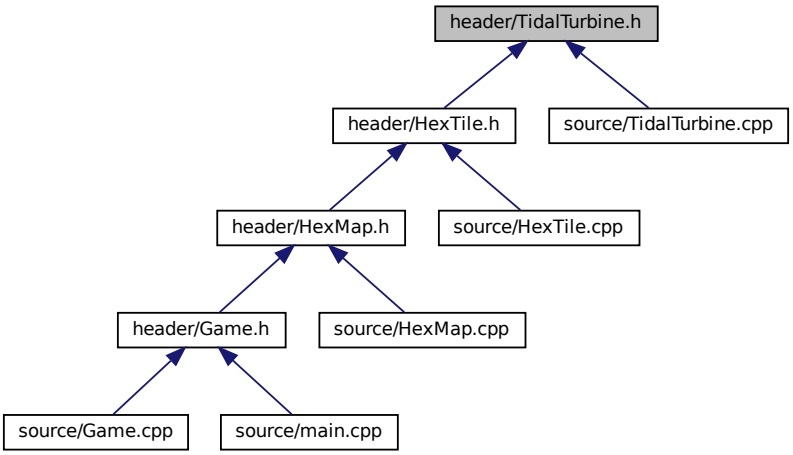
Header file for the TidalTurbine class.

```
#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

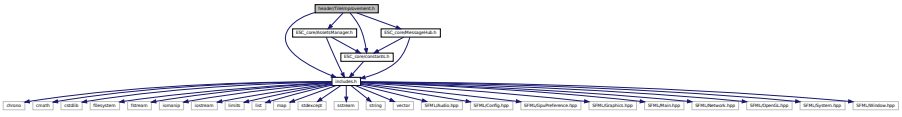
Header file for the TidalTurbine class.

## 5.16 header/TileImprovement.h File Reference

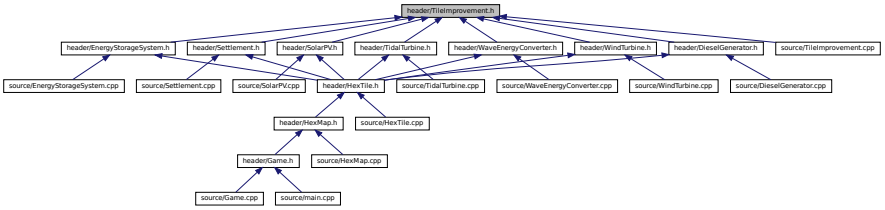
Header file for the TileImprovement class.

```
#include "ESC_core/constants.h"
#include "ESC_core/includes.h"
#include "ESC_core/AssetsManager.h"
#include "ESC_core/MessageHub.h"
```

Include dependency graph for TileImprovement.h:



This graph shows which files directly or indirectly include this file:




## Classes

- class TileImprovement

  *A base class for the tile improvement hierarchy.*

## Enumerations

- enum TileImprovementType {
  SETTLEMENT , DIESEL_GENERATOR , SOLAR_PV , WIND_TURBINE ,
  TIDAL_TURBINE , WAVE_ENERGY_CONVERTER , ENERGY_STORAGE_SYSTEM , N_TILE_IMPROVEMENT_TYPES
  }

  *An enumeration of the different tile improvement types.*

### 5.16.1 Detailed Description

Header file for the TileImprovement class.

### 5.16.2 Enumeration Type Documentation

#### 5.16.2.1 TileImprovementType

`enum TileImprovementType`

An enumeration of the different tile improvement types.

**Enumerator**

| | |
|---|---|
| SETTLEMENT | A settlement. |
| DIESEL_GENERATOR | A diesel generator. |
| SOLAR_PV | A solar PV array. |
| WIND_TURBINE | A wind turbine. |
| TIDAL_TURBINE | A tidal turbine. |
| WAVE_ENERGY_CONVERTER | A wave energy converter. |
| ENERGY_STORAGE_SYSTEM | An energy storage system. |
| N_TILE_IMPROVEMENT_TYPES | A simple hack to get the number of elements in TileImprovementType. |

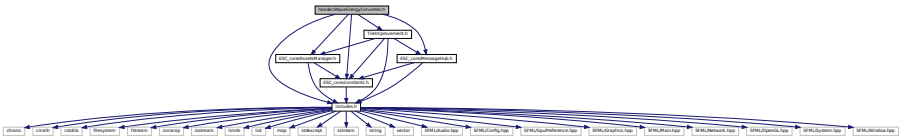
```
68                          {
69     SETTLEMENT,
70     DIESEL_GENERATOR,
71     SOLAR_PV,
72     WIND_TURBINE,
73     TIDAL_TURBINE,
74     WAVE_ENERGY_CONVERTER,
75     ENERGY_STORAGE_SYSTEM,
76     N_TILE_IMPROVEMENT_TYPES
77 };  /* TileImprovementType */
```

## 5.17 header/WaveEnergyConverter.h File Reference

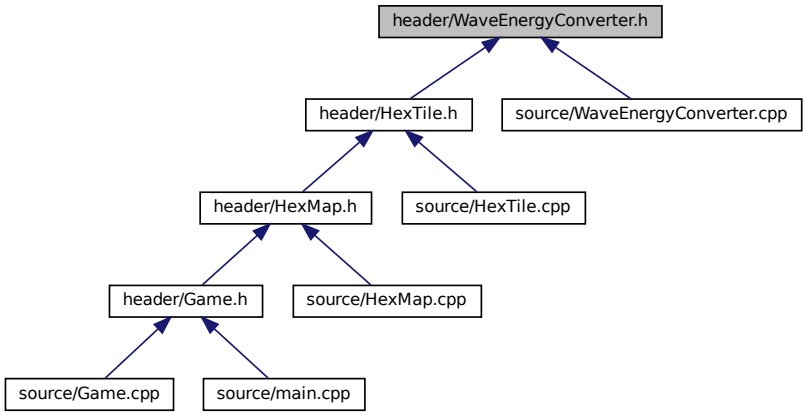
Header file for the WaveEnergyConverter class.

```
#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 WaveEnergyConverter.h:



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

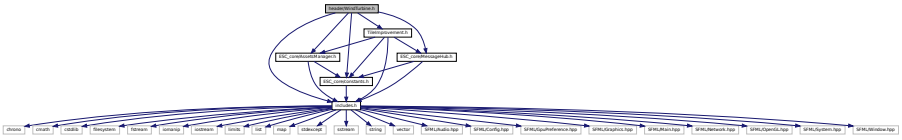
Header file for the WaveEnergyConverter class.

## 5.18 header/WindTurbine.h File Reference

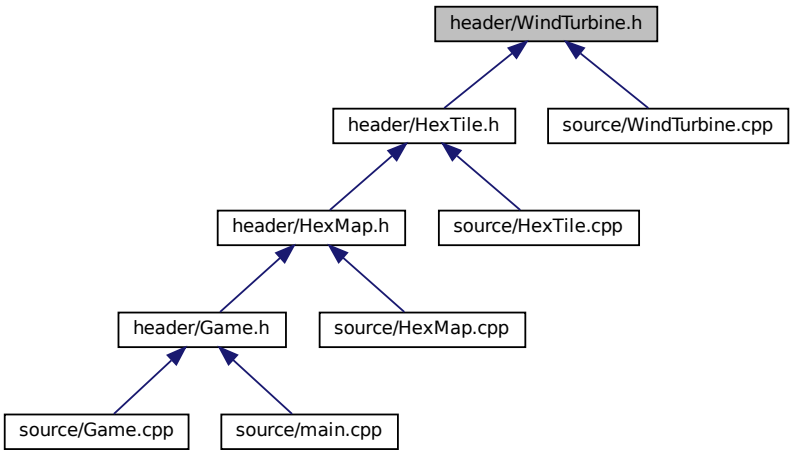
Header file for the WindTurbine class.

```
#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:



This graph shows which files directly or indirectly include this file:




### Classes

- class WindTurbine

  *A settlement class (child class of TileImprovement).*

### 5.18.1 Detailed Description

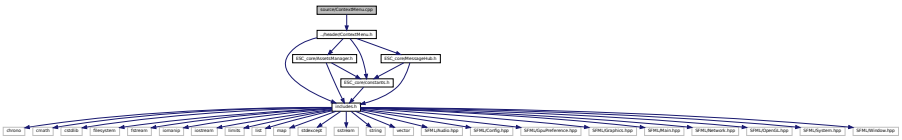
Header file for the WindTurbine class.

## 5.19 source/ContextMenu.cpp File Reference

Implementation file for the ContextMenu class.

```
#include "../header/ContextMenu.h"
```

Include dependency graph for ContextMenu.cpp:



### 5.19.1 Detailed Description

Implementation file for the ContextMenu class.

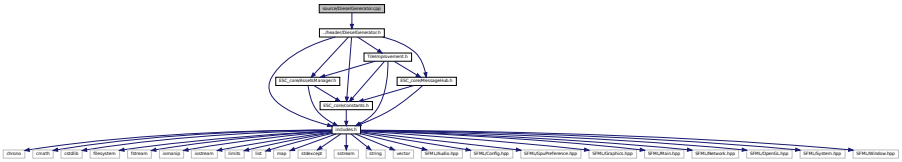
A class which defines a context menu for the game.

## 5.20 source/DieselGenerator.cpp File Reference

Implementation file for the DieselGenerator class.

```
#include "../header/DieselGenerator.h"
```

Include dependency graph for DieselGenerator.cpp:



### 5.20.1 Detailed Description

Implementation file for the DieselGenerator class.

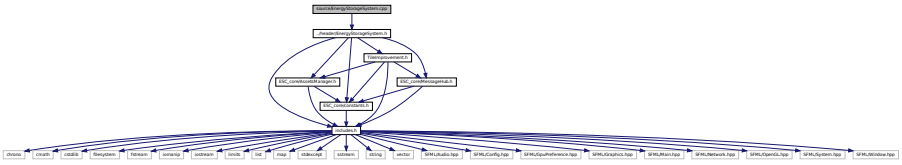
A base class for the tile improvement hierarchy.

## 5.21 source/EnergyStorageSystem.cpp File Reference

Implementation file for the EnergyStorageSystem class.

```
#include "../header/EnergyStorageSystem.h"
```

Include dependency graph for EnergyStorageSystem.cpp:



### 5.21.1 Detailed Description

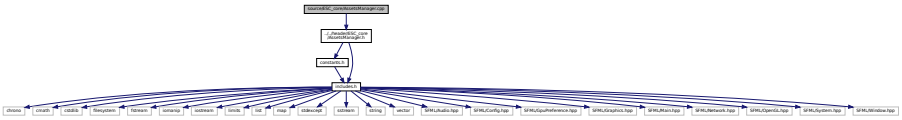
Implementation file for the EnergyStorageSystem class.

A base class for the tile improvement hierarchy.

## 5.22 source/ESC_core/AssetsManager.cpp File Reference

Implementation file for the AssetsManager class.

```
#include "../../header/ESC_core/AssetsManager.h"
```
Include dependency graph for AssetsManager.cpp:



### 5.22.1 Detailed Description

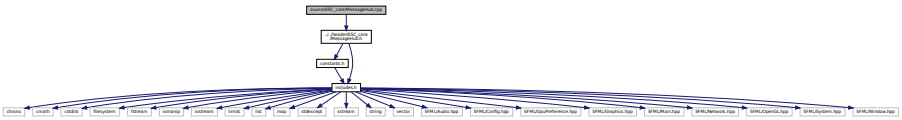
Implementation file for the AssetsManager class.

A class which manages visual and sound assets.

## 5.23 source/ESC_core/MessageHub.cpp File Reference

Implementation file for the MessageHub class.

```
#include "../../header/ESC_core/MessageHub.h"
```
Include dependency graph for MessageHub.cpp:



### 5.23.1 Detailed Description

Implementation file for the MessageHub class.

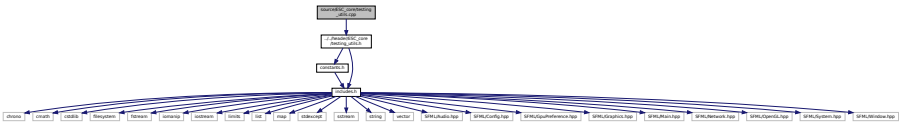
A class which acts as a central hub for inter-object message traffic.

## 5.24 source/ESC_core/testing_utils.cpp File Reference

Implementation file for various testing utilities.

```
#include "../../header/ESC_core/testing_utils.h"
```

Include dependency graph for testing_utils.cpp:



### 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 >= 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 <= 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**

| | |
|---|---|
| *file* | The file in which the test is applied (you should be able to just pass in "__FILE__"). |
| *line* | 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() */
```

#### 5.24.2.2 printGold()

```
void printGold (
            std::string input_str )
```

A function that sends gold text to std::cout.

**Parameters**

| | |
|---|---|
| *input_str* | 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**

| | |
|---|---|
| *input_str* | 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**

| | |
|---|---|
| *input_str* | 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() */
```

#### 5.24.2.5 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**

| | |
|---|---|
| *x* | The first of two numbers to test. |
| *y* | The second of two numbers to test. |
| *file* | The file in which the test is applied (you should be able to just pass in "__FILE__"). |
| *line* | 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() */
```

#### 5.24.2.6 testGreaterThan()

```
void testGreaterThan (
            double x,
```

```
            double y,
            std::string file,
            int line )
```

Tests if x > y.

**Parameters**

| | |
|---|---|
| *x* | The first of two numbers to test. |
| *y* | The second of two numbers to test. |
| *file* | The file in which the test is applied (you should be able to just pass in "__FILE__"). |
| *line* | 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 >= y.

**Parameters**

| | |
|---|---|
| *x* | The first of two numbers to test. |
| *y* | The second of two numbers to test. |
| *file* | The file in which the test is applied (you should be able to just pass in "__FILE__"). |
| *line* | 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**

| | |
|---|---|
| *x* | The first of two numbers to test. |
| *y* | The second of two numbers to test. |
| *file* | The file in which the test is applied (you should be able to just pass in "__FILE__"). |
| *line* | 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 <= y.

**Parameters**

| | |
|---|---|
| *x* | The first of two numbers to test. |
| *y* | The second of two numbers to test. |
| *file* | The file in which the test is applied (you should be able to just pass in "__FILE__"). |
| *line* | 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**

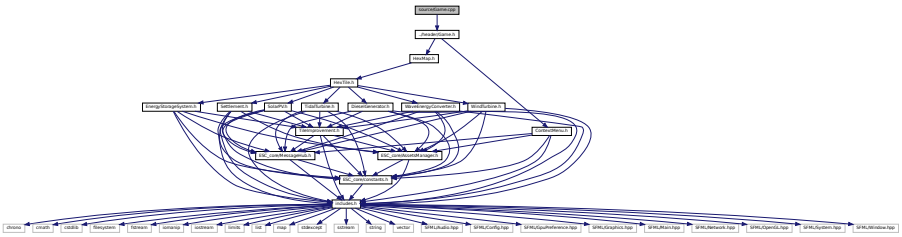
| | |
|---|---|
| *statement* | The statement whose truth is to be tested ("1 == 0", for example). |
| *file* | The file in which the test is applied (you should be able to just pass in "__FILE__"). |
| *line* | The line of the file in which the test is applied (you should be able to just pass in "__LINE__"). |

```
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:



### 5.25.1 Detailed Description

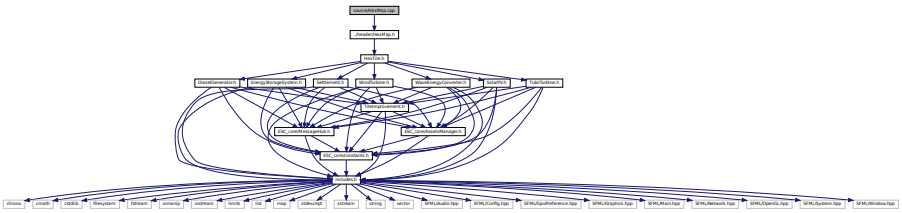
Implementation file for the Game class.

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

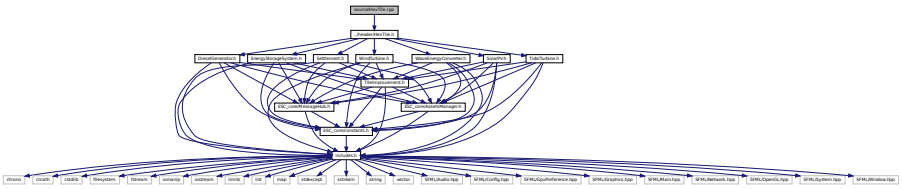
Implementation file for the HexMap class.

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

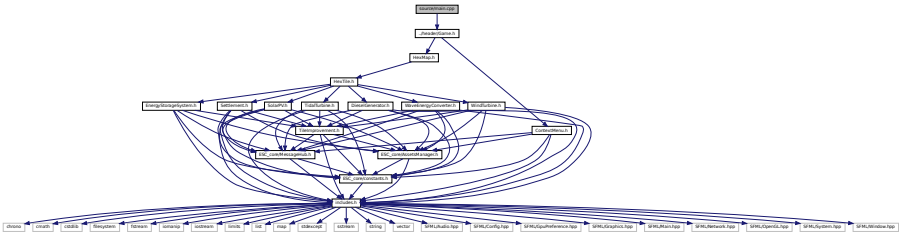
Implementation file for the HexTile class.

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.

```
294 {
295     sf::RenderWindow* render_window_ptr = new sf::RenderWindow(
296         sf::VideoMode(GAME_WIDTH, GAME_HEIGHT),
297         "Road To Zero"
298     );
299 
300     return render_window_ptr;
301 }   /* constructRenderWindow() */
```

### 5.28.2.2 loadAssets()

```
void loadAssets (
            AssetsManager * assets_manager_ptr )
```

Helper function to load game assets.

**Parameters**

| | |
|---|---|
| *assets_manager_ptr* | 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
149     //  3. load sounds
150     assets_manager_ptr->loadSound(
151         "assets/audio/samples/mixkit-magical-coin-win-1936_MixkitFree.ogg",
152         "coin ring"
153     );
154
155     assets_manager_ptr->loadSound(
156         "assets/audio/samples/mixkit-positive-notification-951_MixkitFree.ogg",
157         "positive notification"
158     );
159
160     assets_manager_ptr->loadSound(
161         "assets/audio/samples/mixkit-sci-fi-click-900_MixkitFree.ogg",
162         "sci-fi click"
163     );
164
165     assets_manager_ptr->loadSound(
166         "assets/audio/samples/mixkit-apartment-buzzer-bell-press-932_MixkitFree.ogg",
167         "insufficient credits"
168     );
169
170     assets_manager_ptr->loadSound(
171         "assets/audio/samples/mixkit-data-scanner-2487_MixkitFree.ogg",
172         "resource assessment"
173     );
174
175     assets_manager_ptr->loadSound(
176         "assets/audio/samples/mixkit-interface-click-1126_MixkitFree.ogg",
177         "console string print"
178     );
179
180     assets_manager_ptr->loadSound(
181         "assets/audio/samples/mixkit-video-game-retro-click-237_MixkitFree.ogg",
```

```
182         "resource overlay toggle on"
183     );
184 
185     assets_manager_ptr->loadSound(
186         "assets/audio/samples/mixkit-video-game-retro-click-237_REVERSED_MixkitFree.ogg",
187         "resource overlay toggle off"
188     );
189 
190     assets_manager_ptr->loadSound(
191         "assets/audio/samples/mixkit-explosion-with-rocks-debris-1703_MixkitFree.ogg",
192         "clear mountains tile"
193     );
194 
195     assets_manager_ptr->loadSound(
196         "assets/audio/samples/mixkit-arcade-game-explosion-2759_MixkitFree.ogg",
197         "clear non-mountains tile"
198     );
199 
200     assets_manager_ptr->loadSound(
201         "assets/audio/samples/mixkit-electronic-retro-block-hit-2185_MixkitFree.ogg",
202         "place improvement"
203     );
204 
205     assets_manager_ptr->loadSound(
206         "assets/audio/samples/mixkit-video-game-lock-2851_REVERSED_MixkitFree.ogg",
207         "build menu open"
208     );
209 
210     assets_manager_ptr->loadSound(
211         "assets/audio/samples/mixkit-video-game-lock-2851_MixkitFree.ogg",
212         "build menu close"
213     );
214 
215     assets_manager_ptr->loadSound(
216         "assets/audio/samples/mixkit-jump-into-the-water-1180_MixkitFree.ogg",
217         "splash"
218     );
219 
220     assets_manager_ptr->loadSound(
221         "assets/audio/samples/505316__nuncaconoci__diesel_CC0.ogg",
222         "diesel running"
223     );
224 
225     assets_manager_ptr->loadSound(
226         "assets/audio/samples/33460__pempi__320d_2_CC-BY.ogg",
227         "diesel start"
228     );
229 
230     assets_manager_ptr->loadSound(
231         "assets/audio/samples/132724__andy_gardner__wind-turbine-blades_CC-BY.ogg",
232         "wind turbine running"
233     );
234 
235     assets_manager_ptr->loadSound(
236         "assets/audio/samples/58416__darren1979__oceanwaves_CC-SAMPLING.ogg",
237         "ocean waves"
238     );
239 
240     assets_manager_ptr->loadSound(
241         "assets/audio/samples/369927__mephisto_egmont__water-flowing-in-tubes_CC-BY.ogg",
242         "water flow"
243     );
244 
245     assets_manager_ptr->loadSound(
246 
    "assets/audio/samples/647663__jotraing__electric-train-motor-idle-loop-new-generation-rollingstock_CC0.ogg",
247         "energy storage system idle"
248     );
249 
250     assets_manager_ptr->loadSound(
251         "assets/audio/samples/mixkit-epic-futuristic-movie-accent-2913_MixkitFree.ogg",
252         "game title screen"
253     );
254 
255     assets_manager_ptr->loadSound(
256         "assets/audio/samples/mixkit-calm-park-with-people-and-children_MixkitFree.ogg",
257         "people and children"
258     );
259 
260 
261     //  4. load tracks
262     assets_manager_ptr->loadTrack(
263         "assets/audio/tracks/TreeStarMoon_Dobranoc_CC0.ogg",
264         "Tree Star Moon - Dobranoc"
265     );
266 
267     assets_manager_ptr->loadTrack(
```

```
268         "assets/audio/tracks/TreeStarMoon_Lighthouse_CC0.ogg",
269         "Tree Star Moon - Lighthouse"
270     );
271
272     assets_manager_ptr->loadTrack(
273         "assets/audio/tracks/TreeStarMoon_SkyFarm_CC0.ogg",
274         "Tree Star Moon - Sky Farm"
275     );
276
277     return;
278 }   /* loadAssets() */
```

#### 5.28.2.3 main()

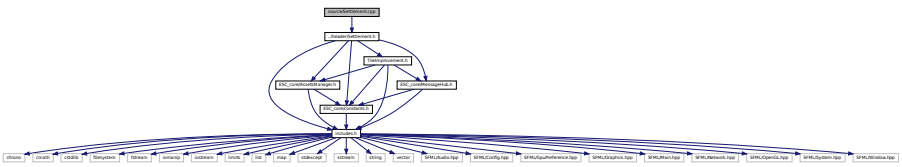
```
int main (
             int argc,
             char ** argv )
310 {
311     //  1. load assets
312     AssetsManager assets_manager;
313     loadAssets(&assets_manager);
314
315     //  2. construct render window
316     sf::RenderWindow* render_window_ptr = constructRenderWindow();
317
318     //  3. start game loop
319     bool quit_game = false;
320     assets_manager.playTrack();
321
322     while (not quit_game) {
323         Game game(render_window_ptr, &assets_manager);
324         quit_game = game.run();
325     }
326
327     //  4. clean up
328     render_window_ptr->close();
329     delete render_window_ptr;
330
331     return 0;
332 }   /* main() */
```

## 5.29 source/Settlement.cpp File Reference

Implementation file for the Settlement class.

```
#include "../header/Settlement.h"
```

Include dependency graph for Settlement.cpp:



### 5.29.1 Detailed Description

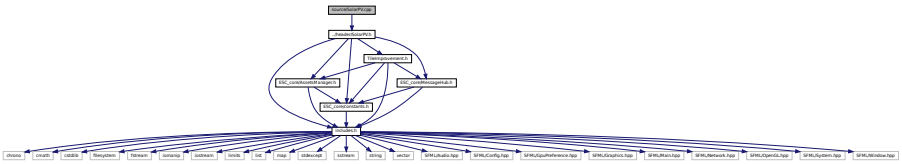
Implementation file for the Settlement class.

A base class for the tile improvement hierarchy.

## 5.30 source/SolarPV.cpp File Reference

Implementation file for the SolarPV class.

```
#include "../header/SolarPV.h"
```
Include dependency graph for SolarPV.cpp:



### 5.30.1 Detailed Description

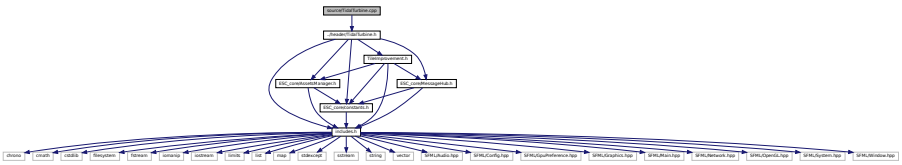
Implementation file for the SolarPV class.

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

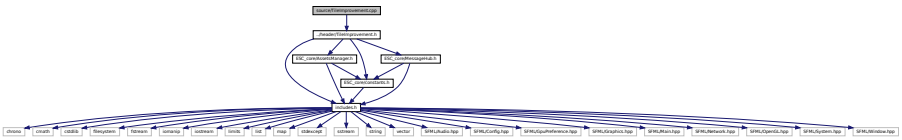
Implementation file for the TidalTurbine class.

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

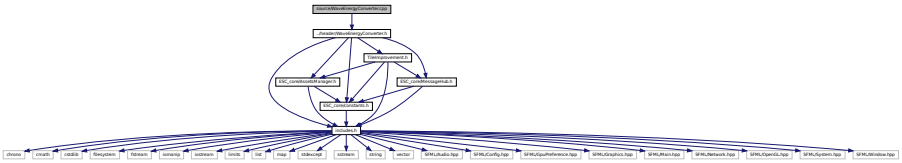
Implementation file for the TileImprovement class.

A base class for the tile improvement hierarchy.

## 5.33 source/WaveEnergyConverter.cpp File Reference

Implementation file for the WaveEnergyConverter class.

```
#include "../header/WaveEnergyConverter.h"
```
Include dependency graph for WaveEnergyConverter.cpp:



### 5.33.1 Detailed Description

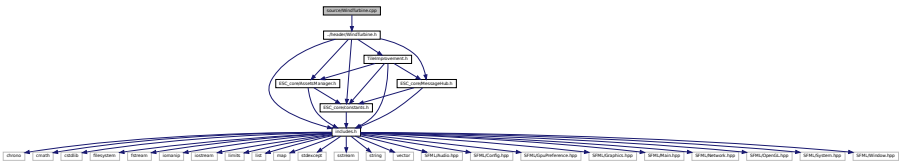
Implementation file for the WaveEnergyConverter class.

A base class for the tile improvement hierarchy.

## 5.34 source/WindTurbine.cpp File Reference

Implementation file for the WindTurbine class.

```
#include "../header/WindTurbine.h"
```
Include dependency graph for WindTurbine.cpp:



### 5.34.1 Detailed Description

Implementation file for the WindTurbine class.

A base class for the tile improvement hierarchy.

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# Index