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:

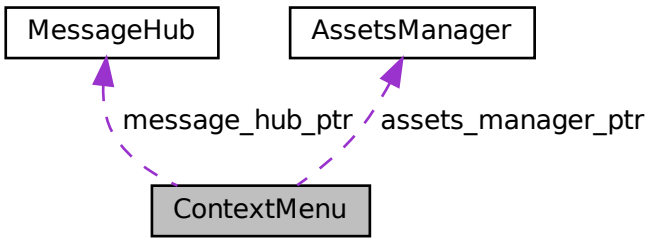
- header/ESC_core/AssetsManager.h
- source/ESC_core/AssetsManager.cpp

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:

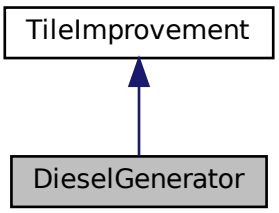
- header/ContextMenu.h
- source/ContextMenu.cpp

4.3 DieselGenerator Class Reference

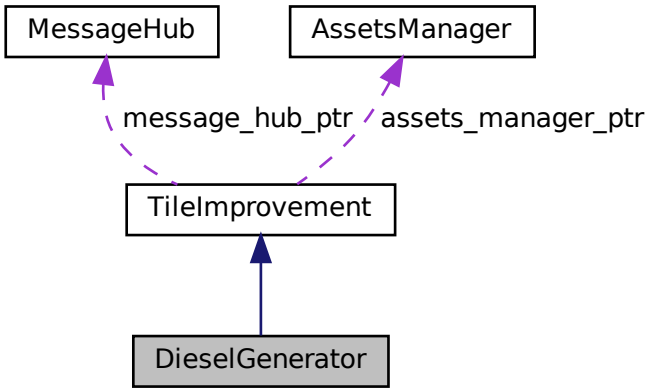
A settlement class (child class of TileImprovement).

```
#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 __upgrade (void)

  Helper method to upgrade the diesel generator.
- void __handleKeyPressEvents (void)

  Helper method to handle key press events.
- void __handleMouseButtonEvents (void)

  Helper method to handle mouse button events.

Additional Inherited Members

4.3.1 Detailed Description

A settlement class (child class of TileImprovement).

4.3.2 Constructor & Destructor Documentation

4.3.2.1 DieselGenerator()

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

Constructor for the DieselGenerator class.

Ref: Wikipedia [2023]

Parameters

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.

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

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

4.3.2.2 ~DieselGenerator()

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

Destructor for the DieselGenerator class.

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

4.3.3 Member Function Documentation

4.3.3.1 __handleKeyPressEvents()

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

Helper method to handle key press events.

```
159 {
160     if (this->just_built) {
161         return;
162     }
163 
164 
165     switch (this->event_ptr->key.code) {
```

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

4.3.3.2 __handleMouseButtonEvents()

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

Helper method to handle mouse button events.

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

4.3.3.3 __setUpTileImprovementSpriteAnimated()

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

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

```
68 {
69     sf::Sprite diesel_generator_sheet(
70         *(this->assets_manager_ptr->getTexture("diesel generator"))
71     );
72 
73     int n_elements = diesel_generator_sheet.getLocalBounds().height / 64;
74 
```

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

4.3.3.4 __upgrade()

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

Helper method to upgrade the diesel generator.

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

4.3.3.5 draw()

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

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

Reimplemented from TileImprovement.

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

4.3.3.6 getTileOptionsSubstring()

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

Helper method to assemble and return tile options substring.

Returns

Tile options substring.

Reimplemented from TileImprovement.

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

4.3.3.7 processEvent()

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

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

Reimplemented from TileImprovement.

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

4.3.3.8 processMessage()

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

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

Reimplemented from TileImprovement.

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

4.3.4 Member Data Documentation

4.3.4.1 capacity_kW

```
int DieselGenerator::capacity_kW
```

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

4.3.4.2 max_production_MWh

```
int DieselGenerator::max_production_MWh
```

The maximum production [MWh] for this turn.

4.3.4.3 production_MWh

```
int DieselGenerator::production_MWh
```

The current production [MWh] of the diesel generator.

4.3.4.4 smoke_da

```
double DieselGenerator::smoke_da
```

The per frame delta in smoke particle alpha value.

4.3.4.5 smoke_dx

```
double DieselGenerator::smoke_dx
```

The per frame delta in smoke particle x position.

4.3.4.6 smoke_dy

```
double DieselGenerator::smoke_dy
```

The per frame delta in smoke particle y position.

4.3.4.7 smoke_prob

```
double DieselGenerator::smoke_prob
```

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

4.3.4.8 smoke_sprite_list

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

A list of smoke sprite (for chimney animation).

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

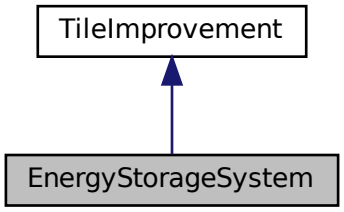
- header/DieselGenerator.h
- source/DieselGenerator.cpp

4.4 EnergyStorageSystem Class Reference

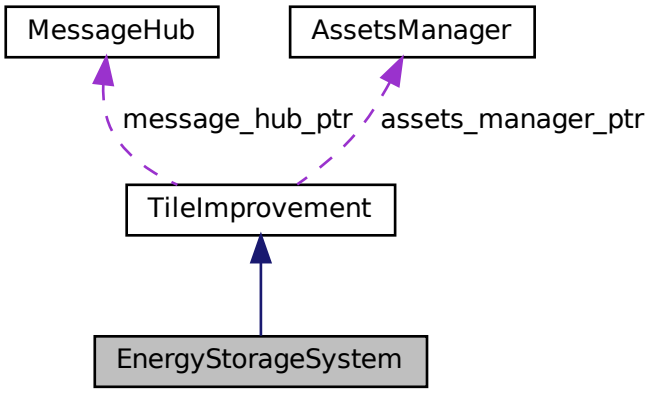
A settlement class (child class of TileImprovement).

`#include <EnergyStorageSystem.h>`

Inheritance diagram for EnergyStorageSystem:



Collaboration diagram for EnergyStorageSystem:



Public Member Functions

- EnergyStorageSystem (double, double, sf::Event ∗, sf::RenderWindow ∗, AssetsManager ∗, MessageHub ∗)

  Constructor for the EnergyStorageSystem class.
- void setIsSelected (bool)

  Method to set the is selected attribute.
- std::string getTileOptionsSubstring (void)

  Helper method to assemble and return tile options substring.
- void processEvent (void)

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

- void processMessage (void)

  Method to process EnergyStorageSystem. To be called once per message.
- void draw (void)

  Method to draw the hex tile to the render window. To be called once per frame.
- virtual ~EnergyStorageSystem (void)

  Destructor for the EnergyStorageSystem class.

Public Attributes

- int capacity_MWh

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

  The charge [MWh] in the energy storage system.

Private Member Functions

- void __setUpTileImprovementSpriteStatic (void)

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

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

  Helper method to upgrade the diesel generator.
- void __handleKeyPressEvents (void)

  Helper method to handle key press events.
- void __handleMouseButtonEvents (void)

  Helper method to handle mouse button events.

Additional Inherited Members

4.4.1 Detailed Description

A settlement class (child class of TileImprovement).

4.4.2 Constructor & Destructor Documentation

4.4.2.1 EnergyStorageSystem()

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

Constructor for the EnergyStorageSystem class.

Ref: Wikipedia [2023]

Parameters

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.

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

4.4.2.2 ~EnergyStorageSystem()

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

Destructor for the EnergyStorageSystem class.

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

4.4.3 Member Function Documentation

4.4.3.1 __handleKeyPressEvents()

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

Helper method to handle key press events.

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

4.4.3.2 __handleMouseButtonEvents()

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

Helper method to handle mouse button events.

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

4.4.3.3 __setUpProductionMenu()

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

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

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

4.4.3.4 __setUpTileImprovementSpriteStatic()

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

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

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

4.4.3.5 __upgrade()

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

Helper method to upgrade the diesel generator.

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

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

4.4.3.6 draw()

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

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

Reimplemented from TileImprovement.

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

4.4.3.7 getTileOptionsSubstring()

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

Helper method to assemble and return tile options substring.

Returns

Tile options substring.

Reimplemented from TileImprovement.

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

4.4.3.8 processEvent()

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

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

Reimplemented from TileImprovement.

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

4.4.3.9 processMessage()

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

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

Reimplemented from TileImprovement.

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

4.4.3.10 setIsSelected()

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

Method to set the is selected attribute.

Parameters

is_selected	The value to set the is selected attribute to.

Reimplemented from TileImprovement.

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

4.4.4 Member Data Documentation

4.4.4.1 capacity_MWh

```
int EnergyStorageSystem::capacity_MWh
```

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

4.4.4.2 charge_MWh

```
int EnergyStorageSystem::charge_MWh
```

The charge [MWh] in the energy storage system.

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

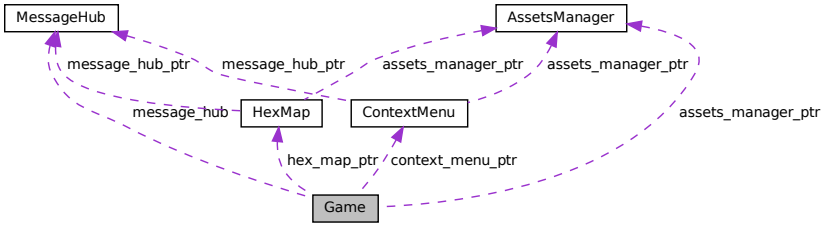
- header/EnergyStorageSystem.h
- source/EnergyStorageSystem.cpp

4.5 Game Class Reference

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

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

Collaboration diagram for Game:



Public Member Functions

- Game (sf::RenderWindow *, AssetsManager *)

  Constructor for the Game class.
- bool run (void)

  Method to run game (defines game loop).
- ~Game (void)

  Destructor for the Game class.

Public Attributes

- GamePhase game_phase

  The current phase of the game.
- bool quit_game

  Boolean indicating whether to quit (true) or create a new Game instance (false).
- bool game_loop_broken

  Boolean indicating whether or not the game loop is broken.
- bool show_frame_clock_overlay

  Boolean indicating whether or not to show frame and clock overlay.
- unsigned long long int frame

  The current frame of the game.
- double time_since_start_s

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

  Current game year.
- int month

  Current game month.
- int population

  Current population.
- int credits

  Current balance of credits.
- int demand_MWh

  Current energy demand [MWh].
- int cumulative_emissions_tonnes

  Cumulative emissions [tonnes] (1 tonne = 1000 kg).
- int turn = 0

  The current game turn.
- sf::Clock clock

  The game clock.
- sf::Event event

  The game events class.
- MessageHub message_hub

  The message hub (for inter-object message traffic).
- HexMap * hex_map_ptr

  Pointer to the hex map (defines game world).
- ContextMenu * context_menu_ptr

  Pointer to the context menu.

Private Member Functions

- void __toggleFrameClockOverlay (void)

  Helper method to toggle frame clock overlay.
- void __handleKeyPressEvents (void)

  Helper method to handle key press events.
- void __handleMouseButtonEvents (void)

  Helper method to handle mouse button events.
- void __processEvent (void)

  Helper method to process Game. To be called once per event.
- void __processMessage (void)

Helper method to process Game. To be called once per message.

- void __sendGameStateMessage (void)

  Helper method to format and send a game state message.
- void __insufficientCreditsAlarm (void)

  Helper method to sound and display and insufficient credits alarm.
- void __drawFrameClockOverlay (void)

  Helper method to draw frame clock overlay.
- void __drawHUD (void)

  Helper method to heads-up display (HUD).
- void __draw (void)

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

Private Attributes

- sf::RenderWindow * render_window_ptr

  A pointer to the render window.
- AssetsManager * assets_manager_ptr

  A pointer to the assets manager.

4.5.1 Detailed Description

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

4.5.2 Constructor & Destructor Documentation

4.5.2.1 Game()

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

Constructor for the Game class.

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

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

4.5.2.2 ~Game()

```
Game::~Game (
            void  )
```

Destructor for the Game class.

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

4.5.3 Member Function Documentation

4.5.3.1 __draw()

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

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

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

4.5.3.2 __drawFrameClockOverlay()

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

Helper method to draw frame clock overlay.

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

4.5.3.3 __drawHUD()

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

Helper method to heads-up display (HUD).

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

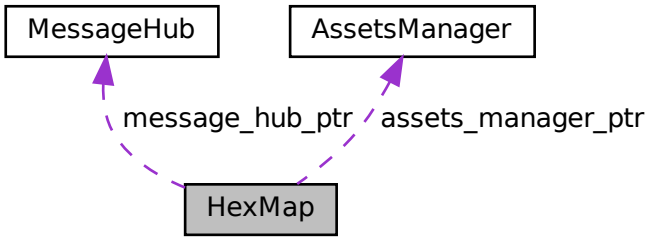
- header/Game.h
- source/Game.cpp

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:

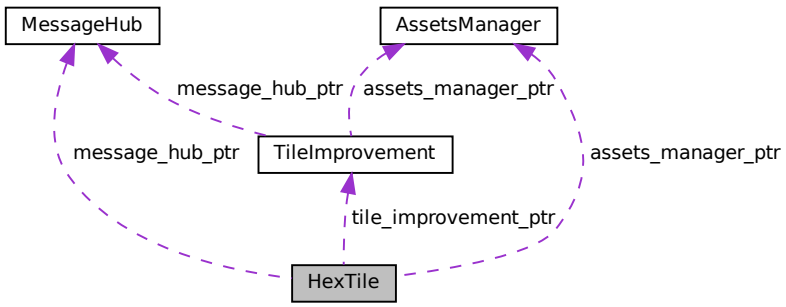
- header/HexMap.h
- source/HexMap.cpp

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.
- int scrap_improvement_frame

  A frame for key-hold to confirm scrapping.
- double position_x

  The x position of the tile.
- double position_y

  The y position of the tile.
- double major_radius

  The radius of the smallest bounding circle.
- double minor_radius

The radius of the largest inscribed circle.

- std::string game_phase

  The current phase of the game.
- sf::CircleShape node_sprite

  A circle shape to mark the tile node.
- sf::ConvexShape tile_sprite

  A convex shape which represents the tile.
- sf::ConvexShape select_outline_sprite

  A convex shape which outlines the tile when selected.
- sf::CircleShape resource_chip_sprite

  A circle shape which represents a resource chip.
- sf::Text resource_text

  A text representation of the resource.
- sf::Sprite tile_decoration_sprite

  A tile decoration sprite.
- sf::Sprite magnifying_glass_sprite

  A magnifying glass sprite.
- std::vector< sf::Sprite > explosion_sprite_reel

  A reel of sprites for a tile explosion animation.
- sf::RectangleShape build_menu_backing

  A backing for the tile build menu.
- sf::Text build_menu_backing_text

  A text label for the build menu.
- std::vector< std::vector< sf::Sprite > > build_menu_options_vec

  A vector of sprites for illustrating the tile build options.
- std::vector< sf::Text > build_menu_options_text_vec

  A vector of text for the tile build options.

Private Member Functions

- void __setUpNodeSprite (void)

  Helper method to set up node sprite.
- void __setUpTileSprite (void)

  Helper method to set up tile sprite.
- void __setUpSelectOutlineSprite (void)

  Helper method to set up select outline sprite.
- void __setUpResourceChipSprite (void)

  Helper method to set up resource chip sprite.
- void __setResourceText (void)

  Helper method to set up resource text.
- void __setUpMagnifyingGlassSprite (void)

  Helper method to set up and position magnifying glass sprite.
- void __setUpTileExplosionReel (void)

  Helper method to set up tile explosion sprite reel.
- void __setUpBuildOption (std::string, std::string)

  Helper method to set up and 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 __handleKeyReleaseEvents (void)
- void __handleMouseButtonEvents (void)

  Helper method to handle mouse button events.
- void __openBuildMenu (void)

  Helper method to open the tile improvement build menu.
- void __closeBuildMenu (void)

  Helper method to close the tile improvement build menu.
- void __buildSettlement (void)

  Helper method to build a settlement on this tile.
- void __buildDieselGenerator (void)

  Helper method to build a diesel generator on this tile.
- void __buildSolarPV (void)

  Helper method to build a solar PV array on this tile.
- void __buildWindTurbine (void)

  Helper method to build a wind turbine on this tile.
- void __buildTidalTurbine (void)

  Helper method to build a tidal turbine on this tile.
- void __buildWaveEnergyConverter (void)

  Helper method to build a wave energy converter on this tile.
- void __buildEnergyStorage (void)

  Helper method to build an energy storage system on this tile.
- void __scrapImprovement (void)

  Helper method to scrap the tile improvement (Settlement cannot be scrapped). Requires the mapped key to be held continuously to confirm.
- void __sendTileSelectedMessage (void)

  Helper method to format and send message on tile selection.
- std::string __getTileCoordsSubstring (void)

  Helper method to assemble and return tile coordinates substring.
- std::string __getTileTypeSubstring (void)

  Helper method to assemble and return tile type substring.
- std::string __getTileResourceSubstring (void)

  Helper method to assemble and return tile resource substring.
- std::string __getTileImprovementSubstring (void)

Helper method to assemble and return the tile improvement substring.

- std::string __getTileOptionsSubstring (void)

  Helper method to assemble and return tile options substring.
- void __sendTileStateMessage (void)

  Helper method to format and send tile state message.
- void __sendAssessNeighboursMessage (void)

  Helper method to format and send assess neighbours message.
- void __sendGameStateRequest (void)

  Helper method to format and send a game state request (message).
- void __sendUpdateGamePhaseMessage (std::string)

  Helper method to format and send update game phase message.
- void __sendCreditsSpentMessage (int)

  Helper method to format and send a credits spent message.
- void __sendInsufficientCreditsMessage (void)

  Helper method to format and send an insufficient credits message.

Private Attributes

- sf::Event * event_ptr

  A pointer to the event class.
- sf::RenderWindow * render_window_ptr

  A pointer to the render window.
- AssetsManager * assets_manager_ptr

  A pointer to the assets manager.
- MessageHub * message_hub_ptr

  A pointer to the message hub.

4.7.1 Detailed Description

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

4.7.2 Constructor & Destructor Documentation

4.7.2.1 HexTile()

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

Constructor for the HexTile class.

Ref: Wikipedia [2023]

Parameters

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.

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

4.7.2.2 ~HexTile()

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

Destructor for the HexTile class.

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

4.7.3 Member Function Documentation

4.7.3.1 __buildDieselGenerator()

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

Helper method to build a diesel generator on this tile.

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

4.7.3.2 __buildEnergyStorage()

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

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

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

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

4.7.3.3 __buildSettlement()

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

Helper method to build a settlement on this tile.

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

4.7.3.4 __buildSolarPV()

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

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

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

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

4.7.3.5 __buildTidalTurbine()

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

Helper method to build a tidal turbine on this tile.

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

4.7.3.6 __buildWaveEnergyConverter()

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

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

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

4.7.3.7 __buildWindTurbine()

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

Helper method to build a wind turbine on this tile.

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

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

4.7.3.8 __clearDecoration()

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

Helper method to clear tile decoration.

```
791 {
792     this->decoration_cleared = true;
793     this->draw_explosion = true;
794
795     switch (this->tile_type) {
796         case (TileType :: FOREST): {
797             this->assets_manager_ptr->getSound("clear non-mountains tile")->play();
798
799             break;
800         }
801
802
803         case (TileType :: MOUNTAINS): {
804             this->assets_manager_ptr->getSound("clear mountains tile")->play();
805
806             break;
807         }
808
809
810         case (TileType :: PLAINS): {
811             this->assets_manager_ptr->getSound("clear non-mountains tile")->play();
812
813             break;
814         }
815
816
817         default: {
818             // do nothing!
819
820             break;
821         }
822     }
823
824     return;
825 }   /* __clearDecoration() */
```

4.7.3.9 __closeBuildMenu()

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

Helper method to close the tile improvement build menu.

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

4.7.3.10 __getTileCoordsSubstring()

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

Helper method to assemble and return tile coordinates substring.

Returns

Tile coordinates substring.

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

4.7.3.11 __getTileImprovementSubstring()

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

Helper method to assemble and return the tile improvement substring.

Returns

Tile improvement substring.

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

4.7.3.12 __getTileOptionsSubstring()

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

Helper method to assemble and return tile options substring.

Returns

Tile options substring.

```
{
    //                  32 char x 17 line console "--------------------------------\n";
    std::string options_substring                = "     **** TILE OPTIONS ****     \n";
    options_substring                           += "                                \n";

    if (this->game_phase == "build settlement") {
        if (
            (this->tile_type != TileType :: OCEAN) and
            (this->tile_type != TileType :: LAKE)
        ) {
            options_substring += "[B]:  BUILD SETTLEMENT (";
            options_substring += std::to_string(BUILD_SETTLEMENT_COST);
            options_substring += " K)\n";
        }
    }


    else if (this->game_phase == "system management") {
        if (this->has_improvement) {
            options_substring.clear();
            options_substring = this->tile_improvement_ptr->getTileOptionsSubstring();
        }


        else if (not this->resource_assessed) {
            options_substring += "[A]:  ASSESS RESOURCE (";
            options_substring += std::to_string(RESOURCE_ASSESSMENT_COST);
            options_substring += " K)\n";
        }


        else if (
            (not this->decoration_cleared) and
            (this->tile_type != TileType :: OCEAN) and
            (this->tile_type != TileType :: LAKE)
        ) {
            options_substring += "[C]:  CLEAR TILE (";

            switch (this->tile_type) {
                case (TileType :: FOREST): {
                    options_substring += std::to_string(CLEAR_FOREST_COST);

                    break;
                }


                case (TileType :: MOUNTAINS): {
                    options_substring += std::to_string(CLEAR_MOUNTAINS_COST);

                    break;
                }


                case (TileType :: PLAINS): {
                    options_substring += std::to_string(CLEAR_PLAINS_COST);

                    break;
                }


                default: {
                    //do nothing!

                    break;
                }
            }

            options_substring += " K)\n";
        }


        else if (
            (this->decoration_cleared) or
            (this->tile_type == TileType :: OCEAN) or
            (this->tile_type == TileType :: LAKE)
        ) {
            options_substring += "[B]: OPEN BUILD MENU\n";
        }
    }


    else if (this->game_phase == "victory") {
        options_substring                       += "       **** VICTORY ****        \n";
    }
```

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

4.7.3.13 __getTileResourceSubstring()

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

Helper method to assemble and return tile resource substring.

Returns

Tile resource substring.

```
1887 {
1888     std::string resource_substring = "TILE RESOURCE:     ";
1889
1890     if (this->resource_assessed) {
1891         switch (this->tile_resource) {
1892             case (TileResource :: POOR): {
1893                 resource_substring += "POOR\n";
1894
1895                 break;
1896             }
1897
1898
1899             case (TileResource ::BELOW_AVERAGE): {
1900                 resource_substring += "BELOW AVERAGE\n";
1901
1902                 break;
1903             }
1904
1905
1906             case (TileResource :: AVERAGE): {
1907                 resource_substring += "AVERAGE\n";
1908
1909                 break;
1910             }
1911
1912
1913             case (TileResource :: ABOVE_AVERAGE): {
1914                 resource_substring += "ABOVE AVERAGE\n";
1915
1916                 break;
1917             }
1918
1919
1920             case (TileResource :: GOOD): {
1921                 resource_substring += "GOOD\n";
1922
1923                 break;
1924             }
1925
1926
1927             default: {
1928                 resource_substring += "???\n";
1929
1930                 break;
1931             }
1932         }
1933     }
1934
1935     else {
1936         resource_substring += "???\n";
1937     }
1938
1939     return resource_substring;
1940 }   /* __getTileResourceSubstring() */
```

4.7.3.14 __getTileTypeSubstring()

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

Helper method to assemble and return tile type substring.

Returns

Tile type substring.

```
1823 {
1824     std::string type_substring = "TILE TYPE:         ";
1825 
1826     switch (this->tile_type) {
1827         case (TileType :: FOREST): {
1828             type_substring += "FOREST\n";
1829 
1830             break;
1831         }
1832 
1833 
1834         case (TileType :: LAKE): {
1835             type_substring += "LAKE\n";
1836 
1837             break;
1838         }
1839 
1840 
1841         case (TileType :: MOUNTAINS): {
1842             type_substring += "MOUNTAINS\n";
1843 
1844             break;
1845         }
1846 
1847 
1848         case (TileType :: OCEAN): {
1849             type_substring += "OCEAN\n";
1850 
1851             break;
1852         }
1853 
1854 
1855         case (TileType :: PLAINS): {
1856             type_substring += "PLAINS\n";
1857 
1858             break;
1859         }
1860 
1861 
1862         default: {
1863             type_substring += "???\n";
1864 
1865             break;
1866         }
1867     }
1868 
1869     return type_substring;
1870 }   /* __getTileTypeSubstring() */
```

4.7.3.15 __handleKeyPressEvents()

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

Helper method to handle key press events.

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

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

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

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

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

4.7.3.16 __handleKeyReleaseEvents()

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

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

4.7.3.17 __handleMouseButtonEvents()

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

Helper method to handle mouse button events.

```
1262 {
1263     switch (this->event_ptr->mouseButton.button) {
1264         case (sf::Mouse::Left): {
1265             if (this->__isClicked()) {
1266                 std::cout « "Tile (" « this->position_x « ", " «
1267                     this->position_y « ") was selected" « std::endl;
1268
1269                 this->__setIsSelected(true);
1270
1271                 this->__sendTileSelectedMessage();
1272                 this->__sendTileStateMessage();
1273                 this->__sendGameStateRequest();
1274             }
1275
1276             else {
1277                 this->__setIsSelected(false);
1278             }
1279
1280             break;
1281         }
1282
1283
1284         case (sf::Mouse::Right): {
1285             this->__setIsSelected(false);
1286
1287             break;
1288         }
1289
1290
1291         default: {
1292             // do nothing!
1293
1294             break;
1295         }
1296     }
1297
1298     return;
1299 }   /* __handleMouseButtonEvents() */
```

4.7.3.18 __isClicked()

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

Helper method to determine if tile was clicked on.

Returns

Boolean indicating whether or not tile was clicked on.

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

4.7.3.19 __openBuildMenu()

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

Helper method to open the tile improvement build menu.

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

4.7.3.20 __scrapImprovement()

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

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

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

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

4.7.3.21 __sendAssessNeighboursMessage()

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

Helper method to format and send assess neighbours message.

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

4.7.3.22 __sendCreditsSpentMessage()

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

Helper method to format and send a credits spent message.

Parameters

credits_spent	The number of credits that were spent.

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

4.7.3.23 __sendGameStateRequest()

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

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

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

4.7.3.24 __sendInsufficientCreditsMessage()

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

Helper method to format and send an insufficient credits message.

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

4.7.3.25 __sendTileSelectedMessage()

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

Helper method to format and send message on tile selection.

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

4.7.3.26 __sendTileStateMessage()

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

Helper method to format and send tile state message.

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

4.7.3.27 __sendUpdateGamePhaseMessage()

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

Helper method to format and send update game phase message.

Parameters

game_phase	The updated game phase.

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

4.7.3.28 __setIsSelected()

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

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

Parameters

is_selected	The value to set the is selected attribute to.

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

4.7.3.29 __setResourceText()

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

Helper method to set up resource text.

```
193 {
194     this->resource_text.setFont(*(assets_manager_ptr->getFont("DroidSansMono")));
195 
196     this->resource_text.setFillColor(sf::Color(0, 0, 0, 255));
197 
198     if (this->resource_assessed) {
199         switch (this->tile_resource) {
200             case (TileResource :: POOR): {
201                 this->resource_text.setString("-2");
202                 this->resource_text.setFillColor(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() */
```

4.7.3.30 __setUpBuildMenu()

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

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

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

```
688     this->build_menu_backing_text.setPosition(400, 400 - 128 + 4);
689
690     //  2. set up and place build menu option sprites and text
691     switch (this->tile_type) {
692         case (TileType :: FOREST): {
693             this->__setUpDieselGeneratorBuildOption();
694             this->__setUpSolarPVBuildOption();
695             this->__setUpWindTurbineBuildOption();
696             //this->__setUpEnergyStorageSystemBuildOption();
697
698             break;
699         }
700
701
702         case (TileType :: LAKE): {
703             this->__setUpSolarPVBuildOption(true);
704             this->__setUpWindTurbineBuildOption(true);
705
706             break;
707         }
708
709
710         case (TileType :: MOUNTAINS): {
711             this->__setUpDieselGeneratorBuildOption();
712             this->__setUpSolarPVBuildOption();
713             this->__setUpWindTurbineBuildOption();
714             //this->__setUpEnergyStorageSystemBuildOption();
715
716             break;
717         }
718
719
720         case (TileType :: OCEAN): {
721             this->__setUpWindTurbineBuildOption(false, true);
722             this->__setUpTidalTurbineBuildOption();
723             this->__setUpWaveEnergyConverterBuildOption();
724
725             break;
726         }
727
728
729         case (TileType :: PLAINS): {
730             this->__setUpDieselGeneratorBuildOption();
731             this->__setUpSolarPVBuildOption();
732             this->__setUpWindTurbineBuildOption();
733             //this->__setUpEnergyStorageSystemBuildOption();
734
735             break;
736         }
737
738
739         default: {
740             // do nothing!
741
742             break;
743         }
744     }
745
746     return;
747 }   /* __setUpBuildMenu() */
```

4.7.3.31 __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() */
```

4.7.3.32 __setUpDieselGeneratorBuildOption()

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

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

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

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

4.7.3.33 __setUpEnergyStorageSystemBuildOption()

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

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

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

4.7.3.34 __setUpMagnifyingGlassSprite()

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

Helper method to set up and position magnifying glass sprite.

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

4.7.3.35 __setUpNodeSprite()

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

Helper method to set up node sprite.

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

4.7.3.36 __setUpResourceChipSprite()

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

Helper method to set up resource chip sprite.

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

4.7.3.37 __setUpSelectOutlineSprite()

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

Helper method to set up select outline sprite.

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

4.7.3.38 __setUpSolarPVBuildOption()

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

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

Parameters

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() */
```

4.7.3.39 __setUpTidalTurbineBuildOption()

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

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

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

4.7.3.40 __setUpTileExplosionReel()

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

Helper method to set up tile explosion sprite reel.

```
308 {
309     for (int i = 0; i < 4; i++) {
310         for (int j = 0; j < 4; j++) {
311             this->explosion_sprite_reel.push_back(
312                 sf::Sprite(
313                     *(this->assets_manager_ptr->getTexture("tile clear explosion")),
314                     sf::IntRect(j * 64, i * 64, 64, 64)
315                 )
316             );
317 
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() */
```

4.7.3.41 __setUpTileSprite()

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

Helper method to set up tile sprite.

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

4.7.3.42 __setUpWaveEnergyConverterBuildOption()

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

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

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

```
602     std::string texture_key = "wave energy converter";
603
604     //  2. set up option string (up to 16 chars wide)
605     //                                          "----------------\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() */
```

4.7.3.43 __setUpWindTurbineBuildOption()

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

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

Parameters

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() */
```

4.7.3.44 assess()

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

Method to assess the tile's resource.

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

4.7.3.45 decorateTile()

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

Method to decorate tile.

```
2557 {
2558     switch (this->tile_type) {
2559         case (TileType :: FOREST): {
2560             this->tile_decoration_sprite.setTexture(
2561                 *(this->assets_manager_ptr->getTexture("pine_tree_64x64_1"))
2562             );
2563 
2564             break;
2565         }
2566 
2567         case (TileType :: LAKE): {
2568             this->tile_decoration_sprite.setTexture(
2569                 *(this->assets_manager_ptr->getTexture("water_shimmer_64x64_1"))
2570             );
2571 
2572             break;
2573         }
2574 
2575         case (TileType :: MOUNTAINS): {
2576             this->tile_decoration_sprite.setTexture(
2577                 *(this->assets_manager_ptr->getTexture("mountain_64x64_1"))
2578             );
2579 
2580             break;
2581         }
2582 
2583         case (TileType :: OCEAN): {
2584             this->tile_decoration_sprite.setTexture(
2585                 *(this->assets_manager_ptr->getTexture("water_waves_64x64_1"))
2586             );
2587 
2588             break;
2589         }
2590 
2591         case (TileType :: PLAINS): {
2592             this->tile_decoration_sprite.setTexture(
2593                 *(this->assets_manager_ptr->getTexture("wheat_64x64_1"))
2594             );
2595 
2596             break;
2597         }
2598 
2599         default: {
2600             // do nothing!
2601 
2602             break;
2603         }
2604     }
2605 
2606 
2607     if (this->tile_type == TileType :: OCEAN or this->tile_type == TileType :: LAKE) {
```

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

4.7.3.46 draw()

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

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

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

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

4.7.3.47 processEvent()

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

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

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

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

4.7.3.48 processMessage()

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

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

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

4.7.3.49 setTileResource() [1/2]

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

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

Parameters

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

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

4.7.3.50 setTileResource() [2/2]

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

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

Parameters

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

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

4.7.3.51 setTileType() [1/2]

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

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

Parameters

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

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

4.7.3.52 setTileType() [2/2]

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

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

Parameters

tile_type	The type (TileType) to set the tile to.

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

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

4.7.3.53 toggleResourceOverlay()

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

Method to toggle the tile resource overlay.

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

4.7.4 Member Data Documentation

4.7.4.1 assets_manager_ptr

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

A pointer to the assets manager.

4.7.4.2 build_menu_backing

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

A backing for the tile build menu.

4.7.4.3 build_menu_backing_text

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

A text label for the build menu.

4.7.4.4 build_menu_open

```
bool HexTile::build_menu_open
```

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

4.7.4.5 build_menu_options_text_vec

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

A vector of text for the tile build options.

4.7.4.6 build_menu_options_vec

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

A vector of sprites for illustrating the tile build options.

4.7.4.7 credits

```
int HexTile::credits
```

The current balance of credits.

4.7.4.8 decoration_cleared

```
bool HexTile::decoration_cleared
```

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

4.7.4.9 draw_explosion

```
bool HexTile::draw_explosion
```

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

4.7.4.10 event_ptr

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

A pointer to the event class.

4.7.4.11 explosion_frame

```
size_t HexTile::explosion_frame
```

The current frame of the explosion animation.

4.7.4.12 explosion_sprite_reel

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

A reel of sprites for a tile explosion animation.

4.7.4.13 frame

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

The current frame of this object.

4.7.4.14 game_phase

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

The current phase of the game.

4.7.4.15 has_improvement

```
bool HexTile::has_improvement
```

A boolean which indicates if tile has improvement or not.

4.7.4.16 is_selected

```
bool HexTile::is_selected
```

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

4.7.4.17 magnifying_glass_sprite

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

A magnifying glass sprite.

4.7.4.18 major_radius

```
double HexTile::major_radius
```

The radius of the smallest bounding circle.

4.7.4.19 message_hub_ptr

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

A pointer to the message hub.

4.7.4.20 minor_radius

```
double HexTile::minor_radius
```

The radius of the largest inscribed circle.

4.7.4.21 node_sprite

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

A circle shape to mark the tile node.

4.7.4.22 position_x

```
double HexTile::position_x
```

The x position of the tile.

4.7.4.23 position_y

```
double HexTile::position_y
```

The y position of the tile.

4.7.4.24 render_window_ptr

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

A pointer to the render window.

4.7.4.25 resource_assessed

```
bool HexTile::resource_assessed
```

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

4.7.4.26 resource_assessment

```
bool HexTile::resource_assessment
```

A boolean which triggers a resource assessment notification.

4.7.4.27 resource_chip_sprite

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

A circle shape which represents a resource chip.

4.7.4.28 resource_text

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

A text representation of the resource.

4.7.4.29 scrap_improvement_frame

```
int HexTile::scrap_improvement_frame
```

A frame for key-hold to confirm scrapping.

4.7.4.30 select_outline_sprite

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

A convex shape which outlines the tile when selected.

4.7.4.31 show_node

```
bool HexTile::show_node
```

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

4.7.4.32 show_resource

```
bool HexTile::show_resource
```

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

4.7.4.33 tile_decoration_sprite

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

A tile decoration sprite.

4.7.4.34 tile_improvement_ptr

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

A pointer to the improvement for this tile.

4.7.4.35 tile_resource

```
TileResource HexTile::tile_resource
```

4.7.4.36 tile_sprite

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

A convex shape which represents the tile.

4.7.4.37 tile_type

```
TileType HexTile::tile_type
```

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

- header/HexTile.h
- source/HexTile.cpp

4.8 Message Struct Reference

A structure which defines a standard message format.

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

Public Attributes

- std::string channel = ""

  A string identifying the appropriate channel for this message.
- std::string subject = ""

  A string describing the message subject.
- std::map< std::string, bool > bool_payload = {}

  A boolean payload.
- std::map< std::string, int > int_payload = {}

  A vector payload.
- std::map< std::string, double > double_payload = {}

  A vector payload.
- std::map< std::string, std::string > string_payload = {}

  A string payload.

4.8.1 Detailed Description

A structure which defines a standard message format.

4.8.2 Member Data Documentation

4.8.2.1 bool_payload

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

A boolean payload.

4.8.2.2 channel

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

A string identifying the appropriate channel for this message.

4.8.2.3 double_payload

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

A vector payload.

4.8.2.4 int_payload

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

A vector payload.

4.8.2.5 string_payload

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

A string payload.

4.8.2.6 subject

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

A string describing the message subject.

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

- header/ESC_core/MessageHub.h

4.9 MessageHub Class Reference

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

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

Public Member Functions

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

Private Attributes

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

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

4.9.1 Detailed Description

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

4.9.2 Constructor & Destructor Documentation

4.9.2.1 MessageHub()

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

Constructor for the MessageHub class.

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

4.9.2.2 ~MessageHub()

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

Destructor for the MessageHub class.

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

4.9.3 Member Function Documentation

4.9.3.1 addChannel()

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

Method to add channel to message map.

Parameters

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:

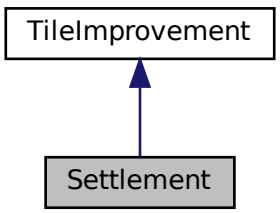
- header/ESC_core/MessageHub.h
- source/ESC_core/MessageHub.cpp

4.10 Settlement Class Reference

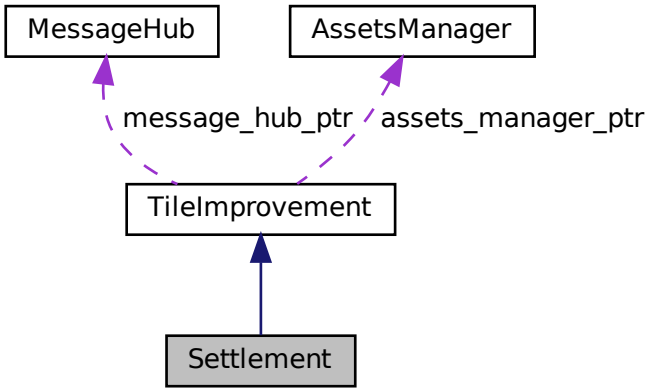
A settlement class (child class of TileImprovement).

`#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.
- void setIsSelected (bool)

  Method to set the is selected attribute.
- std::string getTileOptionsSubstring (void)

  Helper method to assemble and return tile options substring.
- void processEvent (void)

  Method to process Settlement. To be called once per event.
- void processMessage (void)

  Method to process Settlement. To be called once per message.
- void draw (void)

  Method to draw the hex tile to the render window. To be called once per frame.
- virtual ∼Settlement (void)

  Destructor for the Settlement class.

Public Attributes

- double smoke_da

  The per frame delta in smoke particle alpha value.
- double smoke_dx

  The per frame delta in smoke particle x position.
- double smoke_dy

  The per frame delta in smoke particle y position.
- double smoke_prob

  The probability of spawning a new smoke prob in any given frame.
- std::list< sf::Sprite > smoke_sprite_list

  A list of smoke sprite (for chimney animation).

Private Member Functions

- void __setUpTileImprovementSpriteStatic (void)

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

  Helper method to handle key press events.
- void __handleMouseButtonEvents (void)

  Helper method to handle mouse button events.

Additional Inherited Members

4.10.1 Detailed Description

A settlement class (child class of TileImprovement).

4.10.2 Constructor & Destructor Documentation

4.10.2.1 Settlement()

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

Constructor for the Settlement class.

Ref: Wikipedia [2023]

Parameters

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.

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

4.10.3 Member Function Documentation

4.10.3.1 __handleKeyPressEvents()

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

Helper method to handle key press events.

```
103 {
104     if (this->just_built) {
105         return;
106     }
107
108     switch (this->event_ptr->key.code) {
109         //...
110
111
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.

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

4.10.3.5 getTileOptionsSubstring()

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

Helper method to assemble and return tile options substring.

Returns

Tile options substring.

Reimplemented from TileImprovement.

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

4.10.3.6 processEvent()

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

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

Reimplemented from TileImprovement.

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

4.10.3.7 processMessage()

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

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

Reimplemented from TileImprovement.

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

4.10.3.8 setIsSelected()

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

Method to set the is selected attribute.

Parameters

is_selected	The value to set the is selected attribute to.

Reimplemented from TileImprovement.

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

4.10.4 Member Data Documentation

4.10.4.1 smoke_da

```
double Settlement::smoke_da
```

The per frame delta in smoke particle alpha value.

4.10.4.2 smoke_dx

```
double Settlement::smoke_dx
```

The per frame delta in smoke particle x position.

4.10.4.3 smoke_dy

```
double Settlement::smoke_dy
```

The per frame delta in smoke particle y position.

4.10.4.4 smoke_prob

```
double Settlement::smoke_prob
```

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

4.10.4.5 smoke_sprite_list

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

A list of smoke sprite (for chimney animation).

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

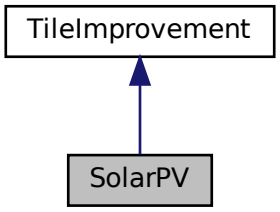
- header/Settlement.h
- source/Settlement.cpp

4.11 SolarPV Class Reference

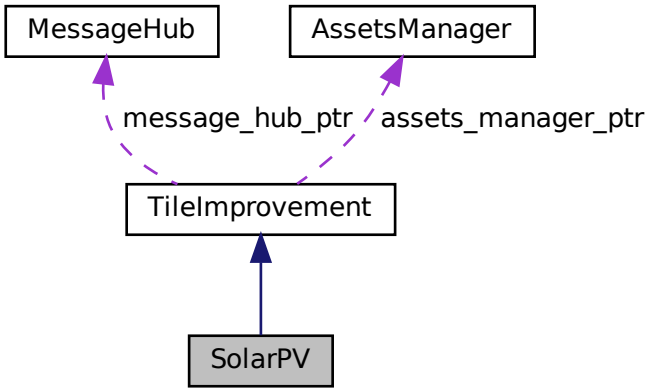
A settlement class (child class of TileImprovement).

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

Inheritance diagram for SolarPV:



Collaboration diagram for SolarPV:



Public Member Functions

- SolarPV (double, double, sf::Event ∗, sf::RenderWindow ∗, AssetsManager ∗, MessageHub ∗)

  Constructor for the SolarPV class.
- std::string getTileOptionsSubstring (void)

  Helper method to assemble and return tile options substring.
- void processEvent (void)

  Method to process SolarPV. To be called once per event.
- void processMessage (void)

  Method to process SolarPV. To be called once per message.
- void draw (void)

  Method to draw the hex tile to the render window. To be called once per frame.
- virtual ∼SolarPV (void)

  Destructor for the SolarPV class.

Public Attributes

- int capacity_kW

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

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

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

Private Member Functions

- void __setUpTileImprovementSpriteStatic (void)

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

  Helper method to upgrade the diesel generator.
- void __handleKeyPressEvents (void)

  Helper method to handle key press events.
- void __handleMouseButtonEvents (void)

  Helper method to handle mouse button events.

Additional Inherited Members

4.11.1 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.

```
262   :
263 TileImprovement(
264     position_x,
265     position_y,
266     event_ptr,
267     render_window_ptr,
```

```
268     assets_manager_ptr,
269     message_hub_ptr
270 )
271 {
272     //  1. set attributes
273 
274     //  1.1. private
275     //...
276 
277     //  1.2. public
278     this->tile_improvement_type = TileImprovementType :: SOLAR_PV;
279 
280     this->is_running = false;
281 
282     this->health = 100;
283 
284     this->capacity_kW = 100;
285     this->upgrade_level = 1;
286 
287     this->production_MWh = 0;
288     this->dispatchable_MWh = 0;
289 
290     this->tile_improvement_string = "SOLAR PV ARRAY";
291 
292     this->__setUpTileImprovementSpriteStatic();
293 
294     std::cout « "SolarPV constructed at " « this « std::endl;
295 
296     return;
297 }   /* SolarPV() */
```

4.11.2.2 ~SolarPV()

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

Destructor for the SolarPV class.

```
446 {
447     std::cout « "SolarPV at " « this « " destroyed" « std::endl;
448 
449     return;
450 }   /* ~SolarPV() */
```

4.11.3 Member Function Documentation

4.11.3.1 __handleKeyPressEvents()

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

Helper method to handle key press events.

```
150 {
151     if (this->just_built) {
152         return;
153     }
154 
155     switch (this->event_ptr->key.code) {
156         case (sf::Keyboard::U): {
157             if (this->upgrade_level < MAX_UPGRADE_LEVELS) {
158                 this->__upgrade();
159             }
160 
161             break;
162         }
163 
```

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

4.11.3.2 __handleMouseButtonEvents()

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

Helper method to handle mouse button events.

```
188 {
189     if (this->just_built) {
190         return;
191     }
192
193     switch (this->event_ptr->mouseButton.button) {
194         case (sf::Mouse::Left): {
195             //...
196
197             break;
198         }
199
200
201         case (sf::Mouse::Right): {
202             //...
203
204             break;
205         }
206
207
208         default: {
209             // do nothing!
210
211             break;
212         }
213     }
214
215     return;
216 }   /* __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 __upgrade()

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

Helper method to upgrade the diesel generator.

```
103 {
104     /*
105     int upgrade_cost = DIESEL_GENERATOR_BUILD_COST;
106 
107     if (this->credits < upgrade_cost) {
108         std::cout « "Cannot upgrade diesel generator: insufficient credits (need "
109             « upgrade_cost « " K)" « std::endl;
110 
111         this->__sendInsufficientCreditsMessage();
112         return;
113     }
114 
115     this->is_running = false;
116 
117     this->health = 100;
118 
119     this->capacity_kW += 100;
120     this->upgrade_level++;
121 
122     this->production_MWh = 0;
123     this->max_production_MWh += 72;
124 
125     this->just_upgraded = true;
126 
127     this->assets_manager_ptr->getSound("upgrade")->play();
128 
129     this->__sendCreditsSpentMessage(upgrade_cost);
130     this->__sendTileStateRequest();
131     this->__sendGameStateRequest();
132     */
133 
134     return;
135 }   /* __upgrade() */
```

4.11.3.5 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.

```
408 {
409     //  1. if just built, call base method and return
410     if (this->just_built) {
411         TileImprovement :: draw();
412 
413         return;
414     }
415 
416 
417     //  2. draw static sprite
418     this->render_window_ptr->draw(this->tile_improvement_sprite_static);
419 
420 
421     //  3. draw production menu
422     if (this->production_menu_open) {
423         this->render_window_ptr->draw(this->production_menu_backing);
424         this->render_window_ptr->draw(this->production_menu_backing_text);
425 
426         //...
427     }
428 
429     this->frame++;
430     return;
431 }   /* draw() */
```

4.11.3.6 getTileOptionsSubstring()

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

Helper method to assemble and return tile options substring.

Returns

Tile options substring.

Reimplemented from TileImprovement.

```
314 {
315     //                  32 char x 17 line console "--------------------------------\n";
316     std::string options_substring                = "CAPACITY:      ";
317     options_substring                           += std::to_string(this->capacity_kW);
318     options_substring                           += " kW (level ";
319     options_substring                           += std::to_string(this->upgrade_level);
320     options_substring                           += ")\n";
321 
322     options_substring                           += "PRODUCTION:    ";
323     options_substring                           += std::to_string(this->production_MWh);
324     options_substring                           += " MWh\n";
325 
326     options_substring                           += "DISPATCHABLE:  ";
327     options_substring                           += std::to_string(this->dispatchable_MWh);
328     options_substring                           += " MWh\n";
329 
330     options_substring                           += "HEALTH:        ";
331     options_substring                           += std::to_string(this->health);
332     options_substring                           += "/100\n";
333 
334     options_substring                           += "                                \n";
335     options_substring                           += "   **** SOLAR PV OPTIONS ****   \n";
336     options_substring                           += "                                \n";
337     options_substring                           += "     [E]:  OPEN PRODUCTION MENU \n";
338     options_substring                           += "     [U]:  OPEN UPGRADE MENU    \n";
339     options_substring                           += "HOLD [P]:  SCRAP (";
340     options_substring                           += std::to_string(SCRAP_COST);
341     options_substring                           += " K)";
342 
343     return options_substring;
344 }   /* getTileOptionsSubstring() */
```

4.11.3.7 processEvent()

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

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

Reimplemented from TileImprovement.

```
359 {
360     TileImprovement :: processEvent();
361 
362     if (this->event_ptr->type == sf::Event::KeyPressed) {
363         this->__handleKeyPressEvents();
364     }
365 
366     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
367         this->__handleMouseButtonEvents();
368     }
369 
370     return;
371 }   /* processEvent() */
```

4.11.3.8 processMessage()

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

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

Reimplemented from TileImprovement.

```
386 {
387     TileImprovement :: processMessage();
388
389     //...
390
391     return;
392 }   /* processMessage() */
```

4.11.4 Member Data Documentation

4.11.4.1 capacity_kW

```
int SolarPV::capacity_kW
```

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

4.11.4.2 dispatchable_MWh

```
int SolarPV::dispatchable_MWh
```

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

4.11.4.3 production_MWh

```
int SolarPV::production_MWh
```

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

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

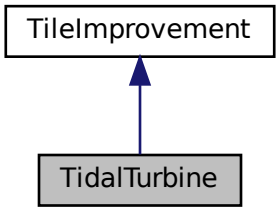
- header/SolarPV.h
- source/SolarPV.cpp

4.12 TidalTurbine Class Reference

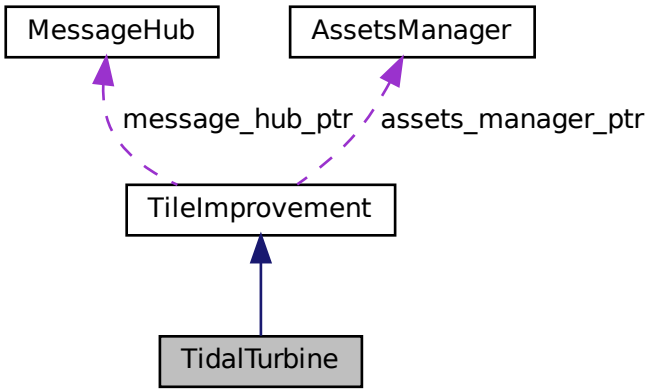
A settlement class (child class of TileImprovement).

`#include <TidalTurbine.h>`

Inheritance diagram for TidalTurbine:



Collaboration diagram for TidalTurbine:



Public Member Functions

- TidalTurbine (double, double, sf::Event ∗, sf::RenderWindow ∗, AssetsManager ∗, MessageHub ∗)

  Constructor for the TidalTurbine class.
- std::string getTileOptionsSubstring (void)

  Helper method to assemble and return tile options substring.
- void processEvent (void)

  Method to process TidalTurbine. To be called once per event.
- void processMessage (void)

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

- void draw (void)

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

- virtual ~TidalTurbine (void)

  Destructor for the TidalTurbine class.

Public Attributes

- int capacity_kW

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

- int production_MWh

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

- int dispatchable_MWh

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

Private Member Functions

- void __setUpTileImprovementSpriteAnimated (void)

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

- void __upgrade (void)

  Helper method to upgrade the diesel generator.

- void __handleKeyPressEvents (void)

  Helper method to handle key press events.

- void __handleMouseButtonEvents (void)

  Helper method to handle mouse button events.

Additional Inherited Members

4.12.1 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.

```
273   :
274 TileImprovement(
275     position_x,
276     position_y,
277     event_ptr,
278     render_window_ptr,
279     assets_manager_ptr,
280     message_hub_ptr
281 )
282 {
283     //  1. set attributes
284
285     //  1.1. private
286     //...
287
288     //  1.2. public
289     this->tile_improvement_type = TileImprovementType :: TIDAL_TURBINE;
290
291     this->is_running = false;
292
293     this->health = 100;
294
295     this->capacity_kW = 100;
296     this->upgrade_level = 1;
297
298     this->production_MWh = 0;
299     this->dispatchable_MWh = 0;
300
301     this->tile_improvement_string = "TIDAL TURBINE";
302
303     this->__setUpTileImprovementSpriteAnimated();
304
305     std::cout « "TidalTurbine constructed at " « this « std::endl;
306
307     return;
308 }   /* TidalTurbine() */
```

4.12.2.2 ~TidalTurbine()

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

Destructor for the TidalTurbine class.

```
468 {
469     std::cout « "TidalTurbine at " « this « " destroyed" « std::endl;
470
471     return;
472 }   /* ~TidalTurbine() */
```

4.12.3 Member Function Documentation

4.12.3.1 __handleKeyPressEvents()

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

Helper method to handle key press events.

```
161 {
162     if (this->just_built) {
163         return;
164     }
165 
166     switch (this->event_ptr->key.code) {
167         case (sf::Keyboard::U): {
168             if (this->upgrade_level < MAX_UPGRADE_LEVELS) {
169                 this->__upgrade();
170             }
171 
172             break;
173         }
174 
175 
176         default: {
177             // do nothing!
178 
179             break;
180         }
181     }
182 
183     return;
184 }   /* __handleKeyPressEvents() */
```

4.12.3.2 __handleMouseButtonEvents()

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

Helper method to handle mouse button events.

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

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

Helper method to upgrade the diesel generator.

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

4.12.3.5 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.

```
419 {
420     //  1. if just built, call base method and return
421     if (this->just_built) {
422         TileImprovement :: draw();
423 
424         return;
425     }
426 
427 
428     //  2. draw first element of animated sprite
429     this->render_window_ptr->draw(this->tile_improvement_sprite_animated[0]);
430 
431 
432     //  3. draw second element of animated sprite
433     if (this->is_running) {
434         //...
435     }
436 
437     else {
438         //...
439     }
440 
441     this->render_window_ptr->draw(this->tile_improvement_sprite_animated[1]);
442 
443     //  4. draw production menu
444     if (this->production_menu_open) {
445         this->render_window_ptr->draw(this->production_menu_backing);
446         this->render_window_ptr->draw(this->production_menu_backing_text);
447 
448         //...
449     }
450 
451     this->frame++;
452     return;
453 }   /* draw() */
```

4.12.3.6 getTileOptionsSubstring()

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

Helper method to assemble and return tile options substring.

Returns

Tile options substring.

Reimplemented from TileImprovement.

```
325 {
326     //                  32 char x 17 line console "--------------------------------\n";
327     std::string options_substring                = "CAPACITY:      ";
328     options_substring                           += std::to_string(this->capacity_kW);
329     options_substring                           += " kW (level ";
330     options_substring                           += std::to_string(this->upgrade_level);
331     options_substring                           += ")\n";
332 
333     options_substring                           += "PRODUCTION:    ";
334     options_substring                           += std::to_string(this->production_MWh);
335     options_substring                           += " MWh\n";
336 
337     options_substring                           += "DISPATCHABLE:  ";
338     options_substring                           += std::to_string(this->dispatchable_MWh);
```

```
339     options_substring                           += " MWh\n";
340
341     options_substring                           += "HEALTH:        ";
342     options_substring                           += std::to_string(this->health);
343     options_substring                           += "/100\n";
344
345     options_substring                           += "                                \n";
346     options_substring                           += "**** TIDAL TURBINE OPTIONS **** \n";
347     options_substring                           += "                                \n";
348     options_substring                           += "     [E]:  OPEN PRODUCTION MENU \n";
349     options_substring                           += "     [U]:  OPEN UPGRADE MENU    \n";
350     options_substring                           += "HOLD [P]:  SCRAP (";
351     options_substring                           += std::to_string(SCRAP_COST);
352     options_substring                           += " K)";
353
354     return options_substring;
355 }   /* getTileOptionsSubstring() */
```

4.12.3.7 processEvent()

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

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

Reimplemented from TileImprovement.

```
370 {
371     TileImprovement :: processEvent();
372
373     if (this->event_ptr->type == sf::Event::KeyPressed) {
374         this->__handleKeyPressEvents();
375     }
376
377     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
378         this->__handleMouseButtonEvents();
379     }
380
381     return;
382 }   /* processEvent() */
```

4.12.3.8 processMessage()

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

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

Reimplemented from TileImprovement.

```
397 {
398     TileImprovement :: processMessage();
399
400     //...
401
402     return;
403 }   /* processMessage() */
```

4.12.4 Member Data Documentation

4.12.4.1 capacity_kW

```
int TidalTurbine::capacity_kW
```

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

4.12.4.2 dispatchable_MWh

```
int TidalTurbine::dispatchable_MWh
```

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

4.12.4.3 production_MWh

```
int TidalTurbine::production_MWh
```

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

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

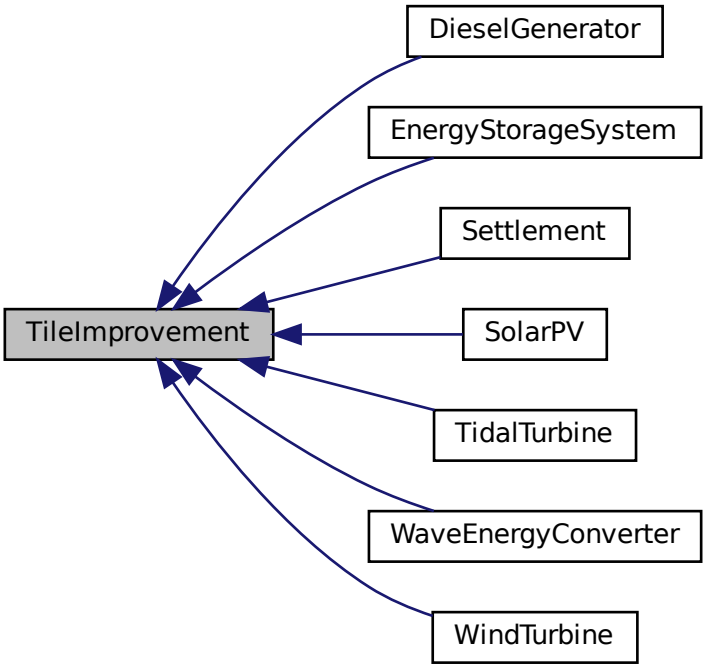
- header/TidalTurbine.h
- source/TidalTurbine.cpp

4.13 TileImprovement Class Reference

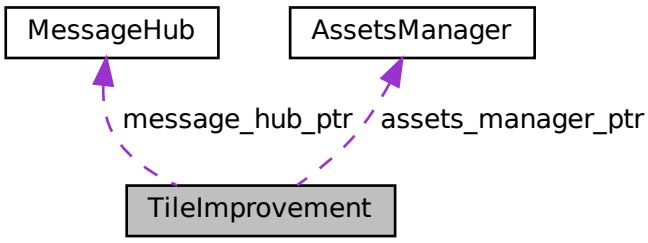
A base class for the tile improvement hierarchy.

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

Inheritance diagram for TileImprovement:



Collaboration diagram for TileImprovement:



Public Member Functions

- TileImprovement (double, double, sf::Event ∗, sf::RenderWindow ∗, AssetsManager ∗, MessageHub ∗)

  Constructor for the TileImprovement class.
- virtual void setIsSelected (bool)

  Method to set the is selected attribute.

- virtual std::string getTileOptionsSubstring (void)
- virtual void processEvent (void)

  Method to process TileImprovement. To be called once per event.
- virtual void processMessage (void)

  Method to process TileImprovement. To be called once per message.
- virtual void draw (void)

  Method to draw the hex tile to the render window. To be called once per frame.
- virtual ~TileImprovement (void)

  Destructor for the TileImprovement class.

Public Attributes

- TileImprovementType tile_improvement_type

  The type of the tile improvement.
- bool is_running

  A boolean which indicates whether or not the improvement is running.
- bool is_selected

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

  A boolean which indicates that the improvement was just built.
- bool just_upgraded

  A boolean which indicates that the improvement was just upgraded.
- bool production_menu_open

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

  A boolean which indicates whether or not the build menu is open.
- unsigned long long int frame

  The current frame of this object.
- int credits

  The current balance of credits.
- int health

  The health of the improvement.
- int upgrade_level

  The upgrade level of the improvement.
- int upgrade_frame

  The frame of the upgrade animation.
- double position_x

  The x position of the tile improvement.
- double position_y

  The y position of the tile improvement.
- std::string game_phase

  The current phase of the game.
- std::string tile_improvement_string

  A string representation of the tile improvement type.
- sf::Sprite tile_improvement_sprite_static

  A static sprite, for decorating the tile.
- std::vector< sf::Sprite > tile_improvement_sprite_animated

  An animated sprite, for the ContextMenu visual screen.
- sf::RectangleShape production_menu_backing

  A backing for the production menu.

- sf::Text production_menu_backing_text

  Text for the production menu backing.
- sf::RectangleShape upgrade_menu_backing

  A backing for the upgrade menu.
- sf::Text upgrade_menu_backing_text

  Text for the upgrade menu backing.

Protected Member Functions

- void __setUpProductionMenu (void)

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

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

  Helper method to handle key press events.
- void __handleMouseButtonEvents (void)

  Helper method to handle mouse button events.
- void __openProductionMenu (void)

  Helper method to open the production menu.
- void __closeProductionMenu (void)

  Helper method to close the production menu.
- void __openUpgradeMenu (void)

  Helper method to open the upgrade menu.
- void __closeUpgradeMenu (void)

  Helper method to close the build menu.
- void __sendTileStateRequest (void)

  Helper method to format and send a request for the parent HexTile to send a tile state message.
- void __sendGameStateRequest (void)

  Helper method to format and send a game state request (message).
- void __sendCreditsSpentMessage (int)

  Helper method to format and send a credits spent message.
- void __sendInsufficientCreditsMessage (void)

  Helper method to format and send an insufficient credits message.

Protected Attributes

- sf::Event * event_ptr

  A pointer to the event class.
- sf::RenderWindow * render_window_ptr

  A pointer to the render window.
- AssetsManager * assets_manager_ptr

  A pointer to the assets manager.
- MessageHub * message_hub_ptr

  A pointer to the message hub.

4.13.1 Detailed Description

A base class for the tile improvement hierarchy.

4.13.2 Constructor & Destructor Documentation

4.13.2.1 TileImprovement()

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

Constructor for the TileImprovement class.

Ref: Wikipedia [2023]

Parameters

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.

```
470 {
471     //  1. set attributes
472
473     //  1.1. protected
474     this->event_ptr = event_ptr;
475     this->render_window_ptr = render_window_ptr;
476
477     this->assets_manager_ptr = assets_manager_ptr;
478     this->message_hub_ptr = message_hub_ptr;
479
480     //  1.2. public
481     this->is_selected = true;
482     this->just_built = true;
483     this->production_menu_open = false;
484
485     this->frame = 0;
486     this->credits = 0;
487
488     this->position_x = position_x;
489     this->position_y = position_y;
490
491     this->game_phase = "build settlement";
492
493     this->__setUpProductionMenu();
494     this->__setUpUpgradeMenu();
495
496     std::cout << "TileImprovement constructed at " << this << std::endl;
497
498     return;
499 }   /* TileImprovement() */
```

4.13.2.2 ~TileImprovement()

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

Destructor for the TileImprovement class.

```
717 {
718     std::cout « "TileImprovement at " « this « " destroyed" « std::endl;
719
720     return;
721 }   /* ~TileImprovement() */
```

4.13.3 Member Function Documentation

4.13.3.1 __closeProductionMenu()

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

Helper method to close the production menu.

```
255 {
256     if (not this->production_menu_open) {
257         return;
258     }
259
260     this->production_menu_open = false;
261     this->assets_manager_ptr->getSound("build menu close")->play();
262
263     return;
264 }   /* __closeProductionMenu() */
```

4.13.3.2 __closeUpgradeMenu()

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

Helper method to close the build menu.

```
307 {
308     if (not this->upgrade_menu_open) {
309         return;
310     }
311
312     this->upgrade_menu_open = false;
313     this->assets_manager_ptr->getSound("build menu close")->play();
314
315     return;
316 }   /* __closeUpgradeMenu() */
```

4.13.3.3 __handleKeyPressEvents()

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

Helper method to handle key press events.

```
140 {
141     if (this->tile_improvement_type == TileImprovementType :: SETTLEMENT) {
142         return;
143     }
144
145     if (this->just_built) {
146         return;
```

```
147     }
148
149     switch (this->event_ptr->key.code) {
150         case (sf::Keyboard::E): {
151             this->__openProductionMenu();
152
153             break;
154         }
155
156
157         default: {
158             // do nothing!
159
160             break;
161         }
162     }
163
164     return;
165 }   /* __handleKeyPressEvents() */
```

4.13.3.4 __handleMouseButtonEvents()

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

Helper method to handle mouse button events.

```
180 {
181     if (this->tile_improvement_type == TileImprovementType :: SETTLEMENT) {
182         return;
183     }
184
185     if (this->just_built) {
186         return;
187     }
188
189     switch (this->event_ptr->mouseButton.button) {
190         case (sf::Mouse::Left): {
191             //...
192
193             break;
194         }
195
196
197         case (sf::Mouse::Right): {
198             //...
199
200             break;
201         }
202
203
204         default: {
205             // do nothing!
206
207             break;
208         }
209     }
210
211     return;
212 }   /* __handleMouseButtonEvents() */
```

4.13.3.5 __openProductionMenu()

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

Helper method to open the production menu.

```
227 {
228     if (this->production_menu_open) {
229         return;
```

```
230     }
231
232     if (this->upgrade_menu_open) {
233         this->__closeUpgradeMenu();
234     }
235
236     this->production_menu_open = true;
237     this->assets_manager_ptr->getSound("build menu open")->play();
238
239     return;
240 }   /* __openProductionMenu() */
```

4.13.3.6 __openUpgradeMenu()

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

Helper method to open the upgrade menu.

```
279 {
280     if (this->upgrade_menu_open) {
281         return;
282     }
283
284     if (this->production_menu_open) {
285         this->__closeProductionMenu();
286     }
287
288     this->upgrade_menu_open = true;
289     this->assets_manager_ptr->getSound("build menu open")->play();
290
291     return;
292 }   /* __openUpgradeMenu() */
```

4.13.3.7 __sendCreditsSpentMessage()

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

Helper method to format and send a credits spent message.

Parameters

credits_spent	The number of credits that were spent.

```
384 {
385     Message credits_spent_message;
386
387     credits_spent_message.channel = GAME_CHANNEL;
388     credits_spent_message.subject = "credits spent";
389
390     credits_spent_message.int_payload["credits spent"] = credits_spent;
391
392     this->message_hub_ptr->sendMessage(credits_spent_message);
393
394     std::cout « "Credits spent (" « credits_spent « ") message sent by " « this
395         « std::endl;
396     return;
397 }   /* __sendCreditsSpentMessage() */
```

4.13.3.8 __sendGameStateRequest()

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

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

```
357 {
358     Message game_state_request;
359
360     game_state_request.channel = GAME_CHANNEL;
361     game_state_request.subject = "state request";
362
363     this->message_hub_ptr->sendMessage(game_state_request);
364
365     std::cout << "Game state request message sent by " << this << std::endl;
366     return;
367 }   /* __sendGameStateRequest() */
```

4.13.3.9 __sendInsufficientCreditsMessage()

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

Helper method to format and send an insufficient credits message.

```
412 {
413     Message insufficient_credits_message;
414
415     insufficient_credits_message.channel = GAME_CHANNEL;
416     insufficient_credits_message.subject = "insufficient credits";
417
418     this->message_hub_ptr->sendMessage(insufficient_credits_message);
419
420     std::cout << "Insufficient credits message sent by " << this << std::endl;
421
422     return;
423 }   /* __sendInsufficientCreditsMessage() */
```

4.13.3.10 __sendTileStateRequest()

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

Helper method to format and send a request for the parent HexTile to send a tile state message.

```
332 {
333     Message tile_state_request;
334
335     tile_state_request.channel = TILE_STATE_CHANNEL;
336     tile_state_request.subject = "state request";
337
338     this->message_hub_ptr->sendMessage(tile_state_request);
339
340     std::cout << "Tile state request sent by " << this << std::endl;
341     return;
342 }   /* __sendTileStateRequest() */
```

4.13.3.11 __setUpProductionMenu()

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

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

```
68 {
69     //  1. set up and place production menu backing and text
70     this->production_menu_backing.setSize(sf::Vector2f(400, 256));
71     this->production_menu_backing.setOrigin(200, 128);
72     this->production_menu_backing.setPosition(400, 400);
73     this->production_menu_backing.setFillColor(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() */
```

4.13.3.12 __setUpUpgradeMenu()

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

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

```
104 {
105     //  1. set up and place upgrade menu backing and text
106     this->upgrade_menu_backing.setSize(sf::Vector2f(400, 256));
107     this->upgrade_menu_backing.setOrigin(200, 128);
108     this->upgrade_menu_backing.setPosition(400, 400);
109     this->upgrade_menu_backing.setFillColor(MONOCHROME_SCREEN_BACKGROUND);
110     this->upgrade_menu_backing.setOutlineColor(MENU_FRAME_GREY);
111     this->upgrade_menu_backing.setOutlineThickness(4);
112 
113     this->upgrade_menu_backing_text.setString("**** UPGARDE MENU ****");
114     this->upgrade_menu_backing_text.setFont(
115         *(this->assets_manager_ptr->getFont("Glass_TTY_VT220"))
116     );
117     this->upgrade_menu_backing_text.setCharacterSize(16);
118     this->upgrade_menu_backing_text.setFillColor(MONOCHROME_TEXT_GREEN);
119     this->upgrade_menu_backing_text.setOrigin(
120         this->upgrade_menu_backing_text.getLocalBounds().width / 2, 0
121     );
122     this->upgrade_menu_backing_text.setPosition(400, 400 - 128 + 4);
123 
124     return;
125 }   /* __setUpUpgradeMenu() */
```

4.13.3.13 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.

```
588 {
589     if (this->tile_improvement_sprite_static.getTexture() != NULL) {
590         int alpha = this->tile_improvement_sprite_static.getColor().a;
591 
592         alpha += 0.08 * FRAMES_PER_SECOND;
593 
594         this->tile_improvement_sprite_static.setColor(
595             sf::Color(255, 255, 255, alpha)
596         );
597 
598         this->tile_improvement_sprite_static.move(0, 50 * SECONDS_PER_FRAME);
599 
600         if (
601             (alpha >= 255) or
602             (this->tile_improvement_sprite_static.getPosition().y >= this->position_y + 12)
603         ) {
604             this->tile_improvement_sprite_static.setColor(
605                 sf::Color(255, 255, 255, 255)
606             );
607 
608             this->tile_improvement_sprite_static.setPosition(
609                 this->position_x,
610                 this->position_y + 12
611             );
612 
613             this->just_built = false;
614             this->assets_manager_ptr->getSound("place improvement")->play();
615         }
616 
617         this->render_window_ptr->draw(this->tile_improvement_sprite_static);
618     }
619 
620 
621     else {
622         int alpha = 0;
623 
624         for (size_t i = 0; i < this->tile_improvement_sprite_animated.size(); i++) {
625             alpha = this->tile_improvement_sprite_animated[i].getColor().a;
626 
627             alpha += 0.08 * FRAMES_PER_SECOND;
628 
629             this->tile_improvement_sprite_animated[i].setColor(
630                 sf::Color(255, 255, 255, alpha)
631             );
632 
633             this->tile_improvement_sprite_animated[i].move(0, 50 * SECONDS_PER_FRAME);
634 
635             if (
636                 (alpha >= 255) or
637                 (this->tile_improvement_sprite_animated[i].getPosition().y >= this->position_y + 12)
638             ) {
639                 this->tile_improvement_sprite_animated[i].setColor(
640                     sf::Color(255, 255, 255, 255)
641                 );
642 
643                 this->tile_improvement_sprite_animated[i].setPosition(
644                     this->position_x,
645                     this->position_y + 12
646                 );
647             }
648 
649             this->render_window_ptr->draw(this->tile_improvement_sprite_animated[i]);
650         }
651 
652         if (
653             (alpha >= 255) or
654             (this->tile_improvement_sprite_animated[0].getPosition().y >= this->position_y + 12)
655         ) {
656             this->just_built = false;
657             this->assets_manager_ptr->getSound("place improvement")->play();
658 
659             switch (this->tile_improvement_type) {
660                 case (TileImprovementType :: WIND_TURBINE): {
661                     for (size_t i = 0; i < this->tile_improvement_sprite_animated.size(); i++) {
662                         this->tile_improvement_sprite_animated[i].setOrigin(32, 32);
663                         this->tile_improvement_sprite_animated[i].move(0, -32);
664                     }
665 
666                     break;
667                 }
668 
669 
670                 case (TileImprovementType :: TIDAL_TURBINE): {
671                     for (size_t i = 0; i < this->tile_improvement_sprite_animated.size(); i++) {
672                         this->tile_improvement_sprite_animated[i].setOrigin(32, 45);
```

```
673                         this->tile_improvement_sprite_animated[i].move(0, -19);
674                     }
675
676                     break;
677                 }
678
679
680                 case (TileImprovementType :: WAVE_ENERGY_CONVERTER): {
681                     for (size_t i = 0; i < this->tile_improvement_sprite_animated.size(); i++) {
682                         this->tile_improvement_sprite_animated[i].setOrigin(32, 32);
683                         this->tile_improvement_sprite_animated[i].move(0, -32);
684                     }
685
686                     break;
687                 }
688
689
690                 default: {
691                     // do nothing!
692
693                     break;
694                 }
695             }
696         }
697     }
698
699
700     this->frame++;
701     return;
702 }   /* draw() */
```

4.13.3.14 getTileOptionsSubstring()

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

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

```
160 {return "";}
```

4.13.3.15 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.

```
543 {
544     if (this->event_ptr->type == sf::Event::KeyPressed) {
545         this->__handleKeyPressEvents();
546     }
547
548     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
549         this->__handleMouseButtonEvents();
550     }
551
552     return;
553 }   /* processEvent() */
```

4.13.3.16 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.

```
568 {
569     //...
570 
571     return;
572 }   /* processMessage() */
```

4.13.3.17 setIsSelected()

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

Method to set the is selected attribute.

Parameters

is_selected	The value to set the is selected attribute to.

Reimplemented in Settlement, and EnergyStorageSystem.

```
516 {
517     this->is_selected = is_selected;
518 
519     if ((not is_selected) and this->production_menu_open) {
520         this->__closeProductionMenu();
521     }
522 
523     if ((not is_selected) and this->upgrade_menu_open) {
524         this->__closeUpgradeMenu();
525     }
526 
527     return;
528 }   /* setIsSelected() */
```

4.13.4 Member Data Documentation

4.13.4.1 assets_manager_ptr

```
AssetsManager* TileImprovement::assets_manager_ptr  [protected]
```

A pointer to the assets manager.

4.13.4.2 credits

```
int TileImprovement::credits
```

The current balance of credits.

4.13.4.3 event_ptr

```
sf::Event* TileImprovement::event_ptr  [protected]
```

A pointer to the event class.

4.13.4.4 frame

```
unsigned long long int TileImprovement::frame
```

The current frame of this object.

4.13.4.5 game_phase

```
std::string TileImprovement::game_phase
```

The current phase of the game.

4.13.4.6 health

```
int TileImprovement::health
```

The health of the improvement.

4.13.4.7 is_running

```
bool TileImprovement::is_running
```

A boolean which indicates whether or not the improvement is running.

4.13.4.8 is_selected

```
bool TileImprovement::is_selected
```

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

4.13.4.9 just_built

```
bool TileImprovement::just_built
```

A boolean which indicates that the improvement was just built.

4.13.4.10 just_upgraded

```
bool TileImprovement::just_upgraded
```

A boolean which indicates that the improvement was just upgraded.

4.13.4.11 message_hub_ptr

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

A pointer to the message hub.

4.13.4.12 position_x

```
double TileImprovement::position_x
```

The x position of the tile improvement.

4.13.4.13 position_y

```
double TileImprovement::position_y
```

The y position of the tile improvement.

4.13.4.14 production_menu_backing

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

A backing for the production menu.

4.13.4.15 production_menu_backing_text

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

Text for the production menu backing.

4.13.4.16 production_menu_open

```
bool TileImprovement::production_menu_open
```

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

4.13.4.17 render_window_ptr

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

A pointer to the render window.

4.13.4.18 tile_improvement_sprite_animated

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

An animated sprite, for the ContextMenu visual screen.

4.13.4.19 tile_improvement_sprite_static

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

A static sprite, for decorating the tile.

4.13.4.20 tile_improvement_string

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

A string representation of the tile improvement type.

4.13.4.21 tile_improvement_type

```
TileImprovementType TileImprovement::tile_improvement_type
```

The type of the tile improvement.

4.13.4.22 upgrade_frame

```
int TileImprovement::upgrade_frame
```

The frame of the upgrade animation.

4.13.4.23 upgrade_level

```
int TileImprovement::upgrade_level
```

The upgrade level of the improvement.

4.13.4.24 upgrade_menu_backing

```
sf::RectangleShape TileImprovement::upgrade_menu_backing
```

A backing for the upgrade menu.

4.13.4.25 upgrade_menu_backing_text

```
sf::Text TileImprovement::upgrade_menu_backing_text
```

Text for the upgrade menu backing.

4.13.4.26 upgrade_menu_open

```
bool TileImprovement::upgrade_menu_open
```

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

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

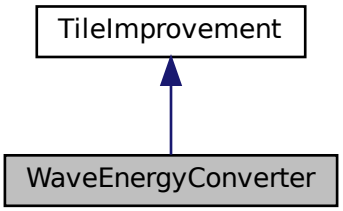
- header/TileImprovement.h
- source/TileImprovement.cpp

4.14 WaveEnergyConverter Class Reference

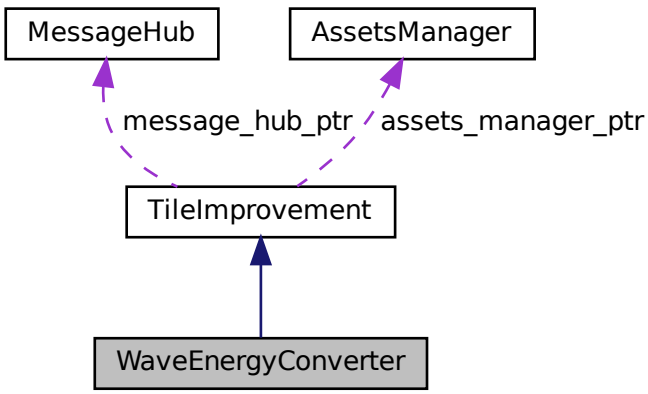
A settlement class (child class of TileImprovement).

```
#include <WaveEnergyConverter.h>
```

Inheritance diagram for WaveEnergyConverter:



Collaboration diagram for WaveEnergyConverter:



Public Member Functions

- WaveEnergyConverter (double, double, sf::Event *, sf::RenderWindow *, AssetsManager *, MessageHub *)

  Constructor for the WaveEnergyConverter class.
- std::string getTileOptionsSubstring (void)

  Helper method to assemble and return tile options substring.
- void processEvent (void)

  Method to process WaveEnergyConverter. To be called once per event.
- void processMessage (void)

  Method to process WaveEnergyConverter. To be called once per message.
- void draw (void)

  Method to draw the hex tile to the render window. To be called once per frame.
- virtual ~WaveEnergyConverter (void)

  Destructor for the WaveEnergyConverter class.

Public Attributes

- int capacity_kW

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

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

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

Private Member Functions

- void __setUpTileImprovementSpriteAnimated (void)

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

  Helper method to upgrade the diesel generator.
- void __handleKeyPressEvents (void)

  Helper method to handle key press events.
- void __handleMouseButtonEvents (void)

  Helper method to handle mouse button events.

Additional Inherited Members

4.14.1 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.

```
272   :
273 TileImprovement(
274     position_x,
275     position_y,
276     event_ptr,
277     render_window_ptr,
278     assets_manager_ptr,
279     message_hub_ptr
280 )
281 {
282     //  1. set attributes
283
284     //  1.1. private
285     //...
286
287     //  1.2. public
288     this->tile_improvement_type = TileImprovementType :: WAVE_ENERGY_CONVERTER;
289
290     this->is_running = false;
291
292     this->health = 100;
293
294     this->capacity_kW = 100;
295     this->upgrade_level = 1;
296
297     this->production_MWh = 0;
298     this->dispatchable_MWh = 0;
299
300     this->tile_improvement_string = "WAVE ENERGY";
301
302     this->__setUpTileImprovementSpriteAnimated();
303
304     std::cout « "WaveEnergyConverter constructed at " « this « std::endl;
305
306     return;
307 }   /* WaveEnergyConverter() */
```

4.14.2.2 ~WaveEnergyConverter()

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

Destructor for the WaveEnergyConverter class.

```
467 {
468     std::cout « "WaveEnergyConverter at " « this « " destroyed" « std::endl;
469 
470     return;
471 }   /* ~WaveEnergyConverter() */
```

4.14.3 Member Function Documentation

4.14.3.1 __handleKeyPressEvents()

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

Helper method to handle key press events.

```
161 {
162     if (this->just_built) {
163         return;
164     }
165 
166     switch (this->event_ptr->key.code) {
167         case (sf::Keyboard::U): {
168             if (this->upgrade_level < MAX_UPGRADE_LEVELS) {
169                 this->__upgrade();
170             }
171 
172             break;
173         }
174 
175 
176         default: {
177             // do nothing!
178 
179             break;
180         }
181     }
182 
183     return;
184 }   /* __handleKeyPressEvents() */
```

4.14.3.2 __handleMouseButtonEvents()

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

Helper method to handle mouse button events.

```
199 {
200     if (this->just_built) {
201         return;
202     }
203     switch (this->event_ptr->mouseButton.button) {
204         case (sf::Mouse::Left): {
205             //...
206 
207             break;
208         }
209 
210 
211         case (sf::Mouse::Right): {
212             //...
213 
214             break;
215         }
216 
217 
```

```
218         default: {
219             // do nothing!
220 
221             break;
222         }
223     }
224 
225     return;
226 }   /* __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 __upgrade()

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

Helper method to upgrade the diesel generator.

```
114 {
115     /*
116     int upgrade_cost = DIESEL_GENERATOR_BUILD_COST;
117 
118     if (this->credits < upgrade_cost) {
119         std::cout << "Cannot upgrade diesel generator: insufficient credits (need "
120             << upgrade_cost << " K)" << std::endl;
121 
122         this->__sendInsufficientCreditsMessage();
123         return;
124     }
125 
126     this->is_running = false;
127 
```

```
128     this->health = 100;
129
130     this->capacity_kW += 100;
131     this->upgrade_level++;
132
133     this->production_MWh = 0;
134     this->max_production_MWh += 72;
135
136     this->just_upgraded = true;
137
138     this->assets_manager_ptr->getSound("upgrade")->play();
139
140     this->__sendCreditsSpentMessage(upgrade_cost);
141     this->__sendTileStateRequest();
142     this->__sendGameStateRequest();
143     */
144
145     return;
146 }   /* __upgrade() */
```

4.14.3.5 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.

```
418 {
419     //  1. if just built, call base method and return
420     if (this->just_built) {
421         TileImprovement :: draw();
422
423         return;
424     }
425
426
427     //  2. draw first element of animated sprite
428     this->render_window_ptr->draw(this->tile_improvement_sprite_animated[0]);
429
430
431     //  3. draw second element of animated sprite
432     if (this->is_running) {
433         //...
434     }
435
436     else {
437         //...
438     }
439
440     this->render_window_ptr->draw(this->tile_improvement_sprite_animated[1]);
441
442     //  4. draw production menu
443     if (this->production_menu_open) {
444         this->render_window_ptr->draw(this->production_menu_backing);
445         this->render_window_ptr->draw(this->production_menu_backing_text);
446
447         //...
448     }
449
450     this->frame++;
451     return;
452 }   /* draw() */
```

4.14.3.6 getTileOptionsSubstring()

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

Helper method to assemble and return tile options substring.

Returns

Tile options substring.

Reimplemented from TileImprovement.

```
324 {
325     //                  32 char x 17 line console "--------------------------------\n";
326     std::string options_substring                = "CAPACITY:      ";
327     options_substring                           += std::to_string(this->capacity_kW);
328     options_substring                           += " kW (level ";
329     options_substring                           += std::to_string(this->upgrade_level);
330     options_substring                           += ")\n";
331
332     options_substring                           += "PRODUCTION:    ";
333     options_substring                           += std::to_string(this->production_MWh);
334     options_substring                           += " MWh\n";
335
336     options_substring                           += "DISPATCHABLE:  ";
337     options_substring                           += std::to_string(this->dispatchable_MWh);
338     options_substring                           += " MWh\n";
339
340     options_substring                           += "HEALTH:        ";
341     options_substring                           += std::to_string(this->health);
342     options_substring                           += "/100\n";
343
344     options_substring                           += "                                \n";
345     options_substring                           += " **** WAVE ENERGY OPTIONS ****  \n";
346     options_substring                           += "                                \n";
347     options_substring                           += "     [E]:  OPEN PRODUCTION MENU \n";
348     options_substring                           += "     [U]:  OPEN UPGRADE MENU    \n";
349     options_substring                           += "HOLD [P]:  SCRAP (";
350     options_substring                           += std::to_string(SCRAP_COST);
351     options_substring                           += " K)";
352
353     return options_substring;
354 }   /* getTileOptionsSubstring() */
```

4.14.3.7 processEvent()

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

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

Reimplemented from TileImprovement.

```
369 {
370     TileImprovement :: processEvent();
371
372     if (this->event_ptr->type == sf::Event::KeyPressed) {
373         this->__handleKeyPressEvents();
374     }
375
376     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
377         this->__handleMouseButtonEvents();
378     }
379
380     return;
381 }   /* processEvent() */
```

4.14.3.8 processMessage()

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

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

Reimplemented from TileImprovement.

```
396 {
397     TileImprovement :: processMessage();
398
399     //...
400
401     return;
402 }   /* processMessage() */
```

4.14.4 Member Data Documentation

4.14.4.1 capacity_kW

```
int WaveEnergyConverter::capacity_kW
```

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

4.14.4.2 dispatchable_MWh

```
int WaveEnergyConverter::dispatchable_MWh
```

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

4.14.4.3 production_MWh

```
int WaveEnergyConverter::production_MWh
```

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

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

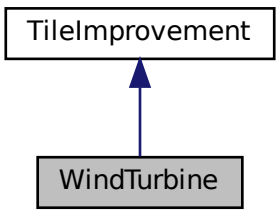
- header/WaveEnergyConverter.h
- source/WaveEnergyConverter.cpp

4.15 WindTurbine Class Reference

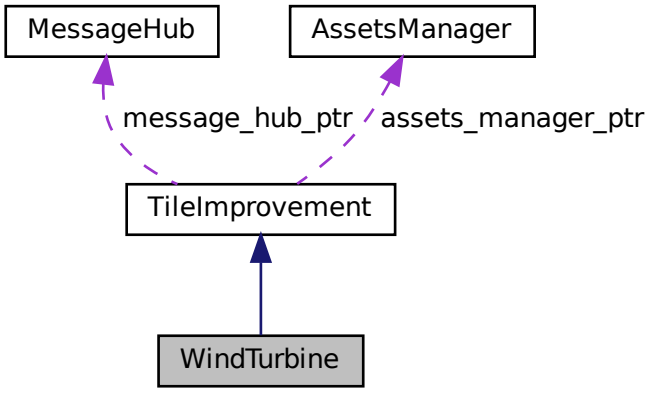
A settlement class (child class of TileImprovement).

```
#include <WindTurbine.h>
```

Inheritance diagram for WindTurbine:



Collaboration diagram for WindTurbine:



Public Member Functions

- WindTurbine (double, double, sf::Event ∗, sf::RenderWindow ∗, AssetsManager ∗, MessageHub ∗)

  Constructor for the WindTurbine class.
- std::string getTileOptionsSubstring (void)

  Helper method to assemble and return tile options substring.
- void processEvent (void)

  Method to process WindTurbine. To be called once per event.
- void processMessage (void)

  Method to process WindTurbine. To be called once per message.
- void draw (void)

  Method to draw the hex tile to the render window. To be called once per frame.
- virtual ∼WindTurbine (void)

  Destructor for the WindTurbine class.

Public Attributes

- int capacity_kW

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

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

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

Private Member Functions

- void __setUpTileImprovementSpriteAnimated (void)

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

  Helper method to upgrade the diesel generator.
- void __handleKeyPressEvents (void)

  Helper method to handle key press events.
- void __handleMouseButtonEvents (void)

  Helper method to handle mouse button events.

Additional Inherited Members

4.15.1 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.

```
273   :
274 TileImprovement(
275     position_x,
276     position_y,
277     event_ptr,
278     render_window_ptr,
```

```
279     assets_manager_ptr,
280     message_hub_ptr
281 )
282 {
283     //  1. set attributes
284 
285     //  1.1. private
286     //...
287 
288     //  1.2. public
289     this->tile_improvement_type = TileImprovementType :: WIND_TURBINE;
290 
291     this->is_running = false;
292 
293     this->health = 100;
294 
295     this->capacity_kW = 100;
296     this->upgrade_level = 1;
297 
298     this->production_MWh = 0;
299     this->dispatchable_MWh = 0;
300 
301     this->tile_improvement_string = "WIND TURBINE";
302 
303     this->__setUpTileImprovementSpriteAnimated();
304 
305     std::cout « "WindTurbine constructed at " « this « std::endl;
306 
307     return;
308 }   /* WindTurbine() */
```

4.15.2.2 ~WindTurbine()

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

Destructor for the WindTurbine class.

```
468 {
469     std::cout « "WindTurbine at " « this « " destroyed" « std::endl;
470 
471     return;
472 }   /* ~WindTurbine() */
```

4.15.3 Member Function Documentation

4.15.3.1 __handleKeyPressEvents()

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

Helper method to handle key press events.

```
161 {
162     if (this->just_built) {
163         return;
164     }
165 
166     switch (this->event_ptr->key.code) {
167         case (sf::Keyboard::U): {
168             if (this->upgrade_level < MAX_UPGRADE_LEVELS) {
169                 this->__upgrade();
170             }
171 
172             break;
173         }
174 
```

```
175
176         default: {
177             // do nothing!
178
179             break;
180         }
181     }
182
183     return;
184 }   /* __handleKeyPressEvents() */
```

4.15.3.2 __handleMouseButtonEvents()

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

Helper method to handle mouse button events.

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

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

Helper method to upgrade the diesel generator.

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

4.15.3.5 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.

```
419 {
420     //  1. if just built, call base method and return
421     if (this->just_built) {
```

```
422         TileImprovement :: draw();
423 
424         return;
425     }
426 
427 
428     //  2. draw first element of animated sprite
429     this->render_window_ptr->draw(this->tile_improvement_sprite_animated[0]);
430 
431 
432     //  3. draw second element of animated sprite
433     if (this->is_running) {
434         //...
435     }
436 
437     else {
438         //...
439     }
440 
441     this->render_window_ptr->draw(this->tile_improvement_sprite_animated[1]);
442 
443     //  4. draw production menu
444     if (this->production_menu_open) {
445         this->render_window_ptr->draw(this->production_menu_backing);
446         this->render_window_ptr->draw(this->production_menu_backing_text);
447 
448         //...
449     }
450 
451     this->frame++;
452     return;
453 }   /* draw() */
```

4.15.3.6 getTileOptionsSubstring()

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

Helper method to assemble and return tile options substring.

Returns

Tile options substring.

Reimplemented from TileImprovement.

```
325 {
326     //                  32 char x 17 line console "--------------------------------\n";
327     std::string options_substring                = "CAPACITY:      ";
328     options_substring                           += std::to_string(this->capacity_kW);
329     options_substring                           += " kW (level ";
330     options_substring                           += std::to_string(this->upgrade_level);
331     options_substring                           += ")\n";
332 
333     options_substring                           += "PRODUCTION:    ";
334     options_substring                           += std::to_string(this->production_MWh);
335     options_substring                           += " MWh\n";
336 
337     options_substring                           += "DISPATCHABLE:  ";
338     options_substring                           += std::to_string(this->dispatchable_MWh);
339     options_substring                           += " MWh\n";
340 
341     options_substring                           += "HEALTH:        ";
342     options_substring                           += std::to_string(this->health);
343     options_substring                           += "/100\n";
344 
345     options_substring                           += "                                \n";
346     options_substring                           += " **** WIND TURBINE OPTIONS **** \n";
347     options_substring                           += "                                \n";
348     options_substring                           += "     [E]:  OPEN PRODUCTION MENU \n";
349     options_substring                           += "     [U]:  OPEN UPGRADE MENU    \n";
350     options_substring                           += "HOLD [P]:  SCRAP (";
351     options_substring                           += std::to_string(SCRAP_COST);
352     options_substring                           += " K)";
353 
354     return options_substring;
355 }   /* getTileOptionsSubstring() */
```

4.15.3.7 processEvent()

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

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

Reimplemented from TileImprovement.

```
370 {
371     TileImprovement :: processEvent();
372 
373     if (this->event_ptr->type == sf::Event::KeyPressed) {
374         this->__handleKeyPressEvents();
375     }
376 
377     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
378         this->__handleMouseButtonEvents();
379     }
380 
381     return;
382 }   /* processEvent() */
```

4.15.3.8 processMessage()

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

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

Reimplemented from TileImprovement.

```
397 {
398     TileImprovement :: processMessage();
399 
400     //...
401 
402     return;
403 }   /* processMessage() */
```

4.15.4 Member Data Documentation

4.15.4.1 capacity_kW

```
int WindTurbine::capacity_kW
```

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

4.15.4.2 dispatchable_MWh

```
int WindTurbine::dispatchable_MWh
```

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

4.15.4.3 production_MWh

```
int WindTurbine::production_MWh
```

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

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

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

Chapter 5

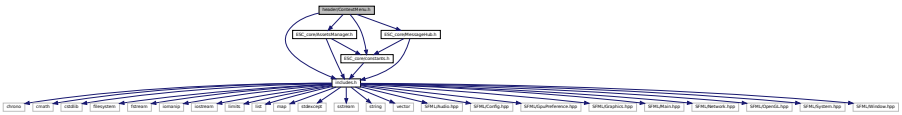
File Documentation

5.1 header/ContextMenu.h File Reference

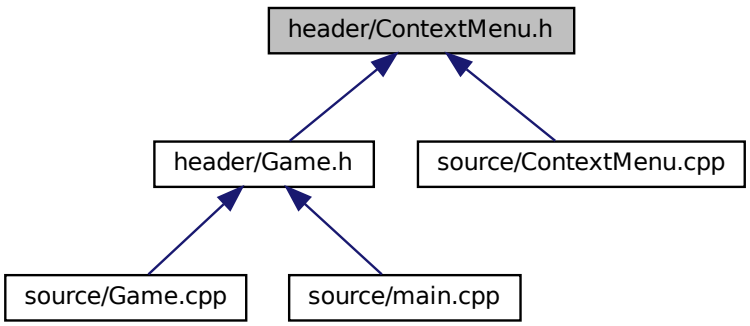
Header file for the ContextMenu class.

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

Include dependency graph for ContextMenu.h:



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



Classes

- class ContextMenu

  A class which defines a context menu for the game.

Enumerations

- enum ConsoleState {
  NONE_STATE , READY , MENU , TILE ,
  N_CONSOLE_STATES }

  An enumeration of the different console screen states.

5.1.1 Detailed Description

Header file for the ContextMenu class.

5.1.2 Enumeration Type Documentation

5.1.2.1 ConsoleState

```
enum ConsoleState
```

An enumeration of the different console screen states.

Enumerator

NONE_STATE	None state (for initialization)
READY	Ready (default) state.
MENU	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 };
```

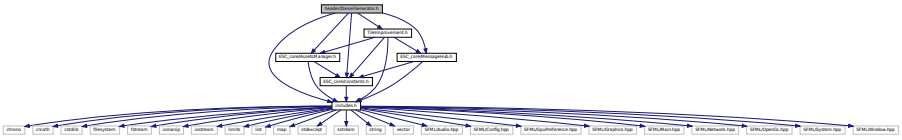
5.2 header/DieselGenerator.h File Reference

Header file for the DieselGenerator class.

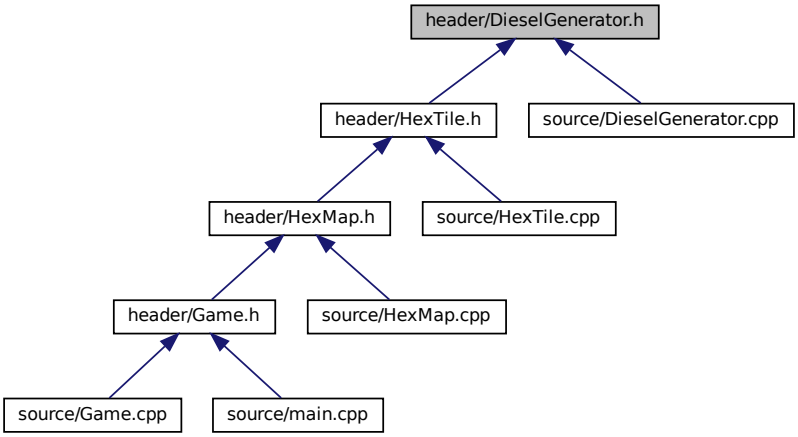
```
#include "ESC_core/constants.h"
#include "ESC_core/includes.h"
#include "ESC_core/AssetsManager.h"
```

```
#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

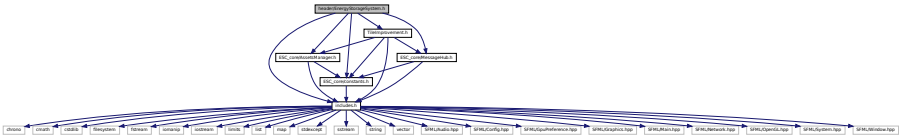
Header file for the DieselGenerator class.

5.3 header/EnergyStorageSystem.h File Reference

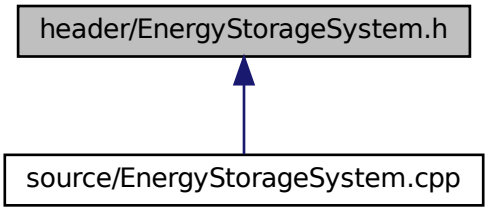
Header file for the EnergyStorageSystem class.

```
#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).

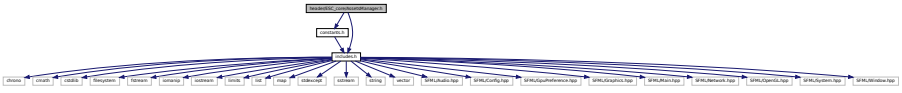
5.3.1 Detailed Description

Header file for the EnergyStorageSystem class.

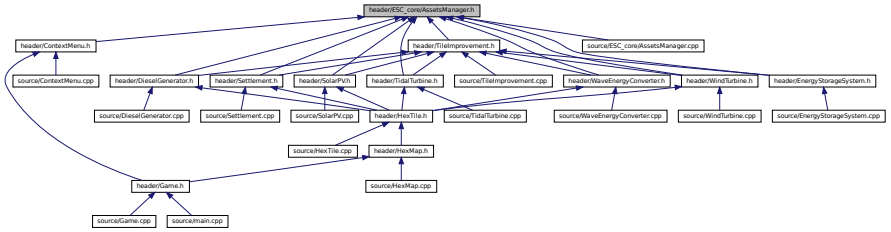
5.4 header/ESC_core/AssetsManager.h File Reference

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.

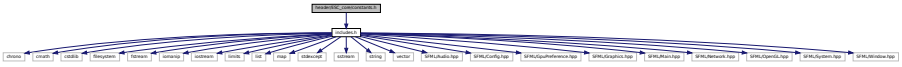
5.4.1 Detailed Description

Header file for the AssetsManager class.

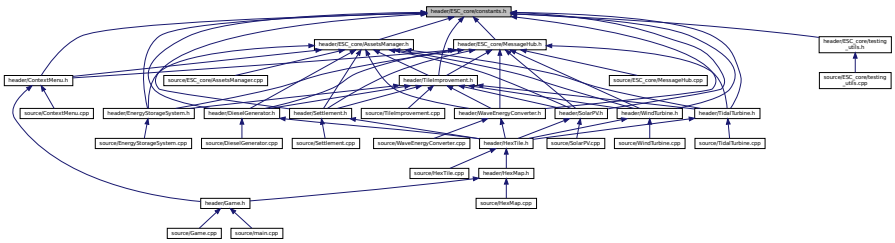
5.5 header/ESC_core/constants.h File Reference

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 in 100 kW increments.
- const int WIND_TURBINE_BUILD_COST = 400

  The cost of building (or upgrading) a wind turbine in 100 kW increments.
- const double WIND_TURBINE_WATER_BUILD_MULTIPLIER = 1.25

  The additional cost of building on water.
- const int SOLAR_PV_BUILD_COST = 300

  The cost of building (or upgrading) a solar PV array in 100 kW increments.
- const double SOLAR_PV_WATER_BUILD_MULTIPLIER = 1.5

  The additional cost of building on water.
- const int TIDAL_TURBINE_BUILD_COST = 600

  The cost of building (or upgrading) a tidal turbine in 100 kW increments.
- const int WAVE_ENERGY_CONVERTER_BUILD_COST = 800

  The cost of building (or upgrading) a wave energy converter in 100 kW increments.
- const int ENERGY_STORAGE_SYSTEM_BUILD_COST = 800

  The cost of building (or upgrading) an energy storage system in 1 MWh increments.
- const int SCRAP_COST = 50

  The cost of scrapping a tile improvement (other than settlement).
- const int MAX_UPGRADE_LEVELS = 5

  The maximum upgrade level of any tile improvement.
- const int 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 in 100 kW increments.

5.5.3.7 EMISSIONS_LIFETIME_LIMIT_TONNES

```
const int EMISSIONS_LIFETIME_LIMIT_TONNES = 1500
```

The CO2-equivalent mass of emissions that would result from burning 1,000,000 L of diesel fuel.

5.5.3.8 ENERGY_STORAGE_SYSTEM_BUILD_COST

```
const int ENERGY_STORAGE_SYSTEM_BUILD_COST = 800
```

The cost of building (or upgrading) an energy storage system in 1 MWh increments.

5.5.3.9 FLOAT_TOLERANCE

```
const double FLOAT_TOLERANCE = 1e-6
```

Tolerance for floating point equality tests.

5.5.3.10 FRAMES_PER_SECOND

```
const int FRAMES_PER_SECOND = 60
```

Target frames per second.

5.5.3.11 GAME_CHANNEL

```
const std::string GAME_CHANNEL = "GAME CHANNEL"
```

A message channel for game messages.

5.5.3.12 GAME_HEIGHT

```
const int GAME_HEIGHT = 800
```

Height of the game space.

5.5.3.13 GAME_STATE_CHANNEL

```
const std::string GAME_STATE_CHANNEL = "GAME STATE CHANNEL"
```

A message channel for game state messages.

5.5.3.14 GAME_WIDTH

```
const int GAME_WIDTH = 1200
```

Width of the game space.

5.5.3.15 HEX_MAP_CHANNEL

```
const std::string HEX_MAP_CHANNEL = "HEX MAP CHANNEL"
```

A message channel for hex map messages.

5.5.3.16 MAX_UPGRADE_LEVELS

```
const int MAX_UPGRADE_LEVELS = 5
```

The maximum upgrade level of any tile improvement.

5.5.3.17 NO_TILE_SELECTED_CHANNEL

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

A message channel for no tile selected messages.

5.5.3.18 RESOURCE_ASSESSMENT_COST

```
const int RESOURCE_ASSESSMENT_COST = 20
```

The cost of doing a resource assessment.

5.5.3.19 SCRAP_COST

```
const int SCRAP_COST = 50
```

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

5.5.3.20 SECONDS_PER_FRAME

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

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

5.5.3.21 SECONDS_PER_MONTH

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

5.5.3.22 SECONDS_PER_YEAR

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

5.5.3.23 SOLAR_PV_BUILD_COST

```
const int SOLAR_PV_BUILD_COST = 300
```

The cost of building (or upgrading) a solar PV array in 100 kW increments.

5.5.3.24 SOLAR_PV_WATER_BUILD_MULTIPLIER

```
const double SOLAR_PV_WATER_BUILD_MULTIPLIER = 1.5
```

The additional cost of building on water.

5.5.3.25 STARTING_CREDITS

```
const int STARTING_CREDITS = 99999
```

The starting balance of credits.

5.5.3.26 STARTING_POPULATION

```
const int STARTING_POPULATION = 100
```

The starting population of a settlement.

5.5.3.27 TIDAL_TURBINE_BUILD_COST

```
const int TIDAL_TURBINE_BUILD_COST = 600
```

The cost of building (or upgrading) a tidal turbine in 100 kW increments.

5.5.3.28 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).

5.5.3.29 TILE_SELECTED_CHANNEL

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

A message channel for tile selection messages.

5.5.3.30 TILE_STATE_CHANNEL

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

A message channel for tile state messages.

5.5.3.31 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).

5.5.3.32 WAVE_ENERGY_CONVERTER_BUILD_COST

```
const int WAVE_ENERGY_CONVERTER_BUILD_COST = 800
```

The cost of building (or upgrading) a wave energy converter in 100 kW increments.

5.5.3.33 WIND_TURBINE_BUILD_COST

```
const int WIND_TURBINE_BUILD_COST = 400
```

The cost of building (or upgrading) a wind turbine in 100 kW increments.

5.5.3.34 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]

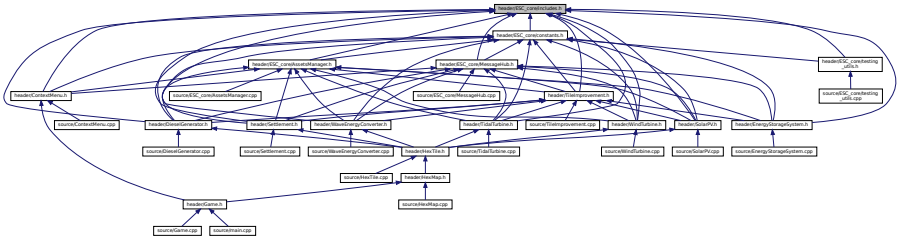
5.7 header/ESC_core/includes.h File Reference

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.

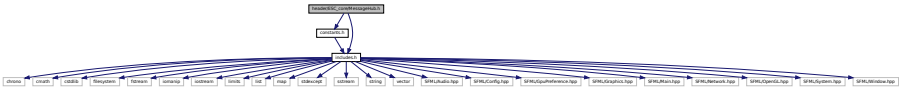
Ref: Gomila [2023]

5.8 header/ESC_core/MessageHub.h File Reference

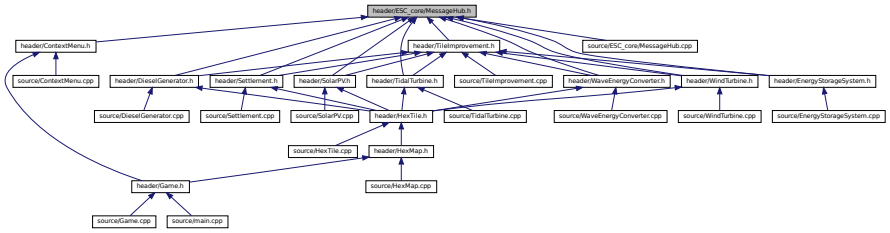
Header file for the MessageHub class.

```
#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

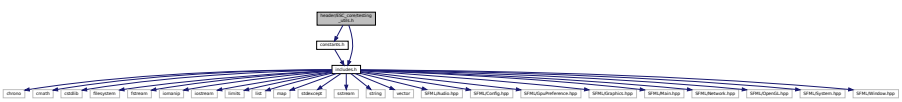
Header file for the MessageHub class.

5.9 header/ESC_core/testing_utils.h File Reference

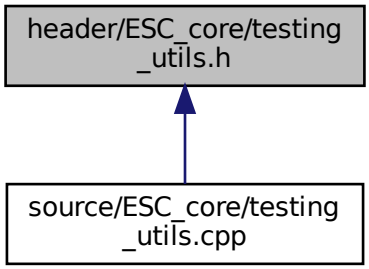
Header file for various testing utilities.

```
#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.

Parameters

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

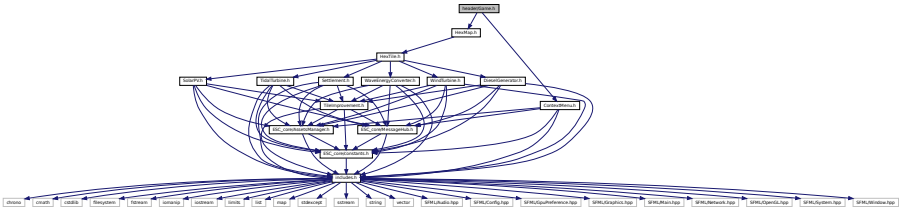
statement	The statement whose truth is to be tested ("1 == 0", for example).
file	The file in which the test is applied (you should be able to just pass in "__FILE__").
line	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```
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() */
```

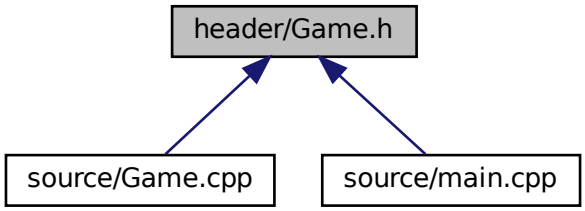
5.10 header/Game.h File Reference

```
#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.

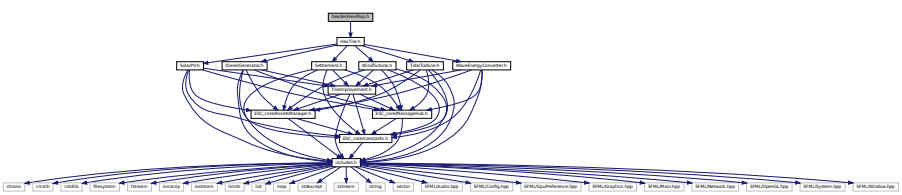
```
66                {
67     BUILD_SETTLEMENT,
68     SYSTEM_MANAGEMENT,
69     LOSS_EMISSIONS,
70     LOSS_DEMAND,
71     LOSS_CREDITS,
72     VICTORY,
73     N_GAME_PHASES
74 };  /* GamePhase */
```

5.11 header/HexMap.h File Reference

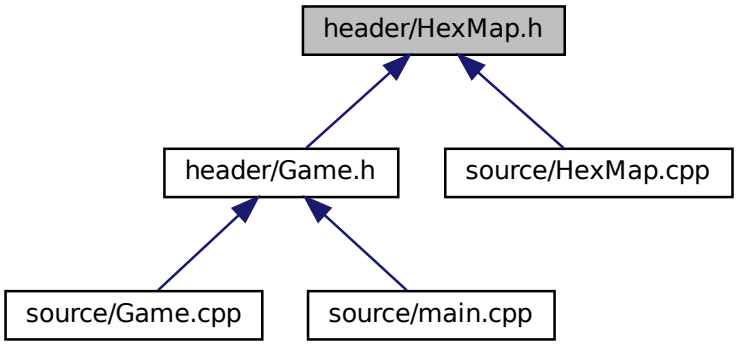
Header file for the HexMap class.

```
#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

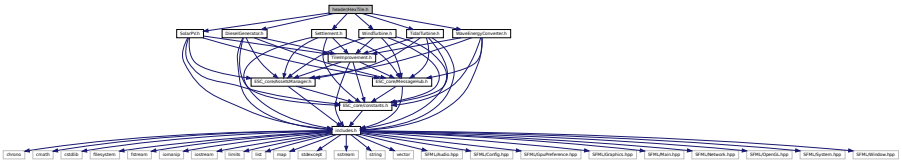
Header file for the HexMap class.

5.12 header/HexTile.h File Reference

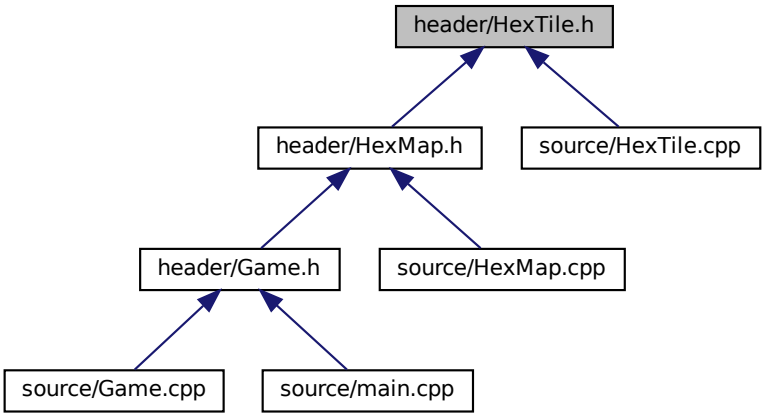
Header file for the Game class.

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

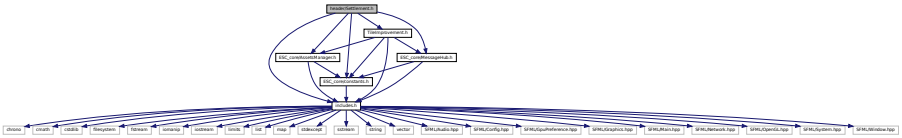
5.13 header/Settlement.h File Reference

Header file for the Settlement class.

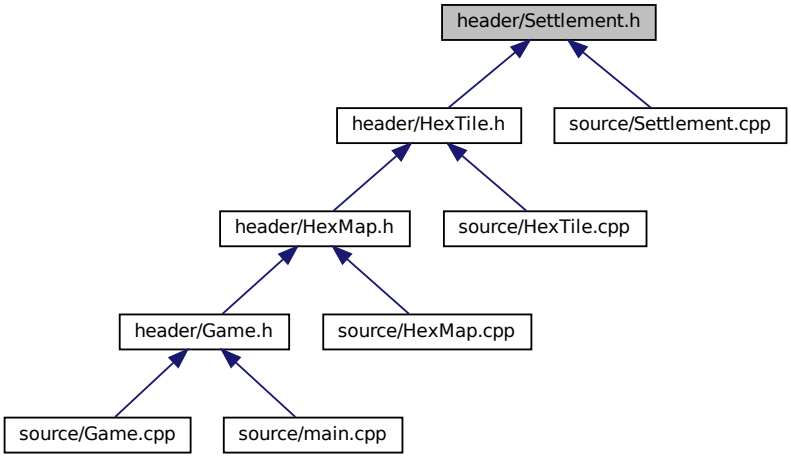
```
#include "ESC_core/constants.h"
#include "ESC_core/includes.h"
#include "ESC_core/AssetsManager.h"
#include "ESC_core/MessageHub.h"
```

```
#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.

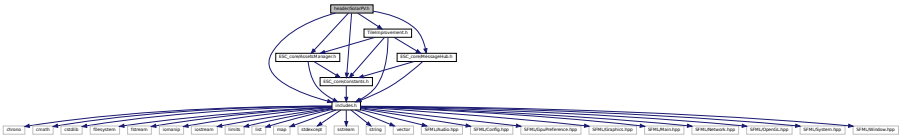
5.14 header/SolarPV.h File Reference

Header file for the SolarPV class.

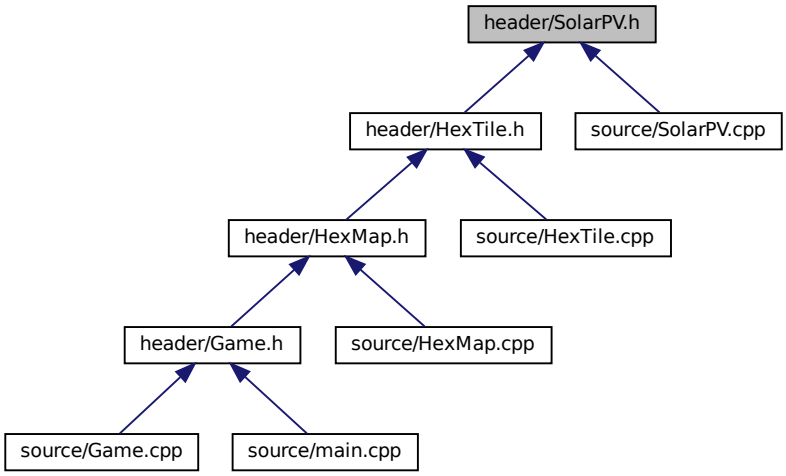
```
#include "ESC_core/constants.h"
#include "ESC_core/includes.h"
#include "ESC_core/AssetsManager.h"
#include "ESC_core/MessageHub.h"
```

```
#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.

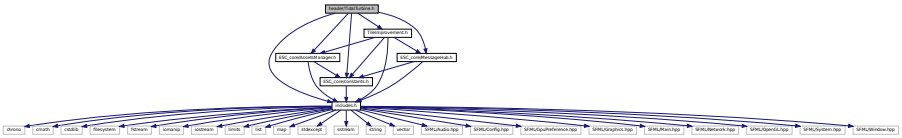
5.15 header/TidalTurbine.h File Reference

Header file for the TidalTurbine class.

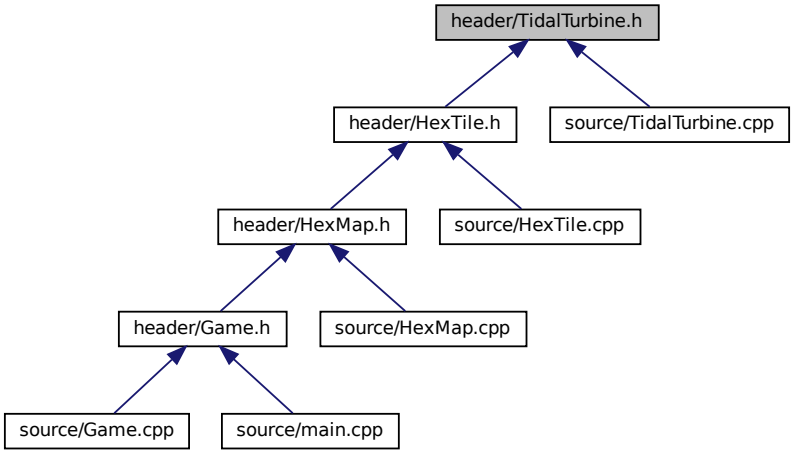
```
#include "ESC_core/constants.h"
#include "ESC_core/includes.h"
#include "ESC_core/AssetsManager.h"
#include "ESC_core/MessageHub.h"
```

```
#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.

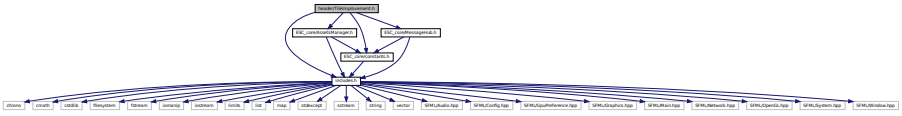
5.16 header/TileImprovement.h File Reference

Header file for the TileImprovement class.

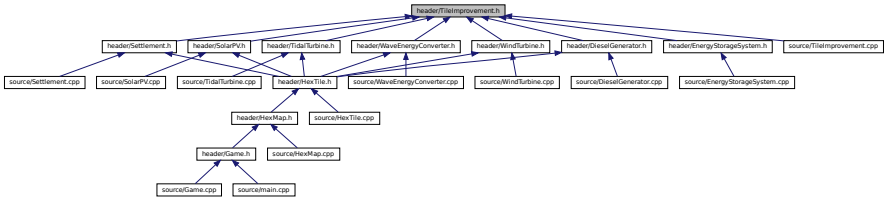
```
#include "ESC_core/constants.h"
#include "ESC_core/includes.h"
#include "ESC_core/AssetsManager.h"
```

```
#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.

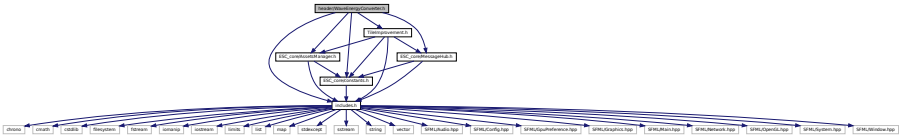
```
68                          {
69     SETTLEMENT,
70     DIESEL_GENERATOR,
71     SOLAR_PV,
72     WIND_TURBINE,
73     TIDAL_TURBINE,
74     WAVE_ENERGY_CONVERTER,
75     ENERGY_STORAGE_SYSTEM,
76     N_TILE_IMPROVEMENT_TYPES
77 };  /* TileImprovementType */
```

5.17 header/WaveEnergyConverter.h File Reference

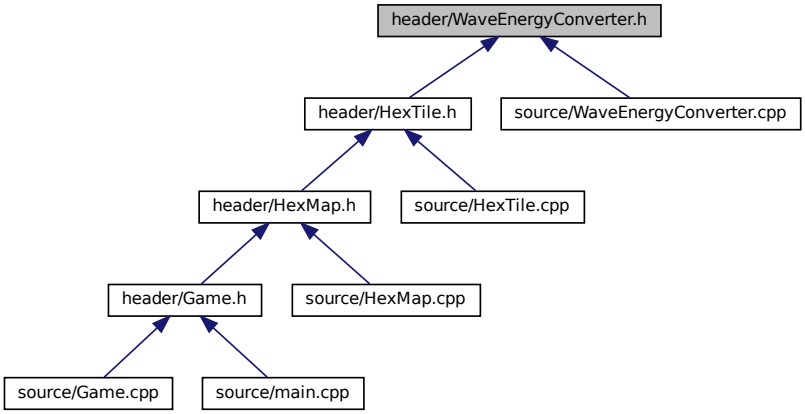
Header file for the WaveEnergyConverter class.

```
#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

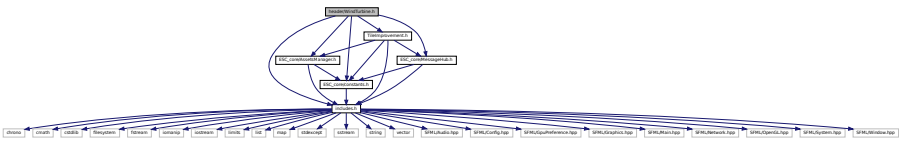
Header file for the WaveEnergyConverter class.

5.18 header/WindTurbine.h File Reference

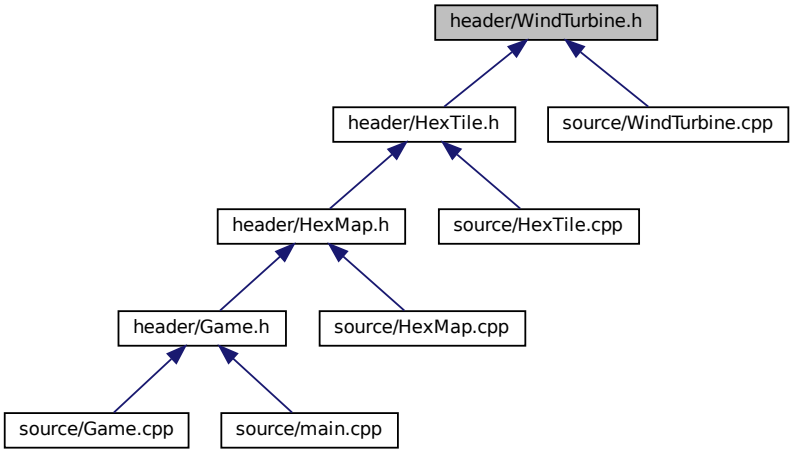
Header file for the WindTurbine class.

```
#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

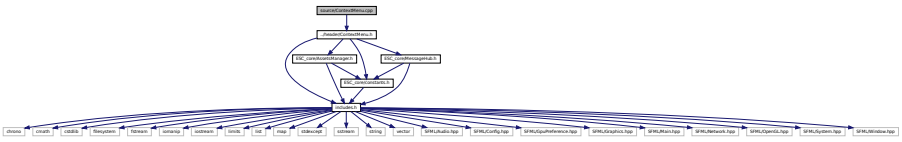
Header file for the WindTurbine class.

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.

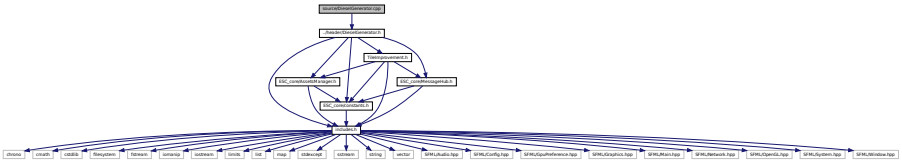
A class which defines a context menu for the game.

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.

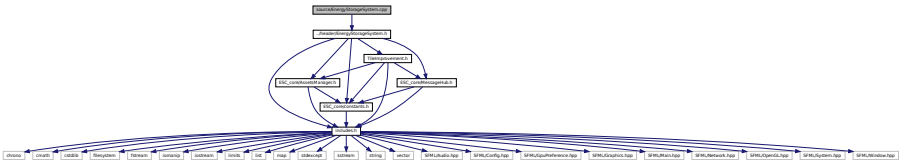
A base class for the tile improvement hierarchy.

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.

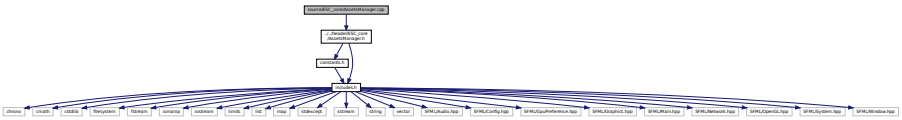
A base class for the tile improvement hierarchy.

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

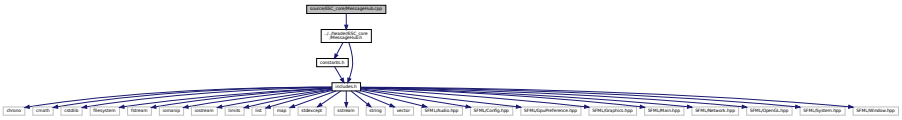
Implementation file for the AssetsManager class.

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

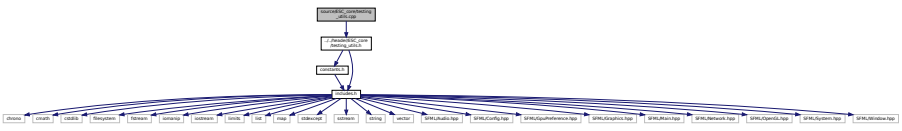
Implementation file for the MessageHub class.

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

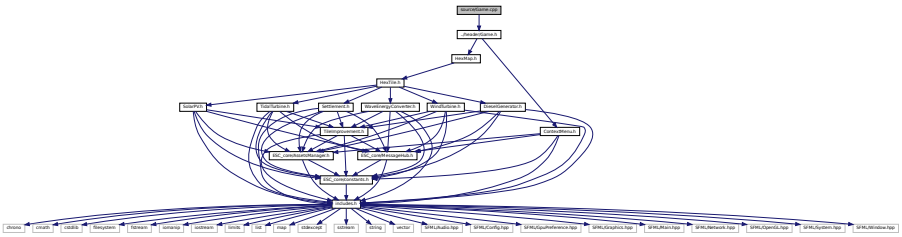
statement	The statement whose truth is to be tested ("1 == 0", for example).
file	The file in which the test is applied (you should be able to just pass in "__FILE__").
line	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```
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

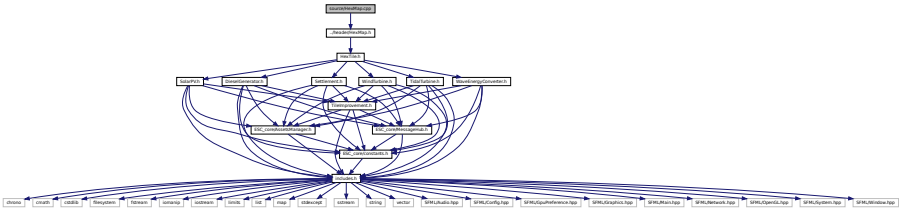
Implementation file for the Game class.

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

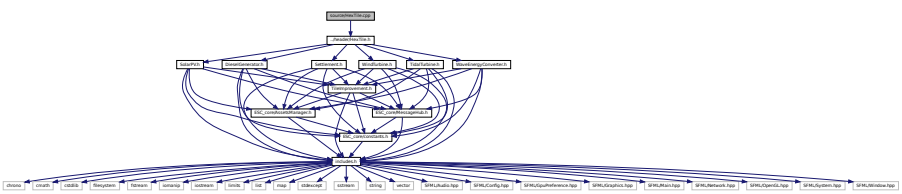
Implementation file for the HexMap class.

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.

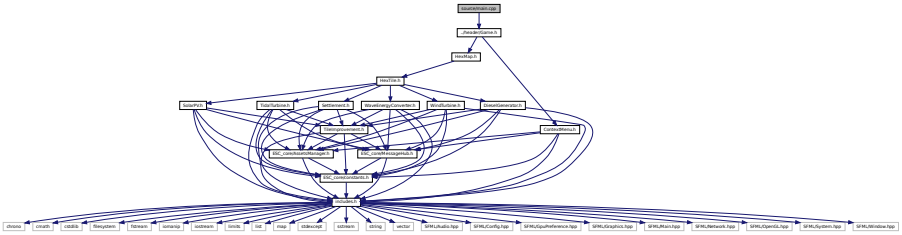
A class which defines a tile of a hex map.

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.

```
299 {
300     sf::RenderWindow* render_window_ptr = new sf::RenderWindow(
301         sf::VideoMode(GAME_WIDTH, GAME_HEIGHT),
302         "Road To Zero"
303     );
304 
305     return render_window_ptr;
306 }   /* 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"
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     assets_manager_ptr->loadSound(
261         "assets/audio/samples/mixkit-magical-coin-win-1936_MixkitFree.ogg",
262         "upgrade"
263     );
264
265
266     //  4. load tracks
267     assets_manager_ptr->loadTrack(
268         "assets/audio/tracks/TreeStarMoon_Dobranoc_CC0.ogg",
269         "Tree Star Moon - Dobranoc"
270     );
271
272     assets_manager_ptr->loadTrack(
273         "assets/audio/tracks/TreeStarMoon_Lighthouse_CC0.ogg",
274         "Tree Star Moon - Lighthouse"
275     );
276
277     assets_manager_ptr->loadTrack(
278         "assets/audio/tracks/TreeStarMoon_SkyFarm_CC0.ogg",
279         "Tree Star Moon - Sky Farm"
280     );
281
282     return;
283 }   /* loadAssets() */
```

5.28.2.3 main()

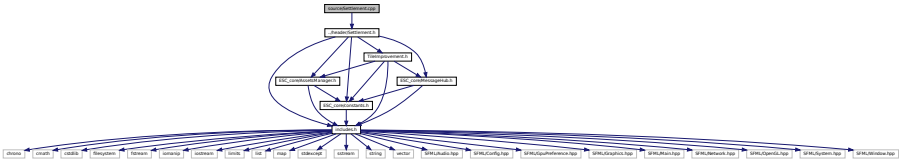
```
int main (
              int argc,
              char ** argv )
315 {
316     //  1. load assets
317     AssetsManager assets_manager;
318     loadAssets(&assets_manager);
319
320     //  2. construct render window
321     sf::RenderWindow* render_window_ptr = constructRenderWindow();
322
323     //  3. start game loop
324     bool quit_game = false;
325     assets_manager.playTrack();
```

```
326
327     while (not quit_game) {
328         Game game(render_window_ptr, &assets_manager);
329         quit_game = game.run();
330     }
331
332     //  4. clean up
333     render_window_ptr->close();
334     delete render_window_ptr;
335
336     return 0;
337 }   /* 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

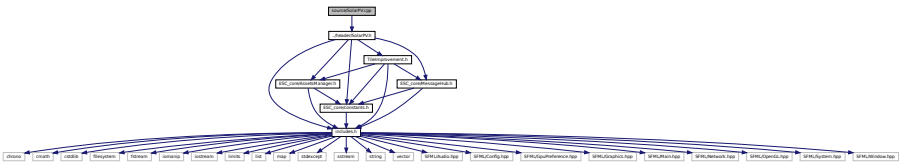
Implementation file for the Settlement class.

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.

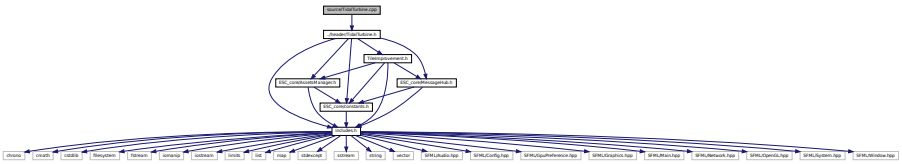
A base class for the tile improvement hierarchy.

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.

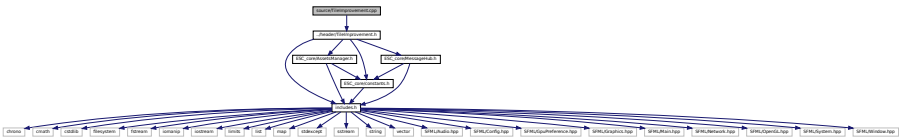
A base class for the tile improvement hierarchy.

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.

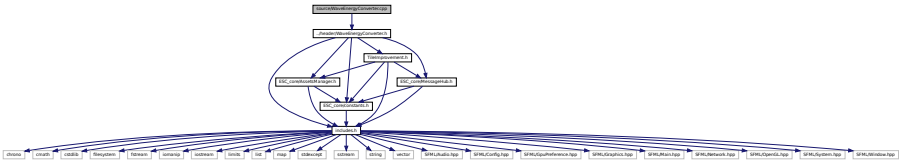
A base class for the tile improvement hierarchy.

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.

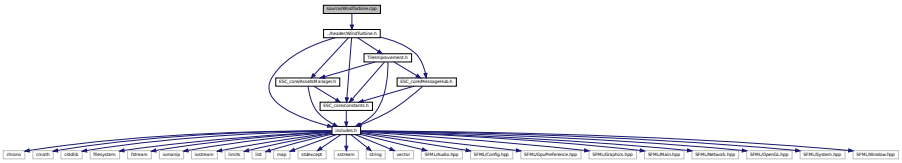
A base class for the tile improvement hierarchy.

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.

Bibliography

L. Gomila. SFML: Simple and Fast Multimedia Library, 2023. URL https://www.sfml-dev.org/. 219

D. van Heesch. Doxygen: Generate documentation from source code, 2023. URL https://www.doxygen.nl. 218

Wikipedia. Hexagon, 2023. URL https://en.wikipedia.org/wiki/Hexagon. 39, 48, 97, 148, 156, 163, 173, 188, 195

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