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:

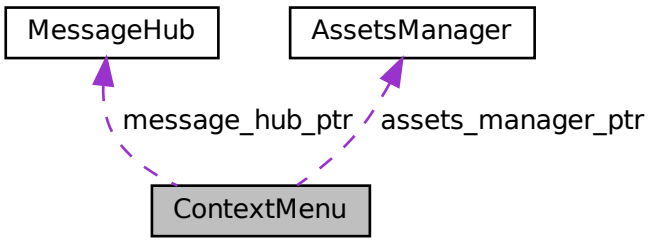
- header/ESC_core/AssetsManager.h
- source/ESC_core/AssetsManager.cpp

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:

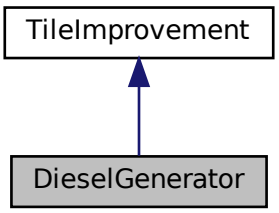
- header/ContextMenu.h
- source/ContextMenu.cpp

4.3 DieselGenerator Class Reference

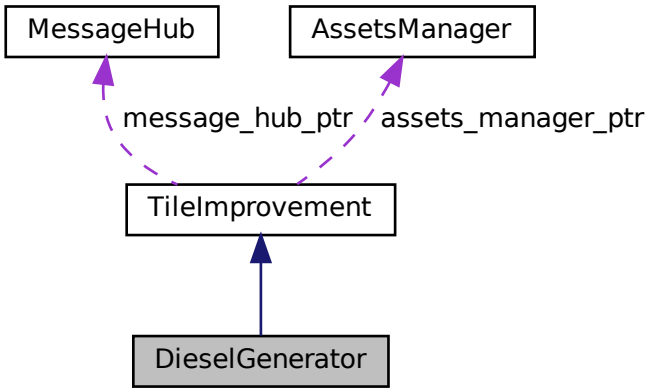
A settlement class (child class of TileImprovement).

```
#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]:  UPGRADE (";
361         options_substring                        += std::to_string(upgrade_cost);
362         options_substring                        +=" K)\n";
363     }
364 
365     options_substring                           += "[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:

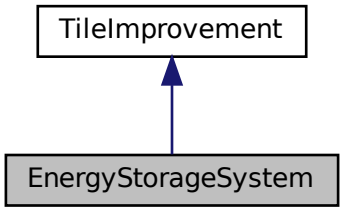
- header/DieselGenerator.h
- source/DieselGenerator.cpp

4.4 EnergyStorageSystem Class Reference

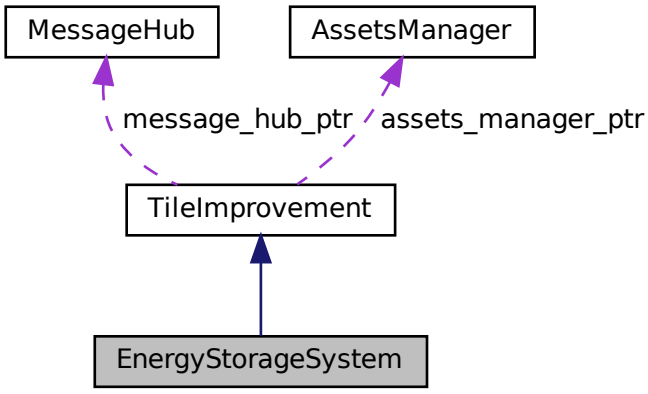
A settlement class (child class of TileImprovement).

`#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.

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

4.4.1 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.

```
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 :: ENERGY_STORAGE_SYSTEM;
279 
280     this->is_running = false;
281 
282     this->health = 100;
283 
284     this->tile_improvement_string = "ENERGY STORAGE";
285 
286     this->__setUpTileImprovementSpriteStatic();
287 
288     std::cout « "EnergyStorageSystem constructed at " « this « std::endl;
289 
290     return;
291 }   /* EnergyStorageSystem() */
```

4.4.2.2 ~EnergyStorageSystem()

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

Destructor for the EnergyStorageSystem class.

```
451 {
452     std::cout « "EnergyStorageSystem at " « this « " destroyed" « std::endl;
453 
454     return;
455 }   /* ~EnergyStorageSystem() */
```

4.4.3 Member Function Documentation

4.4.3.1 __handleKeyPressEvents()

```
void EnergyStorageSystem::__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() */
```

4.4.3.2 __handleMouseButtonEvents()

```
void EnergyStorageSystem::__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() */
```

4.4.3.3 __setUpTileImprovementSpriteStatic()

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

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

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

4.4.3.4 __upgrade()

```
void EnergyStorageSystem::__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() */
```

4.4.3.5 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.

```
413 {
414     //  1. if just built, call base method and return
415     if (this->just_built) {
416         TileImprovement :: draw();
417 
418         return;
419     }
420 
421 
422     //  2. draw static sprite
423     this->render_window_ptr->draw(this->tile_improvement_sprite_static);
424 
425 
426     //  3. draw production menu
427     if (this->production_menu_open) {
428         this->render_window_ptr->draw(this->production_menu_backing);
429         this->render_window_ptr->draw(this->production_menu_backing_text);
430 
431         //...
432     }
433 
434     this->frame++;
435     return;
436 }   /* draw() */
```

4.4.3.6 getTileOptionsSubstring()

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

Helper method to assemble and return tile options substring.

Returns

Tile options substring.

Reimplemented from TileImprovement.

```
333 {
334     //                  32 char x 17 line console "--------------------------------\n";
335     std::string options_substring                = "**** ENERGY STORAGE OPTIONS ****\n";
336     options_substring                           += "                                \n";
337     options_substring                           += "                                \n";
338     options_substring                           += "                                \n";
339     options_substring                           += "                                \n";
340     options_substring                           += "                                \n";
341     options_substring                           += "                                \n";
342     options_substring                           += "                                \n";
343
344     options_substring                           += "[P]:  SCRAP (";
345     options_substring                           += std::to_string(SCRAP_COST);
346     options_substring                           += " K)";
347
348     return options_substring;
349 }   /* getTileOptionsSubstring() */
```

4.4.3.7 processEvent()

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

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

Reimplemented from TileImprovement.

```
364 {
365     TileImprovement :: processEvent();
366
367     if (this->event_ptr->type == sf::Event::KeyPressed) {
368         this->__handleKeyPressEvents();
369     }
370
371     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
372         this->__handleMouseButtonEvents();
373     }
374
375     return;
376 }   /* processEvent() */
```

4.4.3.8 processMessage()

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

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

Reimplemented from TileImprovement.

```
391 {
392     TileImprovement :: processMessage();
393
394     //...
395
396     return;
397 }   /* processMessage() */
```

4.4.3.9 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.

```
308 {
309     TileImprovement :: setIsSelected(is_selected);
310 
311     if (this->is_selected) {
312         this->assets_manager_ptr->getSound("energy storage system")->play();
313     }
314 
315     return;
316 }   /* setIsSelected() */
```

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

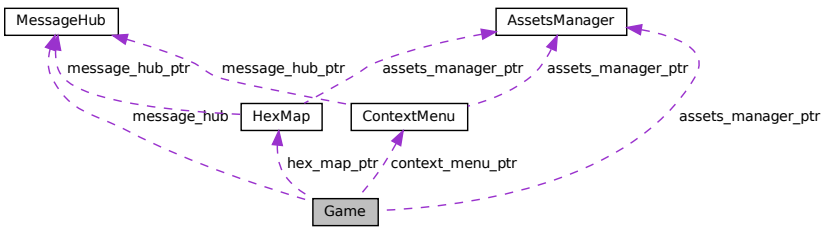
- header/EnergyStorageSystem.h
- source/EnergyStorageSystem.cpp

4.5 Game Class Reference

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

`#include <Game.h>`

Collaboration diagram for Game:



Public Member Functions

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

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

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

  Destructor for the Game class.

Public Attributes

- GamePhase game_phase

  The current phase of the game.
- bool quit_game

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

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

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

  The current frame of the game.
- double time_since_start_s

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

  Current game year.
- int month

  Current game month.
- int population

  Current population.
- int credits

  Current balance of credits.
- int demand_MWh

  Current energy demand [MWh].
- int cumulative_emissions_tonnes

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

  The current game turn.
- sf::Clock clock

  The game clock.
- sf::Event event

  The game events class.
- MessageHub message_hub

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

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

  Pointer to the context menu.

Private Member Functions

- void __toggleFrameClockOverlay (void)

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

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

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

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

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

- void __sendGameStateMessage (void)

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

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

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

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

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

Private Attributes

- sf::RenderWindow * render_window_ptr

  A pointer to the render window.
- AssetsManager * assets_manager_ptr

  A pointer to the assets manager.

4.5.1 Detailed Description

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

4.5.2 Constructor & Destructor Documentation

4.5.2.1 Game()

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

Constructor for the Game class.

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

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

4.5.2.2 ~Game()

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

Destructor for the Game class.

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

4.5.3 Member Function Documentation

4.5.3.1 __draw()

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

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

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

4.5.3.2 __drawFrameClockOverlay()

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

Helper method to draw frame clock overlay.

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

4.5.3.3 __drawHUD()

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

Helper method to heads-up display (HUD).

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

```
571     HUD_string += std::to_string(this->cumulative_emissions_tonnes);
572     HUD_string += " tonnes (CO2e)";
573 
574     HUD_string += "    LIFETIME LIMIT: ";
575     HUD_string += std::to_string(EMISSIONS_LIFETIME_LIMIT_TONNES);
576     HUD_string += " tonnes (CO2e)";
577 
578     HUD_text.setString(HUD_string);
579 
580     HUD_text.setPosition(
581         (800 - HUD_text.getLocalBounds().width) / 2,
582         35
583     );
584 
585     this->render_window_ptr->draw(HUD_text);
586 
587 
588     //  3. third line (bottom)
589     HUD_string = "GAME PHASE: ";
590 
591     switch (this->game_phase) {
592         case (GamePhase :: BUILD_SETTLEMENT): {
593             HUD_string += "BUILD SETTLEMENT";
594 
595             break;
596         }
597 
598 
599         case (GamePhase :: SYSTEM_MANAGEMENT): {
600             HUD_string += "SYSTEM MANAGEMENT";
601 
602             break;
603         }
604 
605 
606         case (GamePhase :: LOSS_EMISSIONS): {
607             HUD_string += "LOSS (EMISSIONS)";
608 
609             break;
610         }
611 
612 
613         case (GamePhase :: LOSS_DEMAND): {
614             HUD_string += "LOSS (DEMAND)";
615 
616             break;
617         }
618 
619 
620         case (GamePhase :: LOSS_CREDITS): {
621             HUD_string += "LOSS (CREDITS)";
622 
623             break;
624         }
625 
626 
627         case (GamePhase :: VICTORY): {
628             HUD_string += "VICTORY";
629 
630             break;
631         }
632 
633 
634         default: {
635             HUD_string += "???";
636 
637             break;
638         }
639     }
640 
641     HUD_string += "    TURN: ";
642     HUD_string += std::to_string(this->turn);
643 
644     HUD_text.setString(HUD_string);
645 
646     HUD_text.setPosition(
647         (800 - HUD_text.getLocalBounds().width) / 2,
648         GAME_HEIGHT - 35
649     );
650 
651     this->render_window_ptr->draw(HUD_text);
652 
653     return;
654 }   /* __drawHUD() */
```

4.5.3.4 __handleKeyPressEvents()

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

Helper method to handle key press events.

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

4.5.3.5 __handleMouseButtonEvents()

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

Helper method to handle mouse button events.

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

4.5.3.6 __insufficientCreditsAlarm()

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

Helper method to sound and display and insufficient credits alarm.

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

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

4.5.3.7 __processEvent()

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

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

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

4.5.3.8 __processMessage()

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

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

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

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

4.5.3.9 __sendGameStateMessage()

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

Helper method to format and send a game state message.

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

```
208     game_state_message.int_payload["year"] = this->year;
209     game_state_message.int_payload["month"] = this->month;
210     game_state_message.int_payload["population"] = this->population;
211     game_state_message.int_payload["credits"] = this->credits;
212     game_state_message.int_payload["demand_MWh"] = this->demand_MWh;
213     game_state_message.int_payload["cumulative_emissions_tonnes"] =
214         this->cumulative_emissions_tonnes;
215 
216     switch (this->game_phase) {
217         case (GamePhase :: BUILD_SETTLEMENT): {
218             game_state_message.string_payload["game phase"] = "build settlement";
219 
220             break;
221         }
222 
223 
224         case (GamePhase :: SYSTEM_MANAGEMENT): {
225             game_state_message.string_payload["game phase"] = "system management";
226 
227             break;
228         }
229 
230 
231         case (GamePhase :: LOSS_EMISSIONS): {
232             game_state_message.string_payload["game phase"] = "loss emissions";
233 
234             break;
235         }
236 
237 
238         case (GamePhase :: LOSS_DEMAND): {
239             game_state_message.string_payload["game phase"] = "loss demand";
240 
241             break;
242         }
243 
244 
245         case (GamePhase :: LOSS_CREDITS): {
246             game_state_message.string_payload["game phase"] = "loss credits";
247 
248             break;
249         }
250 
251 
252         case (GamePhase :: VICTORY): {
253             game_state_message.string_payload["game phase"] = "victory";
254 
255             break;
256         }
257 
258 
259         default: {
260             // do nothing!
261 
262             break;
263         }
264     }
265 
266     this->message_hub.sendMessage(game_state_message);
267 
268     std::cout « "Game state message sent by " « this « std::endl;
269     return;
270 }   /* __sendGameStateMessage() */
```

4.5.3.10 __toggleFrameClockOverlay()

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

Helper method to toggle frame clock overlay.

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

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

4.5.3.11 run()

```
bool Game::run (
              void  )
```

Method to run game (defines game loop).

Returns

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

```
771 {
772     //  1. play brand animation
773     //...
774
775     //  2. show splash screen
776     //...
777
778     //  3. start game loop
779     while (not this->game_loop_broken) {
780         this->time_since_start_s = this->clock.getElapsedTime().asSeconds();
781
782         if (this->time_since_start_s >= (this->frame + 1) * SECONDS_PER_FRAME) {
783             //  6.1. process events
784             while (this->render_window_ptr->pollEvent(this->event)) {
785                 this->hex_map_ptr->processEvent();
786                 this->context_menu_ptr->processEvent();
787                 this->__processEvent();
788             }
789
790
791             //  6.2. process messages
792             while (this->message_hub.hasTraffic()) {
793                 this->hex_map_ptr->processMessage();
794                 this->context_menu_ptr->processMessage();
795                 this->__processMessage();
796             }
797
798
799             //  6.3. draw frame
800             this->render_window_ptr->clear();
801
802             this->hex_map_ptr->draw();
803             this->context_menu_ptr->draw();
804             this->__draw();
805
806             this->render_window_ptr->display();
807
808
809             //  6.4. increment frame
810             this->frame++;
811         }
812
813         // check track status, move to next if stopped
814         if (this->assets_manager_ptr->getTrackStatus() == sf::SoundSource::Stopped) {
815             this->assets_manager_ptr->nextTrack();
816             this->assets_manager_ptr->playTrack();
817         }
818
819     }
820
821     return this->quit_game;
822 }   /* run() */
```

4.5.4 Member Data Documentation

4.5.4.1 assets_manager_ptr

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

A pointer to the assets manager.

4.5.4.2 clock

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

The game clock.

4.5.4.3 context_menu_ptr

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

Pointer to the context menu.

4.5.4.4 credits

```
int Game::credits
```

Current balance of credits.

4.5.4.5 cumulative_emissions_tonnes

```
int Game::cumulative_emissions_tonnes
```

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

4.5.4.6 demand_MWh

```
int Game::demand_MWh
```

Current energy demand [MWh].

4.5.4.7 event

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

The game events class.

4.5.4.8 frame

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

The current frame of the game.

4.5.4.9 game_loop_broken

```
bool Game::game_loop_broken
```

Boolean indicating whether or not the game loop is broken.

4.5.4.10 game_phase

```
GamePhase Game::game_phase
```

The current phase of the game.

4.5.4.11 hex_map_ptr

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

Pointer to the hex map (defines game world).

4.5.4.12 message_hub

```
MessageHub Game::message_hub
```

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

4.5.4.13 month

```
int Game::month
```

Current game month.

4.5.4.14 population

```
int Game::population
```

Current population.

4.5.4.15 quit_game

```
bool Game::quit_game
```

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

4.5.4.16 render_window_ptr

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

A pointer to the render window.

4.5.4.17 show_frame_clock_overlay

```
bool Game::show_frame_clock_overlay
```

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

4.5.4.18 time_since_start_s

```
double Game::time_since_start_s
```

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

4.5.4.19 turn

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

The current game turn.

4.5.4.20 year

```
int Game::year
```

Current game year.

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

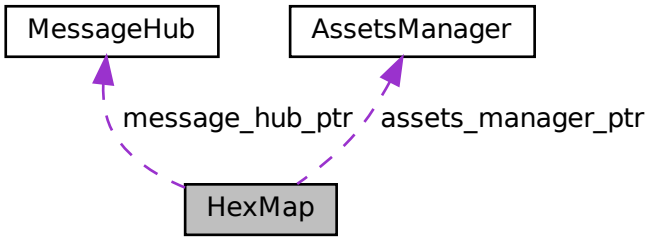
- header/Game.h
- source/Game.cpp

4.6 HexMap Class Reference

A class which defines a hex map of hex tiles.

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

Collaboration diagram for HexMap:



Public Member Functions

- HexMap (int, sf::Event *, sf::RenderWindow *, AssetsManager *, MessageHub *)

  Constructor (intended) for the HexMap class.
- void assess (void)

  Method to assess the resource of the selected tile.
- void reroll (void)

  Method to re-roll the hex map.
- void toggleResourceOverlay (void)

  Method to toggle the hex map resource overlay.
- void processEvent (void)

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

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

  Method to draw the hex map to the render window. To be called once per frame.
- void clear (void)

  Method to clear the hex map.
- ~HexMap (void)

  Destructor for the HexMap class.

Public Attributes

- bool show_resource

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

  A boolean which indicates if a tile is currently selected.
- int n_layers

  The number of layers in the hex map.
- int n_tiles

  The number of tiles in the hex map.
- unsigned long long int frame

  The current frame of this object.
- double position_x

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

  The y position of the hex map's origin (i.e. central) tile.
- sf::RectangleShape glass_screen

  To give the effect of an old glass screen over the hex map.
- std::vector< double > tile_position_x_vec

  A vector of tile x positions.
- std::vector< double > tile_position_y_vec

  A vector of tile y position.
- std::vector< HexTile * > border_tiles_vec

  A vector of pointers to the border tiles.
- std::map< double, std::map< double, HexTile * > > hex_map

  A position-indexed, nested map of hex tiles.
- std::vector< HexTile * > hex_draw_order_vec

  A vector of hex tiles, in drawing order.

Private Member Functions

- void __setUpGlassScreen (void)

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

  Helper method to lay the hex tiles down to generate the game world.
- void __buildDrawOrderVector (void)

  Helper method to build tile drawing order vector.
- std::vector< double > __getNoise (int, int=128)

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

  Helper method to procedurally generate tile types and set tiles accordingly.
- std::vector< double > __getValidMapIndexPositions (double, double)

  Helper method to translate given position into valid index position for a.
- std::vector< HexTile * > __getNeighboursVector (HexTile *)

  Helper method to assemble a vector pointers to all neighbours of the given tile.
- TileType __getMajorityTileType (HexTile *)

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

  Helper method to smooth tile types using a majority rules approach.
- bool __isLakeTouchingOcean (HexTile *)
- void __enforceOceanContinuity (void)

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

  Helper method to procedurally generate tile resources and set tiles accordingly.
- void __assembleHexMap (void)

  Helper method to assemble the hex map.
- HexTile * __getSelectedTile (void)

  Helper method to get pointer to selected tile.
- void __handleKeyPressEvents (void)

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

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

  Helper method to format and send message on no tile selected.
- void __assessNeighbours (HexTile *)

  Helper method to assess all neighbours of the given tile.

Private Attributes

- sf::Event * event_ptr

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

  A pointer to the render window.
- AssetsManager * assets_manager_ptr

  A pointer to the assets manager.
- MessageHub * message_hub_ptr

  A pointer to the message hub.

4.6.1 Detailed Description

A class which defines a hex map of hex tiles.

4.6.2 Constructor & Destructor Documentation

4.6.2.1 HexMap()

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

Constructor (intended) for the HexMap class.

Parameters

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

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

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

4.6.2.2 ~HexMap()

```
HexMap::~HexMap (
            void  )
```

Destructor for the HexMap class.

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

4.6.3 Member Function Documentation

4.6.3.1 __assembleHexMap()

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

Helper method to assemble the hex map.

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

4.6.3.2 __assessNeighbours()

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

Helper method to assess all neighbours of the given tile.

Parameters

Pointer	to the tile whose neighbours are to be assessed.

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

4.6.3.3 __buildDrawOrderVector()

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

Helper method to build tile drawing order vector.

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

4.6.3.4 __enforceOceanContinuity()

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

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

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

4.6.3.5 __getMajorityTileType()

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

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

Parameters

hex_ptr	Pointer to the given tile.

Returns

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

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

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

4.6.3.6 __getNeighboursVector()

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

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

Parameters

hex_ptr	A pointer to the given tile.

Returns

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

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

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

4.6.3.7 __getNoise()

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

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

Parameters

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

Returns

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

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

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

4.6.3.8 __getSelectedTile()

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

Helper method to get pointer to selected tile.

Returns

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

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

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

4.6.3.9 __getValidMapIndexPositions()

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

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

Parameters

potential_x	The potential x position of the tile.
potential_y	The potential y position of the tile.

Returns

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

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

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

4.6.3.10 __handleKeyPressEvents()

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

Helper method to handle key press events.

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

4.6.3.11 __handleMouseButtonEvents()

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

Helper method to handle mouse button events.

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

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

4.6.3.12 __isLakeTouchingOcean()

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

4.6.3.13 __layTiles()

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

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

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

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

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

4.6.3.14 __procedurallyGenerateTileResources()

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

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

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

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

4.6.3.15 __procedurallyGenerateTileTypes()

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

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

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

4.6.3.16 __sendNoTileSelectedMessage()

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

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

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

4.6.3.17 __setUpGlassScreen()

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

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

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

4.6.3.18 __smoothTileTypes()

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

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

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

4.6.3.19 assess()

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

Method to assess the resource of the selected tile.

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

4.6.3.20 clear()

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

Method to clear the hex map.

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

4.6.3.21 draw()

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

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

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

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

4.6.3.22 processEvent()

```
void HexMap::processEvent (
             void  )
```

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

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

4.6.3.23 processMessage()

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

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

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

4.6.3.24 reroll()

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

Method to re-roll the hex map.

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

4.6.3.25 toggleResourceOverlay()

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

Method to toggle the hex map resource overlay.

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

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

4.6.4 Member Data Documentation

4.6.4.1 assets_manager_ptr

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

A pointer to the assets manager.

4.6.4.2 border_tiles_vec

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

A vector of pointers to the border tiles.

4.6.4.3 event_ptr

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

A pointer to the event class.

4.6.4.4 frame

```
unsigned long long int HexMap::frame
```

The current frame of this object.

4.6.4.5 glass_screen

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

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

4.6.4.6 hex_draw_order_vec

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

A vector of hex tiles, in drawing order.

4.6.4.7 hex_map

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

A position-indexed, nested map of hex tiles.

4.6.4.8 message_hub_ptr

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

A pointer to the message hub.

4.6.4.9 n_layers

```
int HexMap::n_layers
```

The number of layers in the hex map.

4.6.4.10 n_tiles

```
int HexMap::n_tiles
```

The number of tiles in the hex map.

4.6.4.11 position_x

```
double HexMap::position_x
```

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

4.6.4.12 position_y

```
double HexMap::position_y
```

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

4.6.4.13 render_window_ptr

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

A pointer to the render window.

4.6.4.14 show_resource

```
bool HexMap::show_resource
```

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

4.6.4.15 tile_position_x_vec

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

A vector of tile x positions.

4.6.4.16 tile_position_y_vec

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

A vector of tile y position.

4.6.4.17 tile_selected

```
bool HexMap::tile_selected
```

A boolean which indicates if a tile is currently selected.

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

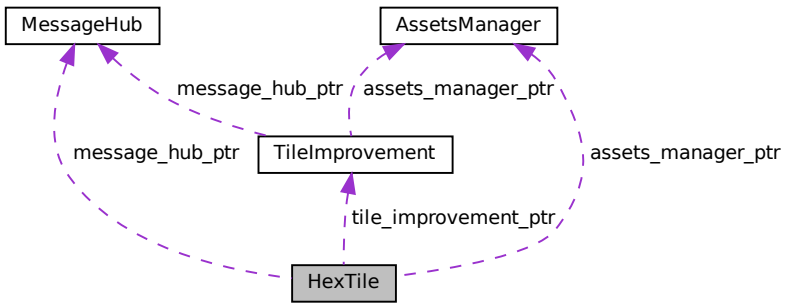
- header/HexMap.h
- source/HexMap.cpp

4.7 HexTile Class Reference

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

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

Collaboration diagram for HexTile:



Public Member Functions

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

  Constructor for the HexTile class.
- void setTileType (TileType)

  Method to set the tile type (by enum value).
- void setTileType (double)

  Method to set the tile type (by numeric input).
- void setTileResource (TileResource)

  Method to set the tile resource (by enum value).
- void setTileResource (double)

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

  Method to decorate tile.
- void toggleResourceOverlay (void)

  Method to toggle the tile resource overlay.

- void assess (void)

  Method to assess the tile's resource.
- void processEvent (void)

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

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

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

  Destructor for the HexTile class.

Public Attributes

- TileType tile_type
- TileResource tile_resource
- bool show_node

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

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

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

  A boolean which triggers a resource assessment notification.
- bool is_selected

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

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

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

  A boolean which indicates if tile has improvement or not.
- TileImprovement * tile_improvement_ptr

  A pointer to the improvement for this tile.
- bool build_menu_open

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

  The current frame of the explosion animation.
- unsigned long long int frame

  The current frame of this object.
- int credits

  The current balance of credits.
- double position_x

  The x position of the tile.
- double position_y

  The y position of the tile.
- double major_radius

  The radius of the smallest bounding circle.
- double minor_radius

  The radius of the largest inscribed circle.
- std::string game_phase

The current phase of the game.

- sf::CircleShape node_sprite

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

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

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

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

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

  A tile decoration sprite.
- sf::Sprite magnifying_glass_sprite

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

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

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

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

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

  A vector of text for the tile build options.

Private Member Functions

- void __setUpNodeSprite (void)

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

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

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

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

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

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

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

  Helper method to set up and postion the sprite and text for a build option.
- void __setUpDieselGeneratorBuildOption (void)

  Helper method to set up and position the diesel generator build option.
- void __setUpWindTurbineBuildOption (bool=false, bool=false)

  Helper method to set up and position the wind turbine build option.
- void __setUpSolarPVBuildOption (bool=false)

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

- void __setUpTidalTurbineBuildOption (void)

  Helper method to set up and position the tidal turbine build option.
- void __setUpWaveEnergyConverterBuildOption (void)

  Helper method to set up and position the wave energy converter build option.
- void __setUpEnergyStorageSystemBuildOption (void)

  Helper method to set up and position the wave energy converter build option.
- void __setUpBuildMenu (void)

  Helper method to set up and place build menu assets (drawable).
- void __setIsSelected (bool)

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

  Helper method to clear tile decoration.
- bool __isClicked (void)

  Helper method to determine if tile was clicked on.
- void __handleKeyPressEvents (void)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

  Helper method to assemble and return the tile improvement substring.
- std::string __getTileOptionsSubstring (void)

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

Helper method to format and send tile state message.

- void __sendAssessNeighboursMessage (void)

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

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

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

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

  Helper method to format and send an insufficient credits message.

Private Attributes

- sf::Event * event_ptr

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

  A pointer to the render window.
- AssetsManager * assets_manager_ptr

  A pointer to the assets manager.
- MessageHub * message_hub_ptr

  A pointer to the message hub.

4.7.1 Detailed Description

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

4.7.2 Constructor & Destructor Documentation

4.7.2.1 HexTile()

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

Constructor for the HexTile class.

Ref: Wikipedia [2023]

Parameters

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

```
2212 {
2213     //  1. set attributes
2214
2215     //  1.1. private
2216     this->event_ptr = event_ptr;
2217     this->render_window_ptr = render_window_ptr;
2218
2219     this->assets_manager_ptr = assets_manager_ptr;
2220     this->message_hub_ptr = message_hub_ptr;
2221
2222     //  1.2. public
2223     this->show_node = false;
2224     this->show_resource = false;
2225     this->resource_assessed = false;
2226     this->resource_assessment = false;
2227     this->is_selected = false;
2228     this->draw_explosion = false;
2229
2230     this->decoration_cleared = false;
2231     this->has_improvement = false;
2232     this->tile_improvement_ptr = NULL;
2233
2234     this->build_menu_open = false;
2235
2236     this->explosion_frame = 0;
2237
2238     this->frame = 0;
2239     this->credits = 0;
2240
2241     this->position_x = position_x;
2242     this->position_y = position_y;
2243
2244     this->major_radius = 32;
2245     this->minor_radius = (sqrt(3) / 2) * this->major_radius;
2246
2247     this->game_phase = "build settlement";
2248
2249     //  2. set up and position drawable attributes
2250     this->__setUpNodeSprite();
2251     this->__setUpTileSprite();
2252     this->__setUpSelectOutlineSprite();
2253     this->__setUpResourceChipSprite();
2254     this->__setResourceText();
2255     this->__setUpMagnifyingGlassSprite();
2256     this->__setUpTileExplosionReel();
2257
2258     //  3. set tile type and resource (default to none type and average)
2259     this->setTileType(TileType :: NONE_TYPE);
2260     this->setTileResource(TileResource :: AVERAGE);
2261
2262     std::cout « "HexTile constructed at " « this « std::endl;
2263
2264     return;
2265 }   /* HexTile() */
```

4.7.2.2 ~HexTile()

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

Destructor for the HexTile class.

```
2816 {
2817     if (this->tile_improvement_ptr != NULL) {
```

```
2818         delete this->tile_improvement_ptr;
2819     }
2820
2821     std::cout « "HexTile at " « this « " destroyed" « std::endl;
2822
2823     return;
2824 }   /* ~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.

```
1353 {
1354     int build_cost = DIESEL_GENERATOR_BUILD_COST;
1355
1356     if (this->credits < build_cost) {
1357         std::cout « "Cannot build diesel generator: insufficient credits (need "
1358             « build_cost « " K)" « std::endl;
1359
1360         this->__sendInsufficientCreditsMessage();
1361         return;
1362     }
1363
1364     this->tile_improvement_ptr = new DieselGenerator(
1365         this->position_x,
1366         this->position_y,
1367         this->event_ptr,
1368         this->render_window_ptr,
1369         this->assets_manager_ptr,
1370         this->message_hub_ptr
1371     );
1372
1373     this->has_improvement = true;
1374     this->__closeBuildMenu();
1375
1376     this->__sendCreditsSpentMessage(build_cost);
1377     this->__sendTileStateMessage();
1378     this->__sendGameStateRequest();
1379
1380     return;
1381 }   /* __buildDieselGenerator() */
```

4.7.3.2 __buildEnergyStorage()

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

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

```
1596 {
1597     int build_cost = ENERGY_STORAGE_SYSTEM_BUILD_COST;
1598
1599     if (this->credits < build_cost) {
1600         std::cout « "Cannot build energy storage system: insufficient credits (need "
1601             « build_cost « " K)" « std::endl;
1602
1603         this->__sendInsufficientCreditsMessage();
1604         return;
1605     }
1606
1607     this->tile_improvement_ptr = new EnergyStorageSystem(
1608         this->position_x,
```

```
1609         this->position_y,
1610         this->event_ptr,
1611         this->render_window_ptr,
1612         this->assets_manager_ptr,
1613         this->message_hub_ptr
1614     );
1615
1616     this->has_improvement = true;
1617     this->__closeBuildMenu();
1618
1619     this->__sendCreditsSpentMessage(build_cost);
1620     this->__sendTileStateMessage();
1621     this->__sendGameStateRequest();
1622
1623     return;
1624 }   /* __buildEnergyStorage() */
```

4.7.3.3 __buildSettlement()

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

Helper method to build a settlement on this tile.

```
1307 {
1308     if (this->credits < BUILD_SETTLEMENT_COST) {
1309         std::cout « "Cannot build settlement: insufficient credits (need "
1310             « BUILD_SETTLEMENT_COST « " K)" « std::endl;
1311
1312         this->__sendInsufficientCreditsMessage();
1313         return;
1314     }
1315
1316     this->__clearDecoration();
1317
1318     this->tile_improvement_ptr = new Settlement(
1319         this->position_x,
1320         this->position_y,
1321         this->event_ptr,
1322         this->render_window_ptr,
1323         this->assets_manager_ptr,
1324         this->message_hub_ptr
1325     );
1326
1327     this->has_improvement = true;
1328
1329     this->assess();
1330     this->__sendAssessNeighboursMessage();
1331
1332     this->__sendUpdateGamePhaseMessage("system management");
1333     this->__sendCreditsSpentMessage(BUILD_SETTLEMENT_COST);
1334     this->__sendTileStateMessage();
1335     this->__sendGameStateRequest();
1336
1337     return;
1338 }   /* __buildSettlement() */
```

4.7.3.4 __buildSolarPV()

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

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

```
1396 {
1397     int build_cost = SOLAR_PV_BUILD_COST;
1398
1399     if (this->tile_type == TileType :: LAKE) {
1400         build_cost *= SOLAR_PV_WATER_BUILD_MULTIPLIER;
1401     }
1402
```

```
1403     if (this->credits < build_cost) {
1404         std::cout « "Cannot build solar PV array: insufficient credits (need "
1405             « build_cost « " K)" « std::endl;
1406 
1407         this->__sendInsufficientCreditsMessage();
1408         return;
1409     }
1410 
1411     this->tile_improvement_ptr = new SolarPV(
1412         this->position_x,
1413         this->position_y,
1414         this->event_ptr,
1415         this->render_window_ptr,
1416         this->assets_manager_ptr,
1417         this->message_hub_ptr
1418     );
1419 
1420     this->has_improvement = true;
1421     this->__closeBuildMenu();
1422 
1423     if (this->tile_type == TileType :: LAKE) {
1424         this->decoration_cleared = true;
1425         this->assets_manager_ptr->getSound("splash")->play();
1426     }
1427 
1428     this->__sendCreditsSpentMessage(build_cost);
1429     this->__sendTileStateMessage();
1430     this->__sendGameStateRequest();
1431 
1432     return;
1433 }   /* __buildSolarPV() */
```

4.7.3.5 __buildTidalTurbine()

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

Helper method to build a tidal turbine on this tile.

```
1506 {
1507     int build_cost = TIDAL_TURBINE_BUILD_COST;
1508 
1509     if (this->credits < build_cost) {
1510         std::cout « "Cannot build tidal turbine: insufficient credits (need "
1511             « build_cost « " K)" « std::endl;
1512 
1513         this->__sendInsufficientCreditsMessage();
1514         return;
1515     }
1516 
1517     this->tile_improvement_ptr = new TidalTurbine(
1518         this->position_x,
1519         this->position_y,
1520         this->event_ptr,
1521         this->render_window_ptr,
1522         this->assets_manager_ptr,
1523         this->message_hub_ptr
1524     );
1525 
1526     this->has_improvement = true;
1527     this->decoration_cleared = true;
1528     this->assets_manager_ptr->getSound("splash")->play();
1529     this->__closeBuildMenu();
1530 
1531     this->__sendCreditsSpentMessage(build_cost);
1532     this->__sendTileStateMessage();
1533     this->__sendGameStateRequest();
1534 
1535     return;
1536 }   /* __buildTidalTurbine() */
```

4.7.3.6 __buildWaveEnergyConverter()

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

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

```
1551 {
1552     int build_cost = WAVE_ENERGY_CONVERTER_BUILD_COST;
1553
1554     if (this->credits < build_cost) {
1555         std::cout « "Cannot build wave energy converter: insufficient credits (need "
1556             « build_cost « " K)" « std::endl;
1557
1558         this->__sendInsufficientCreditsMessage();
1559         return;
1560     }
1561
1562     this->tile_improvement_ptr = new WaveEnergyConverter(
1563         this->position_x,
1564         this->position_y,
1565         this->event_ptr,
1566         this->render_window_ptr,
1567         this->assets_manager_ptr,
1568         this->message_hub_ptr
1569     );
1570
1571     this->has_improvement = true;
1572     this->decoration_cleared = true;
1573     this->assets_manager_ptr->getSound("splash")->play();
1574     this->__closeBuildMenu();
1575
1576     this->__sendCreditsSpentMessage(build_cost);
1577     this->__sendTileStateMessage();
1578     this->__sendGameStateRequest();
1579
1580     return;
1581 }   /* __buildWaveEnergyConverter() */
```

4.7.3.7 __buildWindTurbine()

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

Helper method to build a wind turbine on this tile.

```
1448 {
1449     int build_cost = WIND_TURBINE_BUILD_COST;
1450
1451     if (
1452         (this->tile_type == TileType :: LAKE) or
1453         (this->tile_type == TileType :: OCEAN)
1454     ) {
1455         build_cost *= WIND_TURBINE_WATER_BUILD_MULTIPLIER;
1456     }
1457
1458     if (this->credits < build_cost) {
1459         std::cout « "Cannot build wind turbine: insufficient credits (need "
1460             « build_cost « " K)" « std::endl;
1461
1462         this->__sendInsufficientCreditsMessage();
1463         return;
1464     }
1465
1466     this->tile_improvement_ptr = new WindTurbine(
1467         this->position_x,
1468         this->position_y,
1469         this->event_ptr,
1470         this->render_window_ptr,
1471         this->assets_manager_ptr,
1472         this->message_hub_ptr
1473     );
1474
1475     this->has_improvement = true;
1476     this->__closeBuildMenu();
1477
1478     if (
```

```
1479         (this->tile_type == TileType :: LAKE) or
1480         (this->tile_type == TileType :: OCEAN)
1481     ) {
1482         this->decoration_cleared = true;
1483         this->assets_manager_ptr->getSound("splash")->play();
1484     }
1485
1486     this->__sendCreditsSpentMessage(build_cost);
1487     this->__sendTileStateMessage();
1488     this->__sendGameStateRequest();
1489
1490     return;
1491 }   /* __buildWindTurbine() */
```

4.7.3.8 __clearDecoration()

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

Helper method to clear tile decoration.

```
790 {
791     this->decoration_cleared = true;
792     this->draw_explosion = true;
793
794     switch (this->tile_type) {
795         case (TileType :: FOREST): {
796             this->assets_manager_ptr->getSound("clear non-mountains tile")->play();
797
798             break;
799         }
800
801
802         case (TileType :: MOUNTAINS): {
803             this->assets_manager_ptr->getSound("clear mountains tile")->play();
804
805             break;
806         }
807
808
809         case (TileType :: PLAINS): {
810             this->assets_manager_ptr->getSound("clear non-mountains tile")->play();
811
812             break;
813         }
814
815
816         default: {
817             // do nothing!
818
819             break;
820         }
821     }
822
823     return;
824 }   /* __clearDecoration() */
```

4.7.3.9 __closeBuildMenu()

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

Helper method to close the tile improvement build menu.

```
1282 {
1283     if (not this->build_menu_open) {
1284         return;
1285     }
1286
1287     this->build_menu_open = false;
1288     this->assets_manager_ptr->getSound("build menu close")->play();
1289
1290     return;
1291 }   /* __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.

```
1706 {
1707     std::string coords_substring = "TILE COORDS:  (";
1708     coords_substring += std::to_string(int(this->position_x - 400));
1709     coords_substring += ", ";
1710     coords_substring += std::to_string(int(this->position_y - 400));
1711     coords_substring += ")\n";
1712 
1713     return coords_substring;
1714 }   /* __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.

```
1865 {
1866     std::string improvement_substring = "TILE IMPROVEMENT:  ";
1867 
1868     if (this->has_improvement) {
1869         improvement_substring += this->tile_improvement_ptr->tile_improvement_string;
1870         improvement_substring += "\n";
1871     }
1872 
1873     else {
1874         improvement_substring += "NONE\n";
1875     }
1876 
1877     return improvement_substring;
1878 }   /* __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.

```
1895 {
1896     //                  32 char x 17 line console "--------------------------------\n";
1897     std::string options_substring                = "     **** TILE OPTIONS ****     \n";
1898     options_substring                           += "                                \n";
1899 
1900     if (this->game_phase == "build settlement") {
1901         if (
1902             (this->tile_type != TileType :: OCEAN) and
1903             (this->tile_type != TileType :: LAKE)
1904         ) {
1905             options_substring += "[B]:  BUILD SETTLEMENT (";
1906             options_substring += std::to_string(BUILD_SETTLEMENT_COST);
1907             options_substring += " K)\n";
1908         }
1909     }
1910 
1911 
1912     else if (this->game_phase == "system management") {
1913         if (this->has_improvement) {
1914             options_substring.clear();
1915             options_substring = this->tile_improvement_ptr->getTileOptionsSubstring();
1916         }
1917 
1918 
1919         else if (not this->resource_assessed) {
1920             options_substring += "[A]:  ASSESS RESOURCE (";
1921             options_substring += std::to_string(RESOURCE_ASSESSMENT_COST);
1922             options_substring += " K)\n";
1923         }
1924 
1925 
1926         else if (
1927             (not this->decoration_cleared) and
1928             (this->tile_type != TileType :: OCEAN) and
1929             (this->tile_type != TileType :: LAKE)
1930         ) {
1931             options_substring += "[C]:  CLEAR TILE (";
1932 
1933             switch (this->tile_type) {
1934                 case (TileType :: FOREST): {
1935                     options_substring += std::to_string(CLEAR_FOREST_COST);
1936 
1937                     break;
1938                 }
1939 
1940 
1941                 case (TileType :: MOUNTAINS): {
1942                     options_substring += std::to_string(CLEAR_MOUNTAINS_COST);
1943 
1944                     break;
1945                 }
1946 
1947 
1948                 case (TileType :: PLAINS): {
1949                     options_substring += std::to_string(CLEAR_PLAINS_COST);
1950 
1951                     break;
1952                 }
1953 
1954 
1955                 default: {
1956                     //do nothing!
1957 
1958                     break;
1959                 }
1960             }
1961 
1962             options_substring += " K)\n";
1963         }
1964 
1965 
1966         else if (
1967             (this->decoration_cleared) or
1968             (this->tile_type == TileType :: OCEAN) or
1969             (this->tile_type == TileType :: LAKE)
1970         ) {
1971             options_substring += "[B]: OPEN BUILD MENU\n";
1972         }
1973     }
1974 
1975 
1976     else if (this->game_phase == "victory") {
1977         options_substring                       += "       **** VICTORY ****        \n";
1978     }
```

```
1979
1980
1981     else {
1982         options_substring                       += "        **** LOSS ****          \n";
1983     }
1984
1985     return options_substring;
1986 }   /* __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.

```
1795 {
1796     std::string resource_substring = "TILE RESOURCE:     ";
1797
1798     if (this->resource_assessed) {
1799         switch (this->tile_resource) {
1800             case (TileResource :: POOR): {
1801                 resource_substring += "POOR\n";
1802
1803                 break;
1804             }
1805
1806
1807             case (TileResource ::BELOW_AVERAGE): {
1808                 resource_substring += "BELOW AVERAGE\n";
1809
1810                 break;
1811             }
1812
1813
1814             case (TileResource :: AVERAGE): {
1815                 resource_substring += "AVERAGE\n";
1816
1817                 break;
1818             }
1819
1820
1821             case (TileResource :: ABOVE_AVERAGE): {
1822                 resource_substring += "ABOVE AVERAGE\n";
1823
1824                 break;
1825             }
1826
1827
1828             case (TileResource :: GOOD): {
1829                 resource_substring += "GOOD\n";
1830
1831                 break;
1832             }
1833
1834
1835             default: {
1836                 resource_substring += "???\n";
1837
1838                 break;
1839             }
1840         }
1841     }
1842
1843     else {
1844         resource_substring += "???\n";
1845     }
1846
1847     return resource_substring;
1848 }   /* __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.

```
1731 {
1732     std::string type_substring = "TILE TYPE:         ";
1733 
1734     switch (this->tile_type) {
1735         case (TileType :: FOREST): {
1736             type_substring += "FOREST\n";
1737 
1738             break;
1739         }
1740 
1741 
1742         case (TileType :: LAKE): {
1743             type_substring += "LAKE\n";
1744 
1745             break;
1746         }
1747 
1748 
1749         case (TileType :: MOUNTAINS): {
1750             type_substring += "MOUNTAINS\n";
1751 
1752             break;
1753         }
1754 
1755 
1756         case (TileType :: OCEAN): {
1757             type_substring += "OCEAN\n";
1758 
1759             break;
1760         }
1761 
1762 
1763         case (TileType :: PLAINS): {
1764             type_substring += "PLAINS\n";
1765 
1766             break;
1767         }
1768 
1769 
1770         default: {
1771             type_substring += "???\n";
1772 
1773             break;
1774         }
1775     }
1776 
1777     return type_substring;
1778 }   /* __getTileTypeSubstring() */
```

4.7.3.15 __handleKeyPressEvents()

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

Helper method to handle key press events.

```
873 {
874     if (not this->is_selected) {
875         return;
876     }
877 
878 
879     if (this->event_ptr->key.code == sf::Keyboard::Escape) {
```

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

```
967                     }
968
969
970                     case (sf::Keyboard::W): {
971                         this->__buildWindTurbine();
972
973                         break;
974                     }
975
976
977                     case (sf::Keyboard::E): {
978                         this->__buildEnergyStorage();
979
980                         break;
981                     }
982
983
984                     default: {
985                         // do nothing!
986
987                         break;
988                     }
989                 }
990
991                 break;
992             }
993
994
995             case (TileType :: OCEAN): {
996                 switch (this->event_ptr->key.code) {
997                     case (sf::Keyboard::W): {
998                         this->__buildWindTurbine();
999
1000                         break;
1001                     }
1002
1003
1004                     case (sf::Keyboard::T): {
1005                         this->__buildTidalTurbine();
1006
1007                         break;
1008                     }
1009
1010
1011                     case (sf::Keyboard::A): {
1012                         this->__buildWaveEnergyConverter();
1013
1014                         break;
1015                     }
1016
1017
1018                     default: {
1019                         // do nothing!
1020
1021                         break;
1022                     }
1023                 }
1024
1025                 break;
1026             }
1027
1028
1029             case (TileType :: PLAINS): {
1030                 switch (this->event_ptr->key.code) {
1031                     case (sf::Keyboard::D): {
1032                         this->__buildDieselGenerator();
1033
1034                         break;
1035                     }
1036
1037
1038                     case (sf::Keyboard::S): {
1039                         this->__buildSolarPV();
1040
1041                         break;
1042                     }
1043
1044
1045                     case (sf::Keyboard::W): {
1046                         this->__buildWindTurbine();
1047
1048                         break;
1049                     }
1050
1051
1052                     case (sf::Keyboard::E): {
1053                         this->__buildEnergyStorage();
```

```
1054
1055                        break;
1056                    }
1057
1058
1059                    default: {
1060                        // do nothing!
1061
1062                        break;
1063                    }
1064                }
1065
1066                break;
1067            }
1068
1069
1070            default: {
1071                //do nothing!
1072
1073                break;
1074            }
1075        }
1076    }
1077
1078
1079    if (this->game_phase == "build settlement") {
1080        if (
1081            (this->tile_type != TileType :: OCEAN) and
1082            (this->tile_type != TileType :: LAKE)
1083        ) {
1084            if (this->event_ptr->key.code == sf::Keyboard::B) {
1085                this->__buildSettlement();
1086            }
1087        }
1088    }
1089
1090
1091    else if (this->game_phase == "system management") {
1092        if (this->has_improvement) {
1093            if (this->tile_improvement_ptr->tile_improvement_type != TileImprovementType :: SETTLEMENT)
    {
1094                if (this->event_ptr->key.code == sf::Keyboard::P) {
1095                    this->__scrapImprovement();
1096                }
1097            }
1098
1099            /*
1100             * All other inputs will be caught and handled by
1101             *   this->tile_improvement_ptr->processEvent()
1102             */
1103        }
1104
1105
1106        else if (not this->resource_assessed) {
1107            if (this->event_ptr->key.code == sf::Keyboard::A) {
1108                if (this->credits < RESOURCE_ASSESSMENT_COST) {
1109                    std::cout « "Cannot assess resource: insufficient credits (need "
1110                        « RESOURCE_ASSESSMENT_COST « " K)" « std::endl;
1111
1112                    this->__sendInsufficientCreditsMessage();
1113                }
1114
1115                else {
1116                    this->assess();
1117                    this->__sendCreditsSpentMessage(RESOURCE_ASSESSMENT_COST);
1118                    this->__sendTileStateMessage();
1119                    this->__sendGameStateRequest();
1120                }
1121            }
1122        }
1123
1124
1125        else if (
1126            (not this->decoration_cleared) and
1127            (this->tile_type != TileType :: OCEAN) and
1128            (this->tile_type != TileType :: LAKE)
1129        ) {
1130            if (this->event_ptr->key.code == sf::Keyboard::C) {
1131                int clear_cost = 0;
1132
1133                switch (this->tile_type) {
1134                    case (TileType :: FOREST): {
1135                        clear_cost = CLEAR_FOREST_COST;
1136
1137                        break;
1138                    }
1139
```

```
1140
1141                    case (TileType :: MOUNTAINS): {
1142                        clear_cost = CLEAR_MOUNTAINS_COST;
1143
1144                        break;
1145                    }
1146
1147
1148                    case (TileType :: PLAINS): {
1149                        clear_cost = CLEAR_PLAINS_COST;
1150
1151                        break;
1152                    }
1153
1154
1155                    default: {
1156                        // do nothing!
1157
1158                        break;
1159                    }
1160                }
1161
1162                if (this->credits < clear_cost) {
1163                    std::cout « "Cannot clear tile: insufficient credits (need "
1164                        « clear_cost « " K)" « std::endl;
1165
1166                    this->__sendInsufficientCreditsMessage();
1167                }
1168
1169                else {
1170                    this->__clearDecoration();
1171                    this->__sendCreditsSpentMessage(clear_cost);
1172                    this->__sendTileStateMessage();
1173                    this->__sendGameStateRequest();
1174                }
1175            }
1176        }
1177
1178
1179        else if (
1180            (this->decoration_cleared) or
1181            (this->tile_type == TileType :: OCEAN) or
1182            (this->tile_type == TileType :: LAKE)
1183        ) {
1184            if (this->event_ptr->key.code == sf::Keyboard::B) {
1185                this->__openBuildMenu();
1186            }
1187        }
1188    }
1189
1190    return;
1191 }   /* __handleKeyPressEvents() */
```

4.7.3.16 __handleMouseButtonEvents()

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

Helper method to handle mouse button events.

```
1206 {
1207     switch (this->event_ptr->mouseButton.button) {
1208         case (sf::Mouse::Left): {
1209             if (this->__isClicked()) {
1210                 std::cout « "Tile (" « this->position_x « ", " «
1211                     this->position_y « ") was selected" « std::endl;
1212
1213                 this->__setIsSelected(true);
1214
1215                 this->__sendTileSelectedMessage();
1216                 this->__sendTileStateMessage();
1217                 this->__sendGameStateRequest();
1218             }
1219
1220             else {
1221                 this->__setIsSelected(false);
1222             }
1223
1224             break;
```

```
1225         }
1226
1227
1228         case (sf::Mouse::Right): {
1229             this->__setIsSelected(false);
1230
1231             break;
1232         }
1233
1234
1235         default: {
1236             // do nothing!
1237
1238             break;
1239         }
1240     }
1241
1242     return;
1243 }   /* __handleMouseButtonEvents() */
```

4.7.3.17 __isClicked()

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

Helper method to determine if tile was clicked on.

Returns

Boolean indicating whether or not tile was clicked on.

```
841 {
842     sf::Vector2i mouse_position = sf::Mouse::getPosition(*render_window_ptr);
843
844     double mouse_x = mouse_position.x;
845     double mouse_y = mouse_position.y;
846
847     double distance = sqrt(
848         pow(this->position_x - mouse_x, 2) +
849         pow(this->position_y - mouse_y, 2)
850     );
851
852     if (distance < this->minor_radius) {
853         return true;
854     }
855     else {
856         return false;
857     }
858 }   /* __isClicked() */
```

4.7.3.18 __openBuildMenu()

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

Helper method to open the tile improvement build menu.

```
1258 {
1259     if (this->build_menu_open) {
1260         return;
1261     }
1262
1263     this->build_menu_open = true;
1264     this->assets_manager_ptr->getSound("build menu open")->play();
1265
1266     return;
1267 }   /* __openBuildMenu() */
```

4.7.3.19 __scrapImprovement()

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

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

```
1639 {
1640     this->draw_explosion = true;
1641     this->assets_manager_ptr->getSound("clear non-mountains tile")->play();
1642 
1643     if (this->tile_improvement_ptr->production_menu_open) {
1644         this->tile_improvement_ptr->production_menu_open = false;
1645         this->assets_manager_ptr->getSound("build menu close")->play();
1646     }
1647 
1648     delete this->tile_improvement_ptr;
1649     this->tile_improvement_ptr = NULL;
1650 
1651     this->has_improvement = false;
1652 
1653     if (
1654         (this->tile_type == TileType :: LAKE) or
1655         (this->tile_type == TileType :: OCEAN)
1656     ) {
1657         this->decoration_cleared = false;
1658     }
1659 
1660     this->__sendCreditsSpentMessage(SCRAP_COST);
1661     this->__sendTileStateMessage();
1662     this->__sendGameStateRequest();
1663 
1664     return;
1665 }   /* __scrapImprovement() */
```

4.7.3.20 __sendAssessNeighboursMessage()

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

Helper method to format and send assess neighbours message.

```
2043 {
2044     Message assess_neighbours_message;
2045 
2046     assess_neighbours_message.channel = HEX_MAP_CHANNEL;
2047     assess_neighbours_message.subject = "assess neighbours";
2048 
2049     this->message_hub_ptr->sendMessage(assess_neighbours_message);
2050 
2051     std::cout « "Assess neighbours message sent by " « this « std::endl;
2052 
2053     return;
2054 }   /* __sendAssessNeighboursMessage() */
```

4.7.3.21 __sendCreditsSpentMessage()

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

Helper method to format and send a credits spent message.

Parameters

credits_spent	The number of credits that were spent.

```
2126 {
2127     Message credits_spent_message;
2128 
2129     credits_spent_message.channel = GAME_CHANNEL;
2130     credits_spent_message.subject = "credits spent";
2131 
2132     credits_spent_message.int_payload["credits spent"] = credits_spent;
2133 
2134     this->message_hub_ptr->sendMessage(credits_spent_message);
2135 
2136     std::cout « "Credits spent (" « credits_spent « ") message sent by " « this
2137         « std::endl;
2138     return;
2139 }   /* __sendCreditsSpentMessage() */
```

4.7.3.22 __sendGameStateRequest()

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

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

```
2069 {
2070     Message game_state_request;
2071 
2072     game_state_request.channel = GAME_CHANNEL;
2073     game_state_request.subject = "state request";
2074 
2075     this->message_hub_ptr->sendMessage(game_state_request);
2076 
2077     std::cout « "Game state request message sent by " « this « std::endl;
2078     return;
2079 }   /* __sendGameStateRequest() */
```

4.7.3.23 __sendInsufficientCreditsMessage()

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

Helper method to format and send an insufficient credits message.

```
2154 {
2155     Message insufficient_credits_message;
2156 
2157     insufficient_credits_message.channel = GAME_CHANNEL;
2158     insufficient_credits_message.subject = "insufficient credits";
2159 
2160     this->message_hub_ptr->sendMessage(insufficient_credits_message);
2161 
2162     std::cout « "Insufficient credits message sent by " « this « std::endl;
2163 
2164     return;
2165 }   /* __sendInsufficientCreditsMessage() */
```

4.7.3.24 __sendTileSelectedMessage()

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

Helper method to format and send message on tile selection.

```
1680 {
1681     Message tile_selected_message;
1682 
1683     tile_selected_message.channel = TILE_SELECTED_CHANNEL;
1684     tile_selected_message.subject = "tile selected";
1685 
1686     this->message_hub_ptr->sendMessage(tile_selected_message);
1687 
1688     return;
1689 }   /* __sendTileSelectedMessage() */
```

4.7.3.25 __sendTileStateMessage()

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

Helper method to format and send tile state message.

```
2001 {
2002     Message tile_state_message;
2003 
2004     tile_state_message.channel = TILE_STATE_CHANNEL;
2005     tile_state_message.subject = "tile state";
2006 
2007 
2008     //                  32 char x 17 line console "--------------------------------\n";
2009     std::string console_string                   = "      **** TILE INFO ****       \n";
2010     console_string                              += "                                \n";
2011 
2012     console_string                              += this->__getTileCoordsSubstring();
2013     console_string                              += "                                \n";
2014 
2015     console_string                              += this->__getTileTypeSubstring();
2016     console_string                              += this->__getTileResourceSubstring();
2017     console_string                              += this->__getTileImprovementSubstring();
2018     console_string                              += "                                \n";
2019 
2020     console_string                              += this->__getTileOptionsSubstring();
2021 
2022     tile_state_message.string_payload["console string"] = console_string;
2023 
2024     this->message_hub_ptr->sendMessage(tile_state_message);
2025 
2026     std::cout « "Tile state message sent by " « this « std::endl;
2027     return;
2028 }   /* __sendTileStateMessage() */
```

4.7.3.26 __sendUpdateGamePhaseMessage()

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

Helper method to format and send update game phase message.

Parameters

game_phase	The updated game phase.

```
2096 {
2097     Message update_game_phase_message;
2098 
2099     update_game_phase_message.channel = GAME_CHANNEL;
2100     update_game_phase_message.subject = "update game phase";
2101 
2102     update_game_phase_message.string_payload["game phase"] = game_phase;
2103 
2104     this->message_hub_ptr->sendMessage(update_game_phase_message);
2105 
2106     std::cout « "Update game phase message sent by " « this « std::endl;
2107 
2108     return;
2109 }   /* __sendUpdateGamePhaseMessage() */
```

4.7.3.27 __setIsSelected()

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

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

Parameters

is_selected	The value to set the is selected attribute to.

```
763 {
764     this->is_selected = is_selected;
765 
766     if (this->tile_improvement_ptr != NULL) {
767         this->tile_improvement_ptr->setIsSelected(is_selected);
768     }
769 
770     if ((not is_selected) and this->build_menu_open) {
771         this->__closeBuildMenu();
772     }
773 
774     return;
775 }   /* __setIsSelected() */
```

4.7.3.28 __setResourceText()

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

Helper method to set up resource text.

```
193 {
194     this->resource_text.setFont(*(assets_manager_ptr->getFont("DroidSansMono")));
195 
196     this->resource_text.setFillColor(sf::Color(0, 0, 0, 255));
197 
198     if (this->resource_assessed) {
199         switch (this->tile_resource) {
200             case (TileResource :: POOR): {
201                 this->resource_text.setString("-2");
202                 this->resource_text.setFillColor(MONOCHROME_TEXT_RED);
203 
204                 break;
205             }
206 
207             case (TileResource :: BELOW_AVERAGE): {
208                 this->resource_text.setString("-1");
209                 this->resource_text.setFillColor(MONOCHROME_TEXT_RED);
210 
211                 break;
212             }
213 
214             case (TileResource :: AVERAGE): {
215                 this->resource_text.setString("+0");
216 
217                 break;
218             }
219 
220             case (TileResource :: ABOVE_AVERAGE): {
221                 this->resource_text.setString("+1");
222                 this->resource_text.setFillColor(MONOCHROME_TEXT_GREEN);
223 
224                 break;
225             }
226 
227             case (TileResource :: GOOD): {
228                 this->resource_text.setString("+2");
229                 this->resource_text.setFillColor(MONOCHROME_TEXT_GREEN);
230 
231                 break;
232             }
233 
234             default: {
235                 this->resource_text.setString("");
236 
237                 break;
238             }
239         }
240     }
241 
```

```
242     else {
243         this->resource_text.setString("");
244     }
245 
246     this->resource_text.setCharacterSize(20);
247 
248     this->resource_text.setOrigin(
249         this->resource_text.getLocalBounds().width / 2,
250         this->resource_text.getLocalBounds().height / 2
251     );
252 
253     this->resource_text.setPosition(
254         this->position_x,
255         this->position_y - 4
256     );
257 
258     this->resource_text.setOutlineThickness(1);
259     this->resource_text.setOutlineColor(sf::Color(0, 0, 0, 255));
260 
261     return;
262 }   /* __setResourceText() */
```

4.7.3.29 __setUpBuildMenu()

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

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

```
666 {
667     this->build_menu_options_vec.clear();
668     this->build_menu_options_text_vec.clear();
669 
670     //  1. set up and place build menu backing and text
671     this->build_menu_backing.setSize(sf::Vector2f(600, 256));
672     this->build_menu_backing.setOrigin(300, 128);
673     this->build_menu_backing.setPosition(400, 400);
674     this->build_menu_backing.setFillColor(MONOCHROME_SCREEN_BACKGROUND);
675     this->build_menu_backing.setOutlineColor(MENU_FRAME_GREY);
676     this->build_menu_backing.setOutlineThickness(4);
677 
678     this->build_menu_backing_text.setString("**** BUILD MENU ****");
679     this->build_menu_backing_text.setFont(
680         *(this->assets_manager_ptr->getFont("Glass_TTY_VT220"))
681     );
682     this->build_menu_backing_text.setCharacterSize(16);
683     this->build_menu_backing_text.setFillColor(MONOCHROME_TEXT_GREEN);
684     this->build_menu_backing_text.setOrigin(
685         this->build_menu_backing_text.getLocalBounds().width / 2, 0
686     );
687     this->build_menu_backing_text.setPosition(400, 400 - 128 + 4);
688 
689     //  2. set up and place build menu option sprites and text
690     switch (this->tile_type) {
691         case (TileType :: FOREST): {
692             this->__setUpDieselGeneratorBuildOption();
693             this->__setUpSolarPVBuildOption();
694             this->__setUpWindTurbineBuildOption();
695             this->__setUpEnergyStorageSystemBuildOption();
696 
697             break;
698         }
699 
700 
701         case (TileType :: LAKE): {
702             this->__setUpSolarPVBuildOption(true);
703             this->__setUpWindTurbineBuildOption(true);
704 
705             break;
706         }
707 
708 
709         case (TileType :: MOUNTAINS): {
710             this->__setUpDieselGeneratorBuildOption();
711             this->__setUpSolarPVBuildOption();
712             this->__setUpWindTurbineBuildOption();
713             this->__setUpEnergyStorageSystemBuildOption();
714 
715             break;
```

```
716         }
717
718
719         case (TileType :: OCEAN): {
720             this->__setUpWindTurbineBuildOption(false, true);
721             this->__setUpTidalTurbineBuildOption();
722             this->__setUpWaveEnergyConverterBuildOption();
723
724             break;
725         }
726
727
728         case (TileType :: PLAINS): {
729             this->__setUpDieselGeneratorBuildOption();
730             this->__setUpSolarPVBuildOption();
731             this->__setUpWindTurbineBuildOption();
732             this->__setUpEnergyStorageSystemBuildOption();
733
734             break;
735         }
736
737
738         default: {
739             // do nothing!
740
741             break;
742         }
743     }
744
745     return;
746 }   /* __setUpBuildMenu() */
```

4.7.3.30 __setUpBuildOption()

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

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

Parameters

texture_key	The key for the appropriate illustration asset for the build option.
option_string	A string for the build option.

```
357 {
358     size_t n_options = this->build_menu_options_vec.size();
359
360     //  1. set up option sprite(s)
361     this->build_menu_options_vec.push_back({});
362
363     if (not texture_key.empty()) {
364         sf::Sprite texture_sheet(
365             *(this->assets_manager_ptr->getTexture(texture_key))
366         );
367
368         int sheet_height = texture_sheet.getLocalBounds().height;
369         int n_subrects = sheet_height / 64;
370
371         for (int i = 0; i < n_subrects; i++) {
372             this->build_menu_options_vec.back().push_back(
373                 sf::Sprite(
374                     *(this->assets_manager_ptr->getTexture(texture_key)),
375                     sf::IntRect(0, i * 64, 64, 64)
376                 )
377             );
378
379             this->build_menu_options_vec.back().back().setOrigin(
380                 this->build_menu_options_vec.back().back().getLocalBounds().width / 2,
381                 this->build_menu_options_vec.back().back().getLocalBounds().height
382             );
383
384             this->build_menu_options_vec.back().back().setPosition(
```

```
385                 400 - 300 + 75 + n_options * 150,
386                 400 - 32
387             );
388         }
389     }
390
391     else {
392         this->build_menu_options_vec.back().push_back(sf::Sprite());
393     }
394
395
396     //  2. set up option text
397     this->build_menu_options_text_vec.push_back(
398         sf::Text(
399             option_string,
400             *(this->assets_manager_ptr->getFont("Glass_TTY_VT220")),
401             16
402         )
403     );
404
405     this->build_menu_options_text_vec.back().setOrigin(
406         this->build_menu_options_text_vec.back().getLocalBounds().width / 2,
407         0
408     );
409
410     this->build_menu_options_text_vec.back().setPosition(
411         400 - 300 + 75 + n_options * 150,
412         400 - 16 - 4
413     );
414
415     this->build_menu_options_text_vec.back().setFillColor(MONOCHROME_TEXT_GREEN);
416
417     return;
418 }   /* __setUpBuildOption() */
```

4.7.3.31 __setUpDieselGeneratorBuildOption()

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

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

```
433 {
434     //  1. set up option sprite(s)
435     std::string texture_key = "diesel generator";
436
437     //  2. set up option string (up to 16 chars wide)
438     //                                  "----------------\n"
439     std::string diesel_generator_string = "DIESEL GENERATOR\n";
440     diesel_generator_string            += "                \n";
441     diesel_generator_string            += "CAPACITY: 100 kW\n";
442     diesel_generator_string            += "COST:     ";
443     diesel_generator_string            += std::to_string(DIESEL_GENERATOR_BUILD_COST);
444     diesel_generator_string            += " K\n\n\n";
445     diesel_generator_string            += "BUILD:    [D]   \n";
446
447     //  3. call general method
448     this->__setUpBuildOption(texture_key, diesel_generator_string);
449
450     return;
451 }   /* __setUpDieselGeneratorBuildOption() */
```

4.7.3.32 __setUpEnergyStorageSystemBuildOption()

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

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

```
633 {
634     //  1. set up option sprite(s)
```

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

4.7.3.33 __setUpMagnifyingGlassSprite()

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

Helper method to set up and position magnifying glass sprite.

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

4.7.3.34 __setUpNodeSprite()

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

Helper method to set up node sprite.

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

4.7.3.35 __setUpResourceChipSprite()

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

Helper method to set up resource chip sprite.

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

4.7.3.36 __setUpSelectOutlineSprite()

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

Helper method to set up select outline sprite.

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

4.7.3.37 __setUpSolarPVBuildOption()

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

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

Parameters

is_lake	If being built on a lake.

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

4.7.3.38 __setUpTidalTurbineBuildOption()

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

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

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

4.7.3.39 __setUpTileExplosionReel()

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

Helper method to set up tile explosion sprite reel.

```
308 {
309     for (int i = 0; i < 4; i++) {
310         for (int j = 0; j < 4; j++) {
311             this->explosion_sprite_reel.push_back(
```

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

4.7.3.40 __setUpTileSprite()

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

Helper method to set up tile sprite.

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

4.7.3.41 __setUpWaveEnergyConverterBuildOption()

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

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

```
600 {
601     //  1. set up option sprite(s)
602     std::string texture_key = "wave energy converter";
603 
604     //  2. set up option string (up to 16 chars wide)
605     //                                          "----------------\n"
606     std::string wave_energy_converter_string    = "WAVE ENERGY CVTR\n";
607     wave_energy_converter_string               += "                \n";
608     wave_energy_converter_string               += "CAPACITY: 100 kW\n";
609     wave_energy_converter_string               += "COST:     ";
610     wave_energy_converter_string               += std::to_string(WAVE_ENERGY_CONVERTER_BUILD_COST);
611     wave_energy_converter_string               += " K\n\n\n";
612     wave_energy_converter_string               += "BUILD:    [A]   \n";
613 
614     //  3. call general method
615     this->__setUpBuildOption(texture_key, wave_energy_converter_string);
616 
617     return;
618 }   /* __setUpWaveEnergyConverterBuildOption() */
```

4.7.3.42 __setUpWindTurbineBuildOption()

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

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

Parameters

is_lake	If being built on a lake tile.
is_ocean	If being built on an ocean tile.

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

4.7.3.43 assess()

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

Method to assess the tile's resource.

```
2586 {
2587     this->resource_assessed = true;
2588     this->resource_assessment = true;
2589 
2590     this->assets_manager_ptr->getSound("resource assessment")->play();
2591 
2592     this->__setResourceText();
2593     this->__sendTileStateMessage();
2594 
2595     return;
2596 }   /* assess() */
```

4.7.3.44 decorateTile()

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

Method to decorate tile.

```
2464 {
2465     switch (this->tile_type) {
2466         case (TileType :: FOREST): {
2467             this->tile_decoration_sprite.setTexture(
2468                 *(this->assets_manager_ptr->getTexture("pine_tree_64x64_1"))
2469             );
2470 
2471             break;
2472         }
2473 
2474         case (TileType :: LAKE): {
2475             this->tile_decoration_sprite.setTexture(
2476                 *(this->assets_manager_ptr->getTexture("water_shimmer_64x64_1"))
2477             );
2478 
2479             break;
2480         }
2481 
2482         case (TileType :: MOUNTAINS): {
2483             this->tile_decoration_sprite.setTexture(
2484                 *(this->assets_manager_ptr->getTexture("mountain_64x64_1"))
2485             );
2486 
2487             break;
2488         }
2489 
2490         case (TileType :: OCEAN): {
2491             this->tile_decoration_sprite.setTexture(
2492                 *(this->assets_manager_ptr->getTexture("water_waves_64x64_1"))
2493             );
2494 
2495             break;
2496         }
2497 
2498         case (TileType :: PLAINS): {
2499             this->tile_decoration_sprite.setTexture(
2500                 *(this->assets_manager_ptr->getTexture("wheat_64x64_1"))
2501             );
2502 
2503             break;
2504         }
2505 
2506         default: {
2507             // do nothing!
2508 
2509             break;
2510         }
2511     }
2512 
2513 
2514     if (this->tile_type == TileType :: OCEAN or this->tile_type == TileType :: LAKE) {
2515         this->tile_decoration_sprite.setOrigin(
2516             this->tile_decoration_sprite.getLocalBounds().width / 2,
2517             this->tile_decoration_sprite.getLocalBounds().height / 2
2518         );
2519 
2520         this->tile_decoration_sprite.setPosition(
2521             this->position_x,
2522             this->position_y
2523         );
2524 
2525         if ((double)rand() / RAND_MAX > 0.5) {
2526             this->tile_decoration_sprite.setScale(sf::Vector2f(-1, 1));
2527         }
2528     }
2529 
2530     else {
2531         this->tile_decoration_sprite.setOrigin(
2532             this->tile_decoration_sprite.getLocalBounds().width / 2,
2533             this->tile_decoration_sprite.getLocalBounds().height
2534         );
2535 
2536         this->tile_decoration_sprite.setPosition(
2537             this->position_x,
2538             this->position_y + 12
2539         );
2540 
2541         if ((double)rand() / RAND_MAX > 0.5) {
```

```
2542             this->tile_decoration_sprite.setScale(sf::Vector2f(-1, 1));
2543         }
2544     }
2545
2546     return;
2547 }   /* decorateTile(void) */
```

4.7.3.45 draw()

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

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

```
2710 {
2711     //  1. draw hex
2712     this->render_window_ptr->draw(this->tile_sprite);
2713
2714     //  2. draw node
2715     if (this->show_node) {
2716         this->render_window_ptr->draw(this->node_sprite);
2717     }
2718
2719     //  3. draw tile decoration
2720     if (not this->decoration_cleared) {
2721         this->render_window_ptr->draw(this->tile_decoration_sprite);
2722     }
2723
2724     //  4. draw selection outline
2725     if (this->is_selected) {
2726         sf::Color outline_colour = this->select_outline_sprite.getOutlineColor();
2727
2728         outline_colour.a =
2729             255 * pow(cos((M_PI * this->frame) / FRAMES_PER_SECOND), 2);
2730
2731         this->select_outline_sprite.setOutlineColor(outline_colour);
2732
2733         this->render_window_ptr->draw(this->select_outline_sprite);
2734     }
2735
2736     //  5. draw tile improvement
2737     if (this->has_improvement) {
2738         if (not this->tile_improvement_ptr->just_built) {
2739             this->tile_improvement_ptr->draw();
2740         }
2741     }
2742
2743     //  6. draw resource
2744     if (this->show_resource) {
2745         this->render_window_ptr->draw(this->resource_chip_sprite);
2746         this->render_window_ptr->draw(this->resource_text);
2747     }
2748
2749     //  7. draw resource assessment notification
2750     if (this->resource_assessment) {
2751         int alpha = this->magnifying_glass_sprite.getColor().a;
2752
2753         alpha -= 0.05 * FRAMES_PER_SECOND;
2754         if (alpha < 0) {
2755             alpha = 0;
2756             this->resource_assessment = false;
2757         }
2758
2759         this->magnifying_glass_sprite.setColor(
2760             sf::Color(255, 255, 255, alpha)
2761         );
2762
2763         this->render_window_ptr->draw(this->magnifying_glass_sprite);
2764     }
2765
2766     //  8. draw explosion, then settlement placement
2767     if (this->draw_explosion) {
2768         this->render_window_ptr->draw(this->explosion_sprite_reel[this->explosion_frame]);
2769
2770         if (this->frame % (FRAMES_PER_SECOND / 20) == 0) {
2771             this->explosion_frame++;
2772         }
2773
2774         if (this->explosion_frame >= this->explosion_sprite_reel.size()) {
```

```
2775             this->draw_explosion = false;
2776             this->explosion_frame = 0;
2777         }
2778     }
2779
2780     else if (this->has_improvement) {
2781         if (this->tile_improvement_ptr->just_built) {
2782             this->tile_improvement_ptr->draw();
2783         }
2784     }
2785
2786     //  9. build menu
2787     if (this->build_menu_open) {
2788         this->render_window_ptr->draw(this->build_menu_backing);
2789         this->render_window_ptr->draw(this->build_menu_backing_text);
2790
2791         for (size_t i = 0; i < this->build_menu_options_vec.size(); i++) {
2792             for (size_t j = 0; j < this->build_menu_options_vec[i].size(); j++) {
2793                 this->render_window_ptr->draw(this->build_menu_options_vec[i][j]);
2794             }
2795             this->render_window_ptr->draw(this->build_menu_options_text_vec[i]);
2796         }
2797     }
2798
2799     this->frame++;
2800     return;
2801 }   /* draw() */
```

4.7.3.46 processEvent()

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

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

```
2611 {
2612     //  1. process TileImprovement events
2613     if (
2614         this->is_selected and
2615         this->tile_improvement_ptr != NULL
2616     ) {
2617         this->tile_improvement_ptr->processEvent();
2618     }
2619
2620     //  2. process HexTile events
2621     if (this->event_ptr->type == sf::Event::KeyPressed) {
2622         this->__handleKeyPressEvents();
2623     }
2624
2625     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
2626         this->__handleMouseButtonEvents();
2627     }
2628
2629     return;
2630 }   /* processEvent() */
```

4.7.3.47 processMessage()

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

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

```
2645 {
2646     //  1. process TileImprovement messages
2647     if (
2648         this->is_selected and
2649         this->tile_improvement_ptr != NULL
2650     ) {
2651         this->tile_improvement_ptr->processMessage();
2652     }
```

```
2653
2654     //  2. process HexTile messages
2655     if (this->is_selected) {
2656         if (not this->message_hub_ptr->isEmpty(GAME_STATE_CHANNEL)) {
2657             Message game_state_message = this->message_hub_ptr->receiveMessage(
2658                 GAME_STATE_CHANNEL
2659             );
2660
2661             if (game_state_message.subject == "game state") {
2662                 this->credits = game_state_message.int_payload["credits"];
2663                 this->game_phase = game_state_message.string_payload["game phase"];
2664
2665                 if (this->tile_improvement_ptr != NULL) {
2666                     this->tile_improvement_ptr->credits = this->credits;
2667                     this->tile_improvement_ptr->game_phase = this->game_phase;
2668                 }
2669
2670                 std::cout « "Game state message received by " « this « std::endl;
2671                 this->__sendTileStateMessage();
2672                 this->message_hub_ptr->popMessage(GAME_STATE_CHANNEL);
2673             }
2674         }
2675
2676         if (not this->message_hub_ptr->isEmpty(TILE_STATE_CHANNEL)) {
2677             Message tile_state_message = this->message_hub_ptr->receiveMessage(
2678                 TILE_STATE_CHANNEL
2679             );
2680
2681             if (tile_state_message.subject == "state request") {
2682                 this->__sendTileStateMessage();
2683
2684                 std::cout « "Tile state request received by " « this « std::endl;
2685                 this->message_hub_ptr->popMessage(TILE_STATE_CHANNEL);
2686             }
2687         }
2688
2689         std::cout « "Current credits (HexTile): " « this->credits « " K" «
2690             std::endl;
2691     }
2692
2693     return;
2694 }   /* processMessage() */
```

4.7.3.48 setTileResource() [1/2]

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

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

Parameters

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

```
2413 {
2414     //  1. check input
2415     if (input_value < 0 or input_value > 1) {
2416         std::string error_str = "ERROR  HexTile::setTileResource()  given input value is ";
2417         error_str += "not in the closed interval [0, 1]";
2418
2419         #ifdef _WIN32
2420             std::cout « error_str « std::endl;
2421         #endif  /* _WIN32 */
2422
2423         throw std::runtime_error(error_str);
2424     }
2425
2426     //  2. convert input value to tile resource
2427     TileResource tile_resource;
2428
2429     if (input_value <= TILE_RESOURCE_CUMULATIVE_PROBABILITIES[0]) {
2430         tile_resource = TileResource :: POOR;
2431     }
2432     else if (input_value <= TILE_RESOURCE_CUMULATIVE_PROBABILITIES[1]) {
2433         tile_resource = TileResource :: BELOW_AVERAGE;
```

```
2434     }
2435     else if (input_value <= TILE_RESOURCE_CUMULATIVE_PROBABILITIES[2]) {
2436         tile_resource = TileResource :: AVERAGE;
2437     }
2438     else if (input_value <= TILE_RESOURCE_CUMULATIVE_PROBABILITIES[3]) {
2439         tile_resource = TileResource :: ABOVE_AVERAGE;
2440     }
2441     else {
2442         tile_resource = TileResource :: GOOD;
2443     }
2444
2445     //  3. call alternate method
2446     this->setTileResource(tile_resource);
2447
2448     return;
2449 }   /* setTileResource(double) */
```

4.7.3.49 setTileResource() [2/2]

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

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

Parameters

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

```
2391 {
2392     this->tile_resource = tile_resource;
2393     this->__setResourceText();
2394
2395     return;
2396 }   /* setTileResource(TileResource) */
```

4.7.3.50 setTileType() [1/2]

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

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

Parameters

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

```
2341 {
2342     //  1. check input
2343     if (input_value < 0 or input_value > 1) {
2344         std::string error_str = "ERROR  HexTile::setTileType()  given input value is ";
2345         error_str += "not in the closed interval [0, 1]";
2346
2347         #ifdef _WIN32
2348             std::cout « error_str « std::endl;
2349         #endif  /* _WIN32 */
2350
2351         throw std::runtime_error(error_str);
2352     }
2353
2354     //  2. convert input value to tile type
2355     TileType tile_type;
2356
```

```
2357     if (input_value <= TILE_TYPE_CUMULATIVE_PROBABILITIES[0]) {
2358         tile_type = TileType :: LAKE;
2359     }
2360     else if (input_value <= TILE_TYPE_CUMULATIVE_PROBABILITIES[1]) {
2361         tile_type = TileType :: PLAINS;
2362     }
2363     else if (input_value <= TILE_TYPE_CUMULATIVE_PROBABILITIES[2]) {
2364         tile_type = TileType :: FOREST;
2365     }
2366     else {
2367         tile_type = TileType :: MOUNTAINS;
2368     }
2369
2370     //  3. call alternate method
2371     this->setTileType(tile_type);
2372
2373     return;
2374 }   /* setTileType(double) */
```

4.7.3.51 setTileType() [2/2]

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

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

Parameters

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

```
2280 {
2281     this->tile_type = tile_type;
2282
2283     switch (this->tile_type) {
2284         case (TileType :: FOREST): {
2285             this->tile_sprite.setFillColor(FOREST_GREEN);
2286
2287             break;
2288         }
2289
2290         case (TileType :: LAKE): {
2291             this->tile_sprite.setFillColor(LAKE_BLUE);
2292
2293             break;
2294         }
2295
2296         case (TileType :: MOUNTAINS): {
2297             this->tile_sprite.setFillColor(MOUNTAINS_GREY);
2298
2299             break;
2300         }
2301
2302         case (TileType :: OCEAN): {
2303             this->tile_sprite.setFillColor(OCEAN_BLUE);
2304
2305             break;
2306         }
2307
2308         case (TileType :: PLAINS): {
2309             this->tile_sprite.setFillColor(PLAINS_YELLOW);
2310
2311             break;
2312         }
2313
2314         default: {
2315             // do nothing!
2316
2317             break;
2318         }
2319     }
2320
2321     this->__setUpBuildMenu();
2322
2323     return;
2324 }   /* setTileType(TileType) */
```

4.7.3.52 toggleResourceOverlay()

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

Method to toggle the tile resource overlay.

```
2562 {
2563     if (this->show_resource) {
2564         this->show_resource = false;
2565     }
2566     else {
2567         this->show_resource = true;
2568     }
2569
2570     return;
2571 }   /* toggleResourceOverlay() */
```

4.7.4 Member Data Documentation

4.7.4.1 assets_manager_ptr

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

A pointer to the assets manager.

4.7.4.2 build_menu_backing

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

A backing for the tile build menu.

4.7.4.3 build_menu_backing_text

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

A text label for the build menu.

4.7.4.4 build_menu_open

```
bool HexTile::build_menu_open
```

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

4.7.4.5 build_menu_options_text_vec

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

A vector of text for the tile build options.

4.7.4.6 build_menu_options_vec

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

A vector of sprites for illustrating the tile build options.

4.7.4.7 credits

```
int HexTile::credits
```

The current balance of credits.

4.7.4.8 decoration_cleared

```
bool HexTile::decoration_cleared
```

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

4.7.4.9 draw_explosion

```
bool HexTile::draw_explosion
```

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

4.7.4.10 event_ptr

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

A pointer to the event class.

4.7.4.11 explosion_frame

```
size_t HexTile::explosion_frame
```

The current frame of the explosion animation.

4.7.4.12 explosion_sprite_reel

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

A reel of sprites for a tile explosion animation.

4.7.4.13 frame

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

The current frame of this object.

4.7.4.14 game_phase

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

The current phase of the game.

4.7.4.15 has_improvement

```
bool HexTile::has_improvement
```

A boolean which indicates if tile has improvement or not.

4.7.4.16 is_selected

```
bool HexTile::is_selected
```

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

4.7.4.17 magnifying_glass_sprite

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

A magnifying glass sprite.

4.7.4.18 major_radius

```
double HexTile::major_radius
```

The radius of the smallest bounding circle.

4.7.4.19 message_hub_ptr

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

A pointer to the message hub.

4.7.4.20 minor_radius

```
double HexTile::minor_radius
```

The radius of the largest inscribed circle.

4.7.4.21 node_sprite

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

A circle shape to mark the tile node.

4.7.4.22 position_x

```
double HexTile::position_x
```

The x position of the tile.

4.7.4.23 position_y

```
double HexTile::position_y
```

The y position of the tile.

4.7.4.24 render_window_ptr

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

A pointer to the render window.

4.7.4.25 resource_assessed

```
bool HexTile::resource_assessed
```

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

4.7.4.26 resource_assessment

```
bool HexTile::resource_assessment
```

A boolean which triggers a resource assessment notification.

4.7.4.27 resource_chip_sprite

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

A circle shape which represents a resource chip.

4.7.4.28 resource_text

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

A text representation of the resource.

4.7.4.29 select_outline_sprite

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

A convex shape which outlines the tile when selected.

4.7.4.30 show_node

```
bool HexTile::show_node
```

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

4.7.4.31 show_resource

```
bool HexTile::show_resource
```

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

4.7.4.32 tile_decoration_sprite

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

A tile decoration sprite.

4.7.4.33 tile_improvement_ptr

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

A pointer to the improvement for this tile.

4.7.4.34 tile_resource

```
TileResource HexTile::tile_resource
```

4.7.4.35 tile_sprite

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

A convex shape which represents the tile.

4.7.4.36 tile_type

```
TileType HexTile::tile_type
```

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

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

4.8 Message Struct Reference

A structure which defines a standard message format.

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

Public Attributes

- std::string channel = ""

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

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

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

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

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

  A string payload.

4.8.1 Detailed Description

A structure which defines a standard message format.

4.8.2 Member Data Documentation

4.8.2.1 bool_payload

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

A boolean payload.

4.8.2.2 channel

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

A string identifying the appropriate channel for this message.

4.8.2.3 double_payload

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

A vector payload.

4.8.2.4 int_payload

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

A vector payload.

4.8.2.5 string_payload

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

A string payload.

4.8.2.6 subject

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

A string describing the message subject.

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

- header/ESC_core/MessageHub.h

4.9 MessageHub Class Reference

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

`#include <MessageHub.h>`

Public Member Functions

- MessageHub (void)

  Constructor for the MessageHub class.
- bool hasTraffic (void)

  Method to determine if there remains any message traffic.
- void addChannel (std::string)

  Method to add channel to message map.
- void removeChannel (std::string)

  Method to remove channel from message map.
- void sendMessage (Message)

  Method to send a message to the message map. Channels are implemented in a first in, first out manner (i.e. message queue).
- bool isEmpty (std::string)

  Method to check if channel is empty.
- Message receiveMessage (std::string)

  Method to receive the first message in the channel. Channels are implemented in a first in, first out manner (i.e. message queue).
- void popMessage (std::string)

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

  Method to clear messages from the MessageHub.
- void clear (void)

  Method to clear the MessageHub.
- ~MessageHub (void)

  Destructor for the MessageHub class.

Private Attributes

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

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

4.9.1 Detailed Description

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

4.9.2 Constructor & Destructor Documentation

4.9.2.1 MessageHub()

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

Constructor for the MessageHub class.

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

4.9.2.2 ~MessageHub()

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

Destructor for the MessageHub class.

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

4.9.3 Member Function Documentation

4.9.3.1 addChannel()

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

Method to add channel to message map.

Parameters

channel	The key for the message channel being added.

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

```
145
146     std::cout « "Channel " « channel « " added to message hub" « std::endl;
147
148     return;
149 }   /* addChannel() */
```

4.9.3.2 clear()

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

Method to clear the MessageHub.

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

4.9.3.3 clearMessages()

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

Method to clear messages from the MessageHub.

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

4.9.3.4 hasTraffic()

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

Method to determine if there remains any message traffic.

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

4.9.3.5 isEmpty()

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

Method to check if channel is empty.

Parameters

channel	The key for the message channel being checked.

Returns

A boolean indicating whether the channel is empty or not.

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

4.9.3.6 popMessage()

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

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

Parameters

channel	The key for the message channel being popped.

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

```
360     //  3. pop message
361     this->message_map[channel].pop_front();
362
363     return;
364 }   /* popMessage() */
```

4.9.3.7 receiveMessage()

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

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

Parameters

channel	The key for the message channel being received from.

Returns

The first message in the given channel.

```
284 {
285     //  1. check if channel is in map (if not, throw error)
286     if (this->message_map.count(channel) <= 0) {
287         std::string error_str = "ERROR  MessageHub::receiveMessage()  channel ";
288         error_str += channel;
289         error_str += " is not in message map";
290
291         #ifdef _WIN32
292             std::cout « error_str « std::endl;
293         #endif  /* _WIN32 */
294
295         throw std::runtime_error(error_str);
296     }
297
298     //  2. check if channel is empty (if so, throw error)
299     if (this->message_map[channel].empty()) {
300         std::string error_str = "ERROR  MessageHub::receiveMessage()  channel ";
301         error_str += channel;
302         error_str += " is empty";
303
304         #ifdef _WIN32
305             std::cout « error_str « std::endl;
306         #endif  /* _WIN32 */
307
308         throw std::runtime_error(error_str);
309     }
310
311     //  3. receive message
312     Message message = this->message_map[channel].front();
313
314     return message;
315 }   /* receiveMessage() */
```

4.9.3.8 removeChannel()

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

Method to remove channel from message map.

Parameters

channel	The key for the message channel being removed.

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

4.9.3.9 sendMessage()

```
void MessageHub::sendMessage (
             Message message )
```

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

Parameters

message	The message to be sent.

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

4.9.4 Member Data Documentation

4.9.4.1 message_map

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

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

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

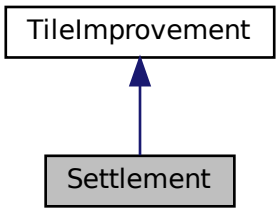
- header/ESC_core/MessageHub.h
- source/ESC_core/MessageHub.cpp

4.10 Settlement Class Reference

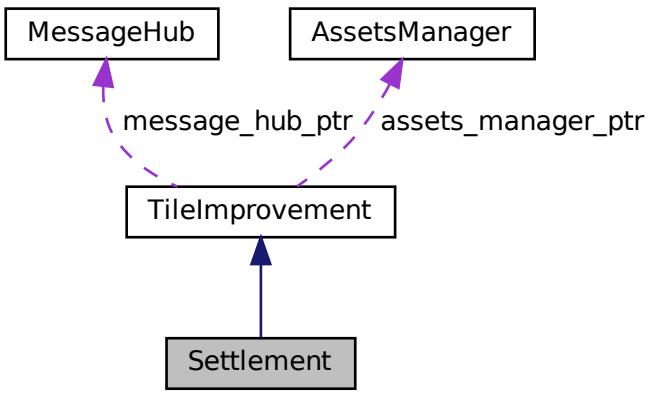
A settlement class (child class of TileImprovement).

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

Inheritance diagram for Settlement:



Collaboration diagram for Settlement:



Public Member Functions

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

  Constructor for the Settlement class.
- 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:

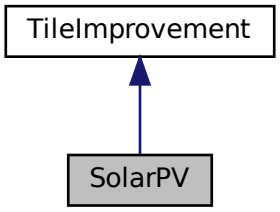
- header/Settlement.h
- source/Settlement.cpp

4.11 SolarPV Class Reference

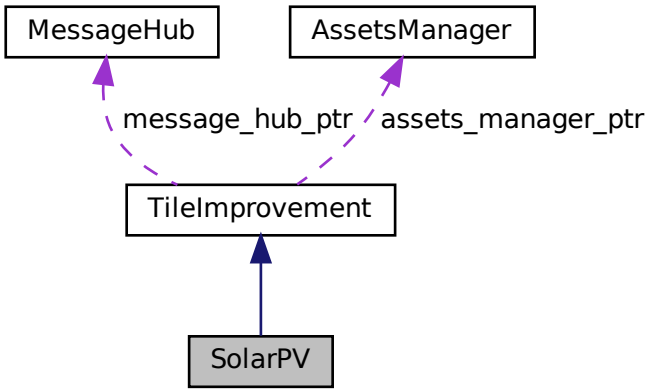
A settlement class (child class of TileImprovement).

`#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.

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->tile_improvement_string = "SOLAR PV ARRAY";
285 
286     this->__setUpTileImprovementSpriteStatic();
287 
288     std::cout « "SolarPV constructed at " « this « std::endl;
289 
290     return;
291 }   /* SolarPV() */
```

4.11.2.2 ~SolarPV()

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

Destructor for the SolarPV class.

```
417 {
418     std::cout « "SolarPV at " « this « " destroyed" « std::endl;
419 
420     return;
421 }   /* ~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.

```
388 {
389     //  1. if just built, call base method and return
390     if (this->just_built) {
391         TileImprovement :: draw();
392 
393         return;
394     }
395 
396 
397     //  1. draw static sprite
398     this->render_window_ptr->draw(this->tile_improvement_sprite_static);
399 
400     this->frame++;
401     return;
402 }   /* 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.

```
308 {
309     //                  32 char x 17 line console "--------------------------------\n";
310     std::string options_substring                = "   **** SOLAR PV OPTIONS ****   \n";
311     options_substring                           += "                                \n";
312     options_substring                           += "                                \n";
313     options_substring                           += "                                \n";
314     options_substring                           += "                                \n";
315     options_substring                           += "                                \n";
316     options_substring                           += "                                \n";
317     options_substring                           += "                                \n";
318
319     options_substring                           += "[P]:  SCRAP (";
320     options_substring                           += std::to_string(SCRAP_COST);
321     options_substring                           += " K)";
322
323     return options_substring;
324 }   /* getTileOptionsSubstring() */
```

4.11.3.7 processEvent()

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

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

Reimplemented from TileImprovement.

```
339 {
340     TileImprovement :: processEvent();
341
342     if (this->event_ptr->type == sf::Event::KeyPressed) {
343         this->__handleKeyPressEvents();
344     }
345
346     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
347         this->__handleMouseButtonEvents();
348     }
349
350     return;
351 }   /* processEvent() */
```

4.11.3.8 processMessage()

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

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

Reimplemented from TileImprovement.

```
366 {
367     TileImprovement :: processMessage();
368
369     //...
370
371     return;
372 }   /* processMessage() */
```

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

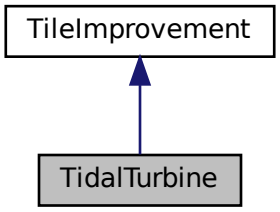
- header/SolarPV.h
- source/SolarPV.cpp

4.12 TidalTurbine Class Reference

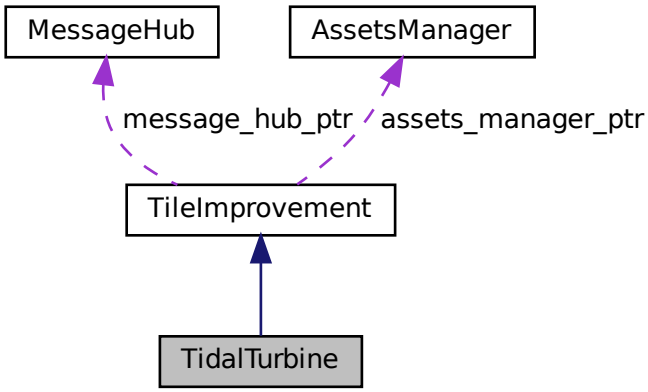
A settlement class (child class of TileImprovement).

`#include <TidalTurbine.h>`

Inheritance diagram for TidalTurbine:



Collaboration diagram for TidalTurbine:



Public Member Functions

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

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

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

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

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

- void draw (void)

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

- virtual ~TidalTurbine (void)

  Destructor for the TidalTurbine class.

Private Member Functions

- void __setUpTileImprovementSpriteAnimated (void)

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

- void __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->tile_improvement_string = "TIDAL TURBINE";
294
295     this->__setUpTileImprovementSpriteAnimated();
296
297     std::cout « "TidalTurbine constructed at " « this « std::endl;
298
299     return;
300 }   /* TidalTurbine() */
```

4.12.2.2 ~TidalTurbine()

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

Destructor for the TidalTurbine class.

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

```
397 {
398     //  1. if just built, call base method and return
399     if (this->just_built) {
400         TileImprovement :: draw();
401
```

```
402         return;
403     }
404
405
406     //  2. draw first element of animated sprite
407     this->render_window_ptr->draw(this->tile_improvement_sprite_animated[0]);
408
409
410     //  3. draw second element of animated sprite
411     if (this->is_running) {
412         //...
413     }
414
415     else {
416         //...
417     }
418
419     this->render_window_ptr->draw(this->tile_improvement_sprite_animated[1]);
420
421     //  4. 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() */
```

4.12.3.6 getTileOptionsSubstring()

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

Helper method to assemble and return tile options substring.

Returns

Tile options substring.

Reimplemented from TileImprovement.

```
317 {
318     //                  32 char x 17 line console "--------------------------------\n";
319     std::string options_substring                = "**** TIDAL TURBINE OPTIONS **** \n";
320     options_substring                           += "                                \n";
321     options_substring                           += "                                \n";
322     options_substring                           += "                                \n";
323     options_substring                           += "                                \n";
324     options_substring                           += "                                \n";
325     options_substring                           += "                                \n";
326     options_substring                           += "                                \n";
327
328     options_substring                           += "[P]:  SCRAP (";
329     options_substring                           += std::to_string(SCRAP_COST);
330     options_substring                           += " K)";
331
332     return options_substring;
333 }   /* getTileOptionsSubstring() */
```

4.12.3.7 processEvent()

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

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

Reimplemented from TileImprovement.

```
348 {
349     TileImprovement :: processEvent();
350
351     if (this->event_ptr->type == sf::Event::KeyPressed) {
352         this->__handleKeyPressEvents();
353     }
354
355     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
356         this->__handleMouseButtonEvents();
357     }
358
359     return;
360 }   /* processEvent() */
```

4.12.3.8 processMessage()

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

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

Reimplemented from TileImprovement.

```
375 {
376     TileImprovement :: processMessage();
377
378     //...
379
380     return;
381 }   /* processMessage() */
```

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

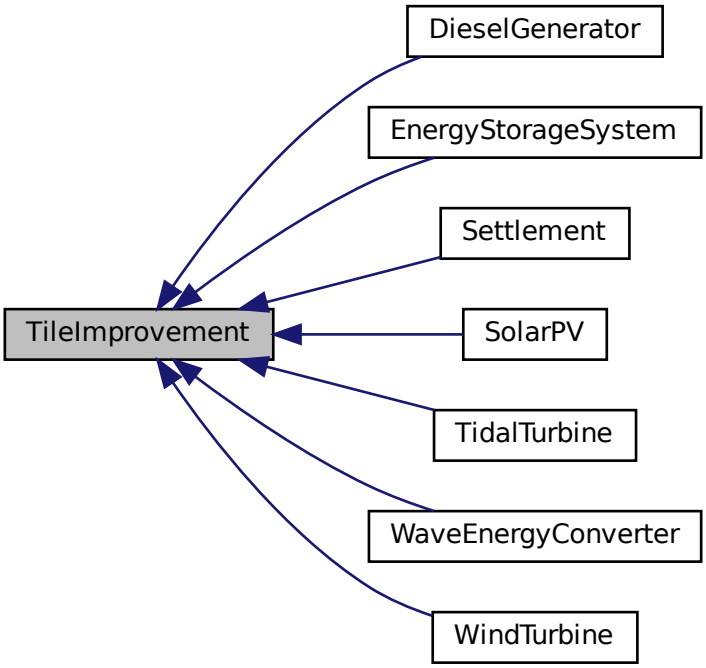
- header/TidalTurbine.h
- source/TidalTurbine.cpp

4.13 TileImprovement Class Reference

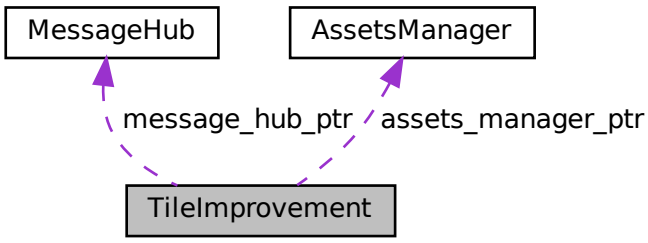
A base class for the tile improvement hierarchy.

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

Inheritance diagram for TileImprovement:



Collaboration diagram for TileImprovement:



Public Member Functions

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

  Constructor for the TileImprovement class.
- 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.
- 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 build menu.
- sf::Text production_menu_backing_text

  Text for the production menu backing.

Protected Member Functions

- void __setUpProductionMenu (void)

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

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

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

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

  Helper method to close the production menu.
- 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.

```
378 {
379     //  1. set attributes
380 
381     //  1.1. protected
382     this->event_ptr = event_ptr;
383     this->render_window_ptr = render_window_ptr;
384 
385     this->assets_manager_ptr = assets_manager_ptr;
386     this->message_hub_ptr = message_hub_ptr;
387 
388     //  1.2. public
389     this->is_selected = true;
390     this->just_built = true;
391     this->production_menu_open = false;
392 
393     this->frame = 0;
394     this->credits = 0;
395 
396     this->position_x = position_x;
397     this->position_y = position_y;
398 
399     this->game_phase = "build settlement";
400 
401     this->__setUpProductionMenu();
402 
403     std::cout « "TileImprovement constructed at " « this « std::endl;
404 
405     return;
406 }   /* TileImprovement() */
```

4.13.2.2 ~TileImprovement()

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

Destructor for the TileImprovement class.

```
620 {
621     std::cout « "TileImprovement at " « this « " destroyed" « std::endl;
622 
623     return;
624 }   /* ~TileImprovement() */
```

4.13.3 Member Function Documentation

4.13.3.1 __closeProductionMenu()

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

Helper method to close the production menu.

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

4.13.3.2 __handleKeyPressEvents()

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

Helper method to handle key press events.

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

4.13.3.3 __handleMouseButtonEvents()

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

Helper method to handle mouse button events.

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

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

4.13.3.4 __openProductionMenu()

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

Helper method to open the production menu.

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

4.13.3.5 __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.

```
292 {
293     Message credits_spent_message;
294
295     credits_spent_message.channel = GAME_CHANNEL;
296     credits_spent_message.subject = "credits spent";
297
298     credits_spent_message.int_payload["credits spent"] = credits_spent;
299
300     this->message_hub_ptr->sendMessage(credits_spent_message);
301
302     std::cout « "Credits spent (" « credits_spent « ") message sent by " « this
303         « std::endl;
304     return;
305 }   /* __sendCreditsSpentMessage() */
```

4.13.3.6 __sendGameStateRequest()

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

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

```
265 {
266     Message game_state_request;
267
268     game_state_request.channel = GAME_CHANNEL;
269     game_state_request.subject = "state request";
270
271     this->message_hub_ptr->sendMessage(game_state_request);
272
273     std::cout << "Game state request message sent by " << this << std::endl;
274     return;
275 }   /* __sendGameStateRequest() */
```

4.13.3.7 __sendInsufficientCreditsMessage()

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

Helper method to format and send an insufficient credits message.

```
320 {
321     Message insufficient_credits_message;
322
323     insufficient_credits_message.channel = GAME_CHANNEL;
324     insufficient_credits_message.subject = "insufficient credits";
325
326     this->message_hub_ptr->sendMessage(insufficient_credits_message);
327
328     std::cout << "Insufficient credits message sent by " << this << std::endl;
329
330     return;
331 }   /* __sendInsufficientCreditsMessage() */
```

4.13.3.8 __sendTileStateRequest()

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

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

```
240 {
241     Message tile_state_request;
242
243     tile_state_request.channel = TILE_STATE_CHANNEL;
244     tile_state_request.subject = "state request";
245
246     this->message_hub_ptr->sendMessage(tile_state_request);
247
248     std::cout << "Tile state request sent by " << this << std::endl;
249     return;
250 }   /* __sendTileStateRequest() */
```

4.13.3.9 __setUpProductionMenu()

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

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

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

4.13.3.10 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.

```
491 {
492     if (this->tile_improvement_sprite_static.getTexture() != NULL) {
493         int alpha = this->tile_improvement_sprite_static.getColor().a;
494 
495         alpha += 0.08 * FRAMES_PER_SECOND;
496 
497         this->tile_improvement_sprite_static.setColor(
498             sf::Color(255, 255, 255, alpha)
499         );
500 
501         this->tile_improvement_sprite_static.move(0, 50 * SECONDS_PER_FRAME);
502 
503         if (
504             (alpha >= 255) or
505             (this->tile_improvement_sprite_static.getPosition().y >= this->position_y + 12)
506         ) {
507             this->tile_improvement_sprite_static.setColor(
508                 sf::Color(255, 255, 255, 255)
509             );
510 
511             this->tile_improvement_sprite_static.setPosition(
512                 this->position_x,
513                 this->position_y + 12
514             );
515 
516             this->just_built = false;
517             this->assets_manager_ptr->getSound("place improvement")->play();
518         }
519 
520         this->render_window_ptr->draw(this->tile_improvement_sprite_static);
521     }
522 
523 
524     else {
525         int alpha = 0;
```

```
526
527         for (size_t i = 0; i < this->tile_improvement_sprite_animated.size(); i++) {
528             alpha = this->tile_improvement_sprite_animated[i].getColor().a;
529
530             alpha += 0.08 * FRAMES_PER_SECOND;
531
532             this->tile_improvement_sprite_animated[i].setColor(
533                 sf::Color(255, 255, 255, alpha)
534             );
535
536             this->tile_improvement_sprite_animated[i].move(0, 50 * SECONDS_PER_FRAME);
537
538             if (
539                 (alpha >= 255) or
540                 (this->tile_improvement_sprite_animated[i].getPosition().y >= this->position_y + 12)
541             ) {
542                 this->tile_improvement_sprite_animated[i].setColor(
543                     sf::Color(255, 255, 255, 255)
544                 );
545
546                 this->tile_improvement_sprite_animated[i].setPosition(
547                     this->position_x,
548                     this->position_y + 12
549                 );
550             }
551
552             this->render_window_ptr->draw(this->tile_improvement_sprite_animated[i]);
553         }
554
555         if (
556             (alpha >= 255) or
557             (this->tile_improvement_sprite_animated[0].getPosition().y >= this->position_y + 12)
558         ) {
559             this->just_built = false;
560             this->assets_manager_ptr->getSound("place improvement")->play();
561
562             switch (this->tile_improvement_type) {
563                 case (TileImprovementType :: WIND_TURBINE): {
564                     for (size_t i = 0; i < this->tile_improvement_sprite_animated.size(); i++) {
565                         this->tile_improvement_sprite_animated[i].setOrigin(32, 32);
566                         this->tile_improvement_sprite_animated[i].move(0, -32);
567                     }
568
569                     break;
570                 }
571
572
573                 case (TileImprovementType :: TIDAL_TURBINE): {
574                     for (size_t i = 0; i < this->tile_improvement_sprite_animated.size(); i++) {
575                         this->tile_improvement_sprite_animated[i].setOrigin(32, 45);
576                         this->tile_improvement_sprite_animated[i].move(0, -19);
577                     }
578
579                     break;
580                 }
581
582
583                 case (TileImprovementType :: WAVE_ENERGY_CONVERTER): {
584                     for (size_t i = 0; i < this->tile_improvement_sprite_animated.size(); i++) {
585                         this->tile_improvement_sprite_animated[i].setOrigin(32, 32);
586                         this->tile_improvement_sprite_animated[i].move(0, -32);
587                     }
588
589                     break;
590                 }
591
592
593                 default: {
594                     // do nothing!
595
596                     break;
597                 }
598             }
599         }
600     }
601
602
603     this->frame++;
604     return;
605 }   /* draw() */
```

4.13.3.11 getTileOptionsSubstring()

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

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

```
152 {return "";}
```

4.13.3.12 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.

```
446 {
447     if (this->event_ptr->type == sf::Event::KeyPressed) {
448         this->__handleKeyPressEvents();
449     }
450 
451     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
452         this->__handleMouseButtonEvents();
453     }
454 
455     return;
456 }   /* processEvent() */
```

4.13.3.13 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.

```
471 {
472     //...
473 
474     return;
475 }   /* processMessage() */
```

4.13.3.14 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.

```
423 {
424     this->is_selected = is_selected;
425 
426     if ((not is_selected) and this->production_menu_open) {
427         this->__closeProductionMenu();
428     }
429 
430     return;
431 }   /* 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 build 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.

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

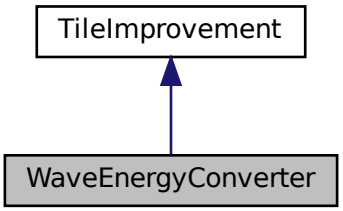
- header/TileImprovement.h
- source/TileImprovement.cpp

4.14 WaveEnergyConverter Class Reference

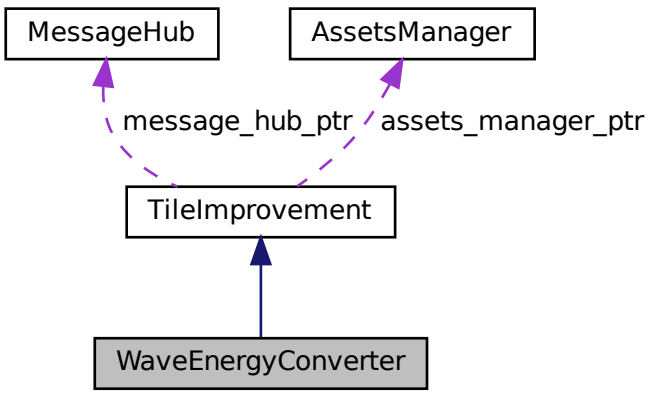
A settlement class (child class of TileImprovement).

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

Inheritance diagram for WaveEnergyConverter:



Collaboration diagram for WaveEnergyConverter:



Public Member Functions

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

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

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

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

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

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

  Destructor for the WaveEnergyConverter class.

Private Member Functions

- void __setUpTileImprovementSpriteAnimated (void)

  Helper method to set up tile improvement sprite (static).
- void __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->tile_improvement_string = "WAVE ENERGY";
295
296     this->__setUpTileImprovementSpriteAnimated();
297
298     std::cout « "WaveEnergyConverter constructed at " « this « std::endl;
299
300     return;
301 }   /* WaveEnergyConverter() */
```

4.14.2.2 ~WaveEnergyConverter()

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

Destructor for the WaveEnergyConverter class.

```
447 {
448     std::cout « "WaveEnergyConverter at " « this « " destroyed" « std::endl;
449
450     return;
451 }   /* ~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.

```
398 {
399     //  1. if just built, call base method and return
400     if (this->just_built) {
401         TileImprovement :: draw();
402 
403         return;
404     }
405 
406 
407     //  2. draw first element of animated sprite
408     this->render_window_ptr->draw(this->tile_improvement_sprite_animated[0]);
409 
410 
411     //  3. draw second element of animated sprite
412     if (this->is_running) {
413         //...
414     }
415 
416     else {
417         //...
418     }
419 
420     this->render_window_ptr->draw(this->tile_improvement_sprite_animated[1]);
421 
422     //  4. draw production menu
423     if (this->production_menu_open) {
424         this->render_window_ptr->draw(this->production_menu_backing);
425         this->render_window_ptr->draw(this->production_menu_backing_text);
426 
427         //...
428     }
429 
430     this->frame++;
431     return;
432 }   /* 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.

```
318 {
319     //                  32 char x 17 line console "--------------------------------\n";
320     std::string options_substring                = " **** WAVE ENERGY OPTIONS ****  \n";
321     options_substring                           += "                                \n";
322     options_substring                           += "                                \n";
323     options_substring                           += "                                \n";
324     options_substring                           += "                                \n";
325     options_substring                           += "                                \n";
326     options_substring                           += "                                \n";
327     options_substring                           += "                                \n";
328 
329     options_substring                           += "[P]:  SCRAP (";
330     options_substring                           += std::to_string(SCRAP_COST);
331     options_substring                           += " K)";
332 
333     return options_substring;
334 }   /* getTileOptionsSubstring() */
```

4.14.3.7 processEvent()

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

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

Reimplemented from TileImprovement.

```
349 {
350     TileImprovement :: processEvent();
351
352     if (this->event_ptr->type == sf::Event::KeyPressed) {
353         this->__handleKeyPressEvents();
354     }
355
356     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
357         this->__handleMouseButtonEvents();
358     }
359
360     return;
361 }   /* processEvent() */
```

4.14.3.8 processMessage()

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

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

Reimplemented from TileImprovement.

```
376 {
377     TileImprovement :: processMessage();
378
379     //...
380
381     return;
382 }   /* processMessage() */
```

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

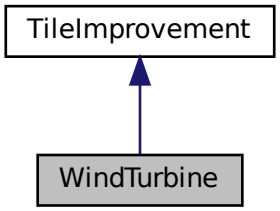
- header/WaveEnergyConverter.h
- source/WaveEnergyConverter.cpp

4.15 WindTurbine Class Reference

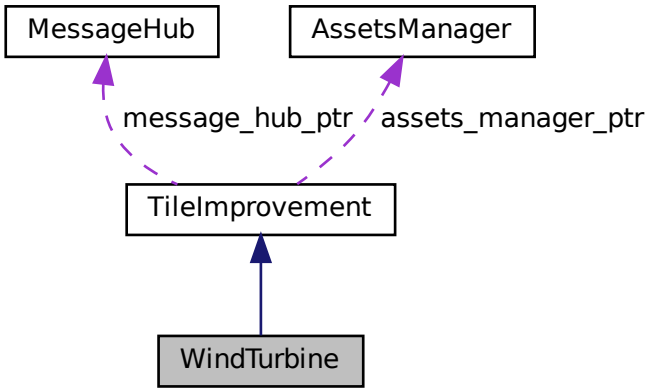
A settlement class (child class of TileImprovement).

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

Inheritance diagram for WindTurbine:



Collaboration diagram for WindTurbine:



Public Member Functions

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

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

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

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

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

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

  Destructor for the WindTurbine class.

Private Member Functions

- void __setUpTileImprovementSpriteAnimated (void)

  Helper method to set up tile improvement sprite (static).
- void __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->tile_improvement_string = "WIND TURBINE";
296
297     this->__setUpTileImprovementSpriteAnimated();
298
299     std::cout « "WindTurbine constructed at " « this « std::endl;
300
301     return;
302 }   /* WindTurbine() */
```

4.15.2.2 ~WindTurbine()

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

Destructor for the WindTurbine class.

```
448 {
449     std::cout « "WindTurbine at " « this « " destroyed" « std::endl;
450
451     return;
452 }   /* ~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.

```
399 {
400     //  1. if just built, call base method and return
401     if (this->just_built) {
402         TileImprovement :: draw();
403 
404         return;
405     }
406 
407 
408     //  2. draw first element of animated sprite
409     this->render_window_ptr->draw(this->tile_improvement_sprite_animated[0]);
410 
411 
412     //  3. draw second element of animated sprite
413     if (this->is_running) {
414         //...
415     }
416 
417     else {
418         //...
419     }
420 
421     this->render_window_ptr->draw(this->tile_improvement_sprite_animated[1]);
422 
423     //  4. draw production menu
424     if (this->production_menu_open) {
```

```
425         this->render_window_ptr->draw(this->production_menu_backing);
426         this->render_window_ptr->draw(this->production_menu_backing_text);
427 
428         //...
429     }
430 
431     this->frame++;
432     return;
433 }   /* 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.

```
319 {
320     //                  32 char x 17 line console "--------------------------------\n";
321     std::string options_substring                = " **** WIND TURBINE OPTIONS **** \n";
322     options_substring                           += "                                \n";
323     options_substring                           += "                                \n";
324     options_substring                           += "                                \n";
325     options_substring                           += "                                \n";
326     options_substring                           += "                                \n";
327     options_substring                           += "                                \n";
328     options_substring                           += "                                \n";
329 
330     options_substring                           += "[P]:  SCRAP (";
331     options_substring                           += std::to_string(SCRAP_COST);
332     options_substring                           += " K)";
333 
334     return options_substring;
335 }   /* getTileOptionsSubstring() */
```

4.15.3.7 processEvent()

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

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

Reimplemented from TileImprovement.

```
350 {
351     TileImprovement :: processEvent();
352 
353     if (this->event_ptr->type == sf::Event::KeyPressed) {
354         this->__handleKeyPressEvents();
355     }
356 
357     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
358         this->__handleMouseButtonEvents();
359     }
360 
361     return;
362 }   /* processEvent() */
```

4.15.3.8 processMessage()

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

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

Reimplemented from TileImprovement.

```
377 {
378     TileImprovement :: processMessage();
379
380     //...
381
382     return;
383 }   /* processMessage() */
```

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

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

Chapter 5

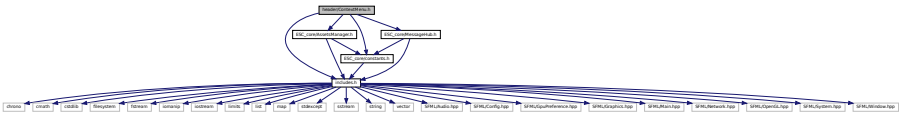
File Documentation

5.1 header/ContextMenu.h File Reference

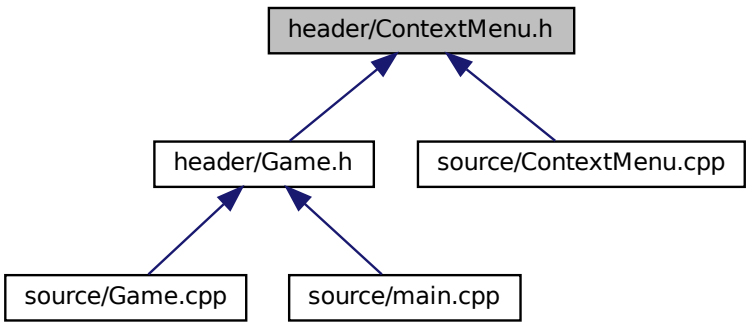
Header file for the ContextMenu class.

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

Include dependency graph for ContextMenu.h:



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



Classes

- class ContextMenu

  A class which defines a context menu for the game.

Enumerations

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

  An enumeration of the different console screen states.

5.1.1 Detailed Description

Header file for the ContextMenu class.

5.1.2 Enumeration Type Documentation

5.1.2.1 ConsoleState

```
enum ConsoleState
```

An enumeration of the different console screen states.

Enumerator

NONE_STATE	None state (for initialization)
READY	Ready (default) state.
MENU	Game menu state.
TILE	Tile context state.
N_CONSOLE_STATES	A simple hack to get the number of console screen states.

```
68                  {
69     NONE_STATE,
70     READY,
71     MENU,
72     TILE,
73     N_CONSOLE_STATES
74 };
```

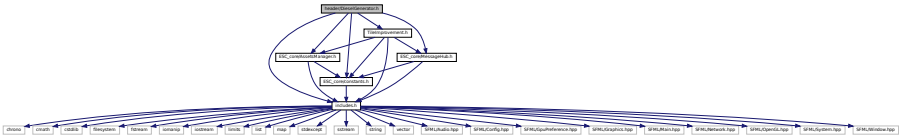
5.2 header/DieselGenerator.h File Reference

Header file for the DieselGenerator class.

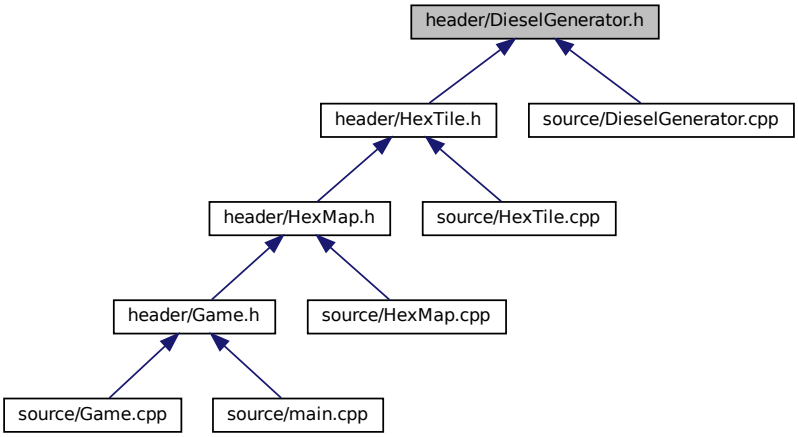
```
#include "ESC_core/constants.h"
#include "ESC_core/includes.h"
#include "ESC_core/AssetsManager.h"
```

```
#include "ESC_core/MessageHub.h"
#include "TileImprovement.h"
```

Include dependency graph for DieselGenerator.h:



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



Classes

- class DieselGenerator

  A settlement class (child class of TileImprovement).

5.2.1 Detailed Description

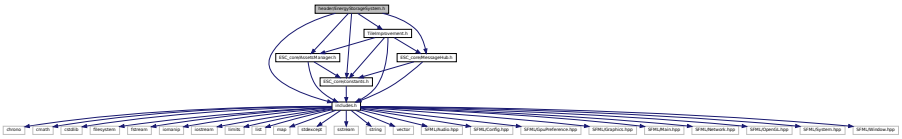
Header file for the DieselGenerator class.

5.3 header/EnergyStorageSystem.h File Reference

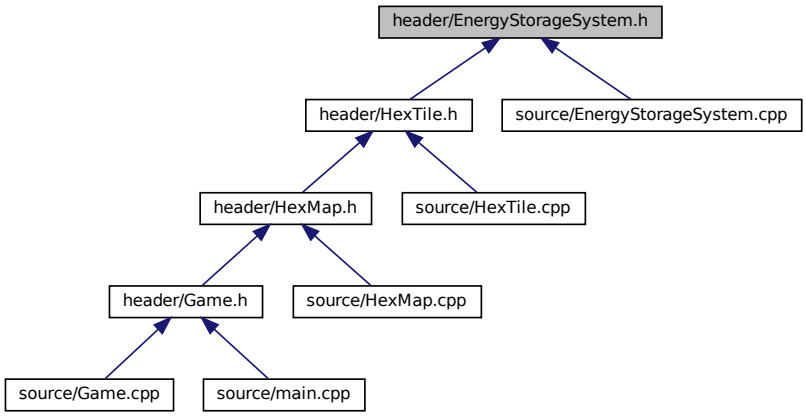
Header file for the EnergyStorageSystem class.

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

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



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



Classes

- class EnergyStorageSystem

  A settlement class (child class of TileImprovement).

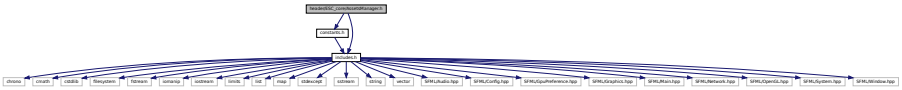
5.3.1 Detailed Description

Header file for the EnergyStorageSystem class.

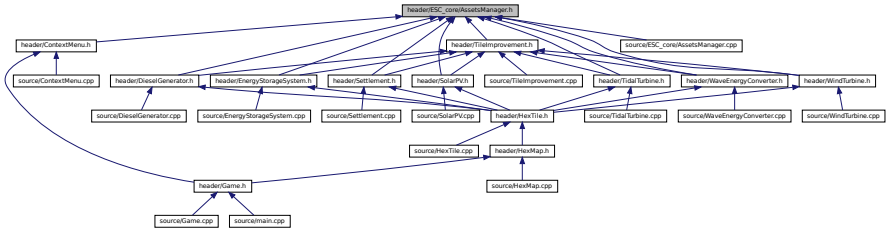
5.4 header/ESC_core/AssetsManager.h File Reference

Header file for the AssetsManager class.

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



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



Classes

- class AssetsManager

  A class which manages visual and sound assets.

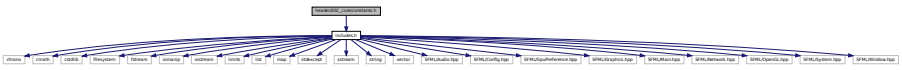
5.4.1 Detailed Description

Header file for the AssetsManager class.

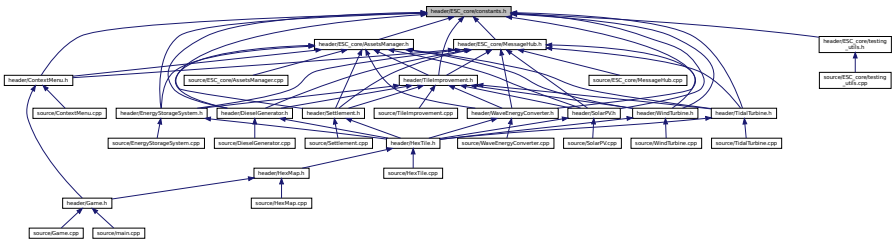
5.5 header/ESC_core/constants.h File Reference

Header file for various constants.

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



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



Functions

- const sf::Color FOREST_GREEN (34, 139, 34)

  The base colour of a forest tile.
- const sf::Color LAKE_BLUE (0, 102, 204)

  The base colour of a lake (water) tile.
- const sf::Color MOUNTAINS_GREY (97, 110, 113)

  The base colour of a mountains tile.
- const sf::Color OCEAN_BLUE (0, 51, 102)

  The base colour of an ocean (water) tile.
- const sf::Color PLAINS_YELLOW (245, 222, 133)

  The base colour of a plains tile.
- const sf::Color RESOURCE_CHIP_GREY (175, 175, 175, 250)

  The base colour of the resource chip (backing).
- const sf::Color MENU_FRAME_GREY (185, 187, 182)

  The base colour of the context menu frame.
- const sf::Color MONOCHROME_SCREEN_BACKGROUND (40, 40, 40)

  The base colour of old monochrome screens.
- const sf::Color VISUAL_SCREEN_FRAME_GREY (151, 151, 143)

  The base colour of the framing of the visual screen.
- const sf::Color MONOCHROME_TEXT_GREEN (0, 255, 102)

  The base colour of old monochrome text (green).
- const sf::Color MONOCHROME_TEXT_AMBER (255, 176, 0)

  The base colour of old monochrome text (amber).
- const sf::Color MONOCHROME_TEXT_RED (255, 44, 0)

  The base colour of old monochrome text (red).

Variables

- const double FLOAT_TOLERANCE = 1e-6

  Tolerance for floating point equality tests.
- const unsigned long long int SECONDS_PER_YEAR = 31537970
- const unsigned long long int SECONDS_PER_MONTH = 2628164
- const int FRAMES_PER_SECOND = 60

  Target frames per second.
- const double SECONDS_PER_FRAME = 1.0 / 60

  Target seconds per frame (just reciprocal of target frames per second).
- const int GAME_WIDTH = 1200

  Width of the game space.
- const int GAME_HEIGHT = 800

  Height of the game space.
- const std::vector< double > TILE_TYPE_CUMULATIVE_PROBABILITIES

  Cumulative probabilities for each tile type (to support procedural generation).
- const std::vector< double > TILE_RESOURCE_CUMULATIVE_PROBABILITIES

  Cumulative probabilities for each tile resource (to support procedural generation).
- const std::string TILE_SELECTED_CHANNEL = "TILE SELECTED CHANNEL"

  A message channel for tile selection messages.
- const std::string NO_TILE_SELECTED_CHANNEL = "NO TILE SELECTED CHANNEL"

  A message channel for no tile selected messages.
- const std::string TILE_STATE_CHANNEL = "TILE STATE CHANNEL"

A message channel for tile state messages.

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

  A message channel for hex map messages.
- const int CLEAR_FOREST_COST = 40

  The cost of clearing a forest tile.
- const int CLEAR_MOUNTAINS_COST = 250

  The cost of clearing a mountains tile.
- const int CLEAR_PLAINS_COST = 20

  The cost of clearing a plains tile.
- const int DIESEL_GENERATOR_BUILD_COST = 100

  The cost of building (or ugrading) a diesel generator.
- const int WIND_TURBINE_BUILD_COST = 400

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

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

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

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

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

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

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

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

5.5.3.7 EMISSIONS_LIFETIME_LIMIT_TONNES

```
const int EMISSIONS_LIFETIME_LIMIT_TONNES = 1500
```

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

5.5.3.8 ENERGY_STORAGE_SYSTEM_BUILD_COST

```
const int ENERGY_STORAGE_SYSTEM_BUILD_COST = 400
```

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

5.5.3.9 FLOAT_TOLERANCE

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

Tolerance for floating point equality tests.

5.5.3.10 FRAMES_PER_SECOND

```
const int FRAMES_PER_SECOND = 60
```

Target frames per second.

5.5.3.11 GAME_CHANNEL

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

A message channel for game messages.

5.5.3.12 GAME_HEIGHT

```
const int GAME_HEIGHT = 800
```

Height of the game space.

5.5.3.13 GAME_STATE_CHANNEL

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

A message channel for game state messages.

5.5.3.14 GAME_WIDTH

```
const int GAME_WIDTH = 1200
```

Width of the game space.

5.5.3.15 HEX_MAP_CHANNEL

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

A message channel for hex map messages.

5.5.3.16 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.

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.

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.

5.5.3.33 WIND_TURBINE_BUILD_COST

```
const int WIND_TURBINE_BUILD_COST = 400
```

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

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]

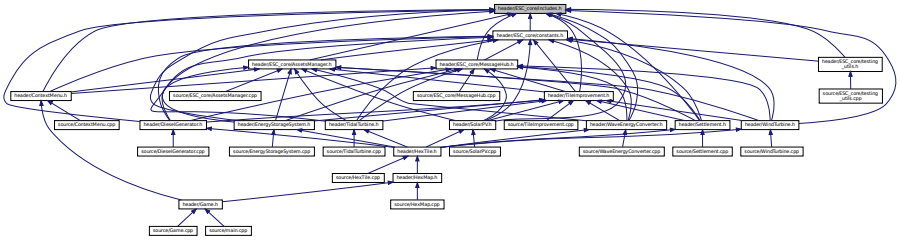
5.7 header/ESC_core/includes.h File Reference

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.

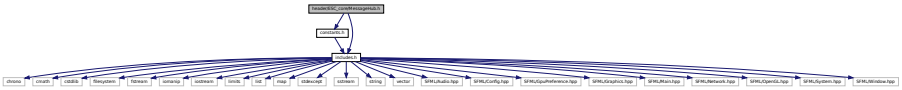
Ref: Gomila [2023]

5.8 header/ESC_core/MessageHub.h File Reference

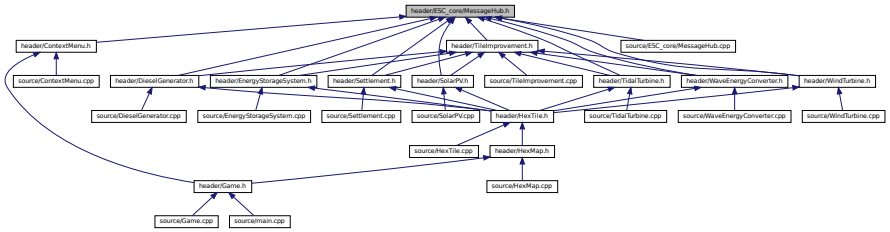
Header file for the MessageHub class.

```
#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

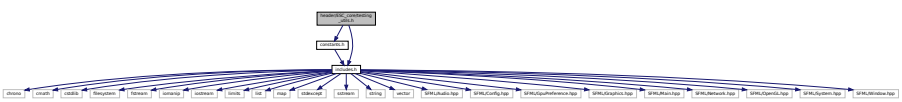
Header file for the MessageHub class.

5.9 header/ESC_core/testing_utils.h File Reference

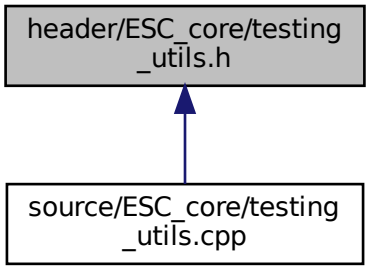
Header file for various testing utilities.

```
#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

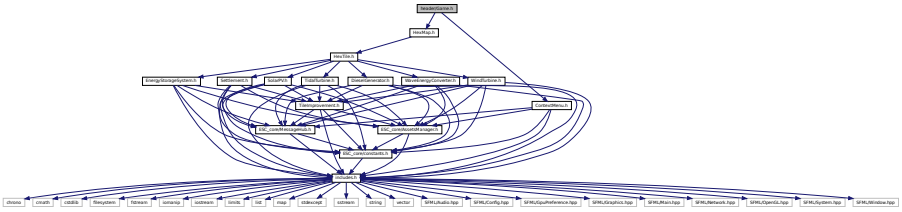
statement	The statement whose truth is to be tested ("1 == 0", for example).
file	The file in which the test is applied (you should be able to just pass in "__FILE__").
line	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```
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() */
```

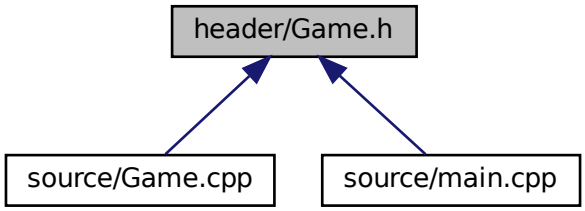
5.10 header/Game.h File Reference

```
#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.

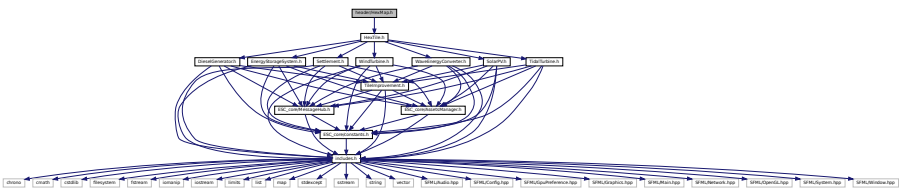
```
66                {
67     BUILD_SETTLEMENT,
68     SYSTEM_MANAGEMENT,
69     LOSS_EMISSIONS,
70     LOSS_DEMAND,
71     LOSS_CREDITS,
72     VICTORY,
73     N_GAME_PHASES
74 };  /* GamePhase */
```

5.11 header/HexMap.h File Reference

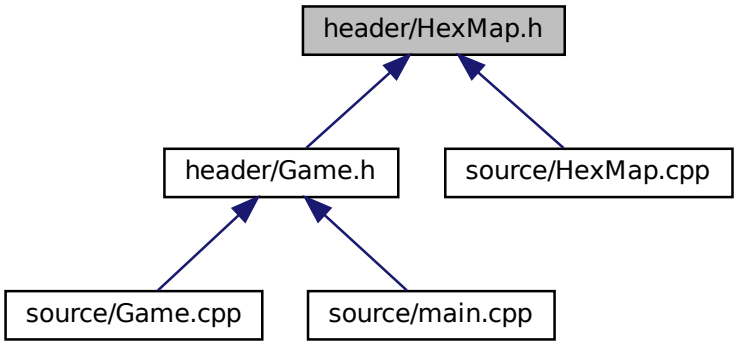
Header file for the HexMap class.

```
#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

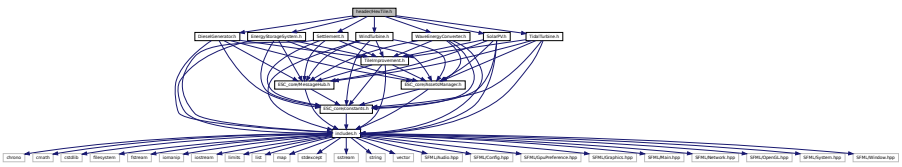
Header file for the HexMap class.

5.12 header/HexTile.h File Reference

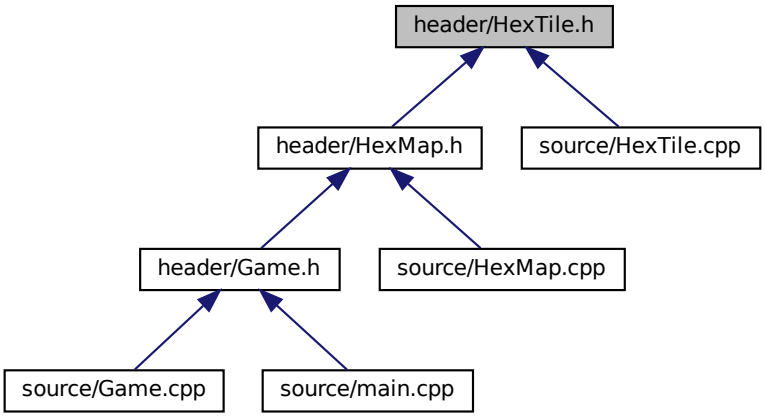
Header file for the Game class.

```
#include "DieselGenerator.h"
#include "EnergyStorageSystem.h"
#include "Settlement.h"
#include "SolarPV.h"
#include "TidalTurbine.h"
#include "WaveEnergyConverter.h"
#include "WindTurbine.h"
```

Include dependency graph for HexTile.h:



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



Classes

- class HexTile

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

Enumerations

- enum TileType {
  NONE_TYPE , FOREST , LAKE , MOUNTAINS ,
  OCEAN , PLAINS , N_TILE_TYPES }

  An enumeration of the different tile types.
- enum TileResource {
  POOR , BELOW_AVERAGE , AVERAGE , ABOVE_AVERAGE ,
  GOOD , N_TILE_RESOURCES }

  An enumeration of the different tile resource values.

5.12.1 Detailed Description

Header file for the Game class.

Header file for the HexTile class.

5.12.2 Enumeration Type Documentation

5.12.2.1 TileResource

```
enum TileResource
```

An enumeration of the different tile resource values.

Enumerator

POOR	A poor resource value.
BELOW_AVERAGE	A below average resource value.
AVERAGE	An average resource value.
ABOVE_AVERAGE	An above average resource value.
GOOD	A good resource value.
N_TILE_RESOURCES	A simple hack to get the number of elements in TileResource.

```
88                  {
89     POOR,
90     BELOW_AVERAGE,
91     AVERAGE,
92     ABOVE_AVERAGE,
93     GOOD,
94     N_TILE_RESOURCES
95 };  /* TileResource */
```

5.12.2.2 TileType

```
enum TileType
```

An enumeration of the different tile types.

Enumerator

NONE_TYPE	A dummy tile (for initialization).
FOREST	A forest tile.
LAKE	A lake tile.
MOUNTAINS	A mountains tile.
OCEAN	An ocean tile.
PLAINS	A plains tile.
N_TILE_TYPES	A simple hack to get the number of elements in TileType.

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

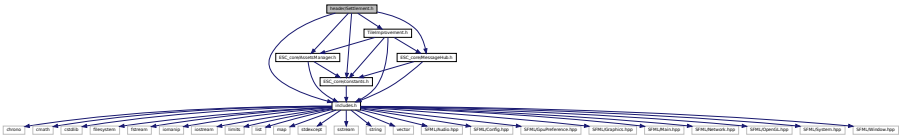
5.13 header/Settlement.h File Reference

Header file for the Settlement class.

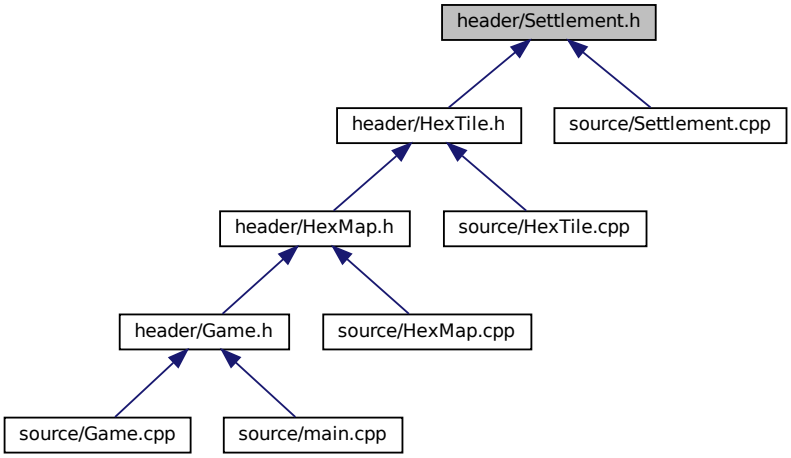
```
#include "ESC_core/constants.h"
#include "ESC_core/includes.h"
#include "ESC_core/AssetsManager.h"
#include "ESC_core/MessageHub.h"
```

```
#include "TileImprovement.h"
```

Include dependency graph for Settlement.h:



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



Classes

- class Settlement

  A settlement class (child class of TileImprovement).

5.13.1 Detailed Description

Header file for the Settlement class.

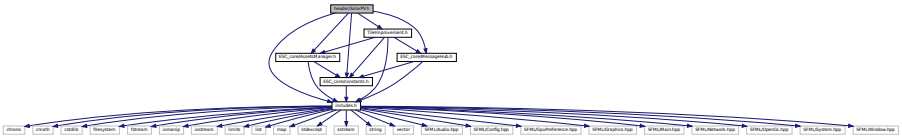
5.14 header/SolarPV.h File Reference

Header file for the SolarPV class.

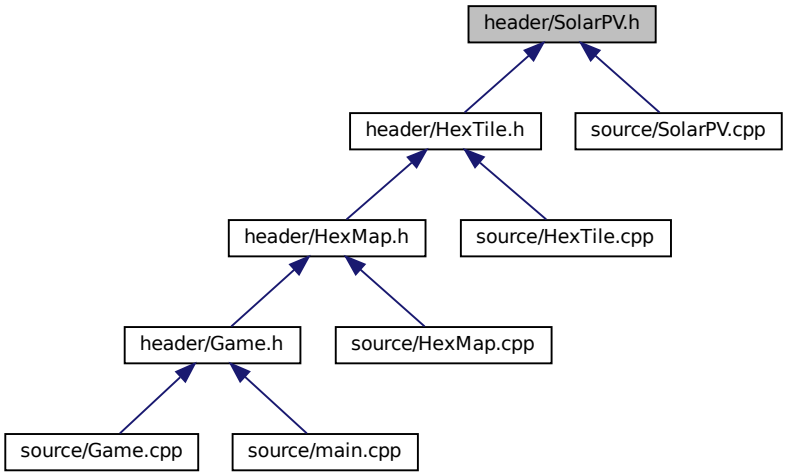
```
#include "ESC_core/constants.h"
#include "ESC_core/includes.h"
#include "ESC_core/AssetsManager.h"
#include "ESC_core/MessageHub.h"
```

```
#include "TileImprovement.h"
```

Include dependency graph for SolarPV.h:



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



Classes

- class SolarPV

  A settlement class (child class of TileImprovement).

5.14.1 Detailed Description

Header file for the SolarPV class.

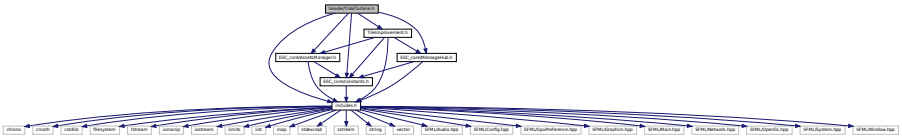
5.15 header/TidalTurbine.h File Reference

Header file for the TidalTurbine class.

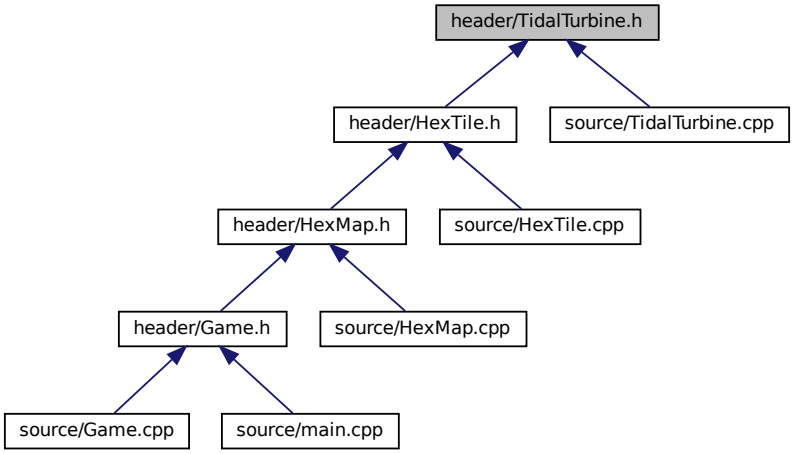
```
#include "ESC_core/constants.h"
#include "ESC_core/includes.h"
#include "ESC_core/AssetsManager.h"
#include "ESC_core/MessageHub.h"
```

```
#include "TileImprovement.h"
```

Include dependency graph for TidalTurbine.h:



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



Classes

- class TidalTurbine

  A settlement class (child class of TileImprovement).

5.15.1 Detailed Description

Header file for the TidalTurbine class.

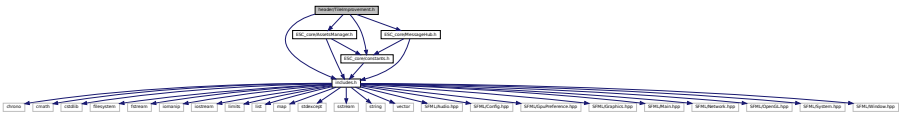
5.16 header/TileImprovement.h File Reference

Header file for the TileImprovement class.

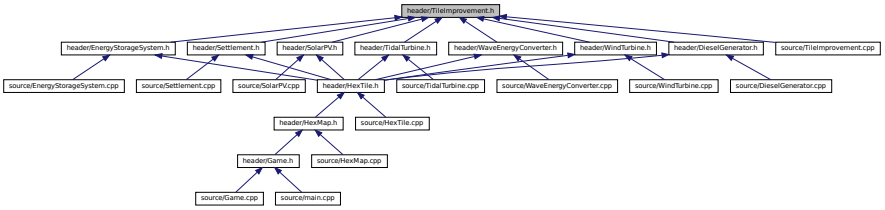
```
#include "ESC_core/constants.h"
#include "ESC_core/includes.h"
#include "ESC_core/AssetsManager.h"
```

```
#include "ESC_core/MessageHub.h"
```

Include dependency graph for TileImprovement.h:



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



Classes

- class TileImprovement

  A base class for the tile improvement hierarchy.

Enumerations

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

  An enumeration of the different tile improvement types.

5.16.1 Detailed Description

Header file for the TileImprovement class.

5.16.2 Enumeration Type Documentation

5.16.2.1 TileImprovementType

```
enum TileImprovementType
```

An enumeration of the different tile improvement types.

Enumerator

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

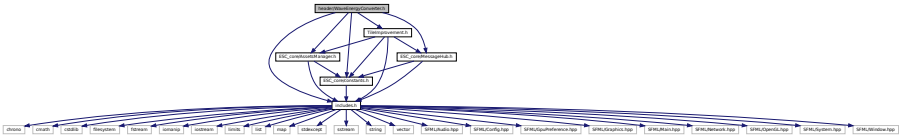
```
68                          {
69     SETTLEMENT,
70     DIESEL_GENERATOR,
71     SOLAR_PV,
72     WIND_TURBINE,
73     TIDAL_TURBINE,
74     WAVE_ENERGY_CONVERTER,
75     ENERGY_STORAGE_SYSTEM,
76     N_TILE_IMPROVEMENT_TYPES
77 };  /* TileImprovementType */
```

5.17 header/WaveEnergyConverter.h File Reference

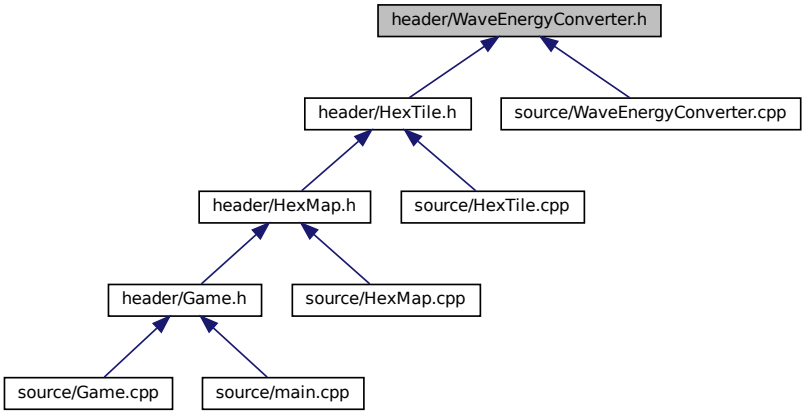
Header file for the WaveEnergyConverter class.

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

Include dependency graph for WaveEnergyConverter.h:



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



Classes

- class WaveEnergyConverter

  A settlement class (child class of TileImprovement).

5.17.1 Detailed Description

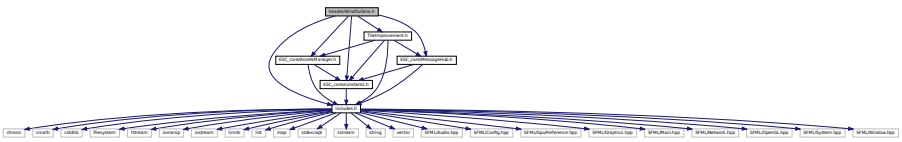
Header file for the WaveEnergyConverter class.

5.18 header/WindTurbine.h File Reference

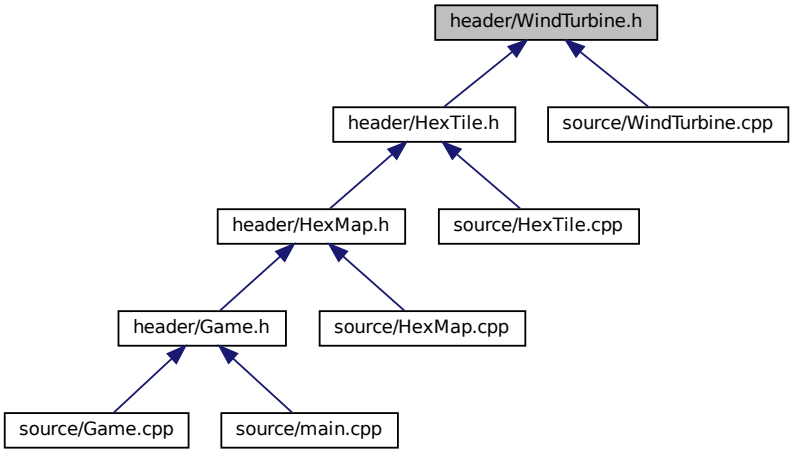
Header file for the WindTurbine class.

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

Include dependency graph for WindTurbine.h:



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



Classes

- class WindTurbine

  A settlement class (child class of TileImprovement).

5.18.1 Detailed Description

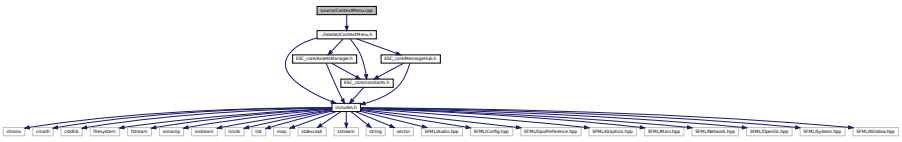
Header file for the WindTurbine class.

5.19 source/ContextMenu.cpp File Reference

Implementation file for the ContextMenu class.

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

Include dependency graph for ContextMenu.cpp:



5.19.1 Detailed Description

Implementation file for the ContextMenu class.

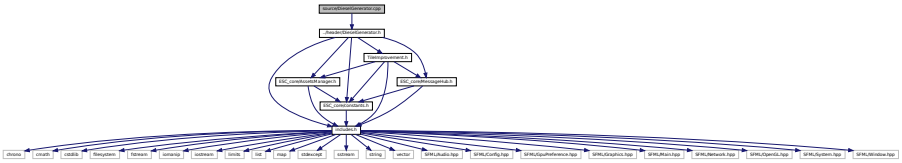
A class which defines a context menu for the game.

5.20 source/DieselGenerator.cpp File Reference

Implementation file for the DieselGenerator class.

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

Include dependency graph for DieselGenerator.cpp:



5.20.1 Detailed Description

Implementation file for the DieselGenerator class.

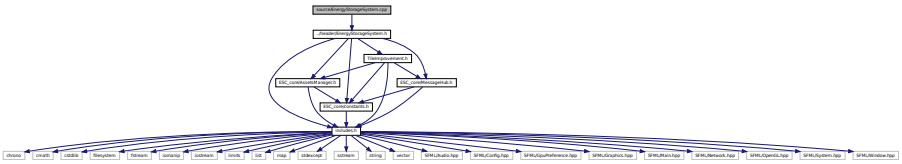
A base class for the tile improvement hierarchy.

5.21 source/EnergyStorageSystem.cpp File Reference

Implementation file for the EnergyStorageSystem class.

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

Include dependency graph for EnergyStorageSystem.cpp:



5.21.1 Detailed Description

Implementation file for the EnergyStorageSystem class.

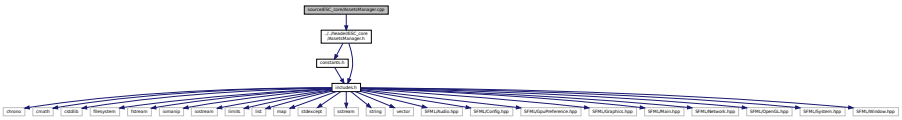
A base class for the tile improvement hierarchy.

5.22 source/ESC_core/AssetsManager.cpp File Reference

Implementation file for the AssetsManager class.

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

Include dependency graph for AssetsManager.cpp:



5.22.1 Detailed Description

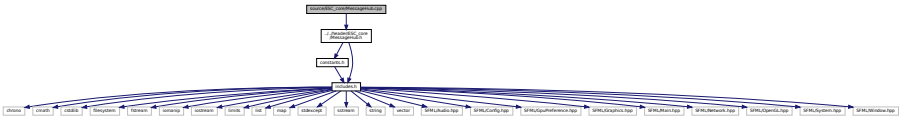
Implementation file for the AssetsManager class.

A class which manages visual and sound assets.

5.23 source/ESC_core/MessageHub.cpp File Reference

Implementation file for the MessageHub class.

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



5.23.1 Detailed Description

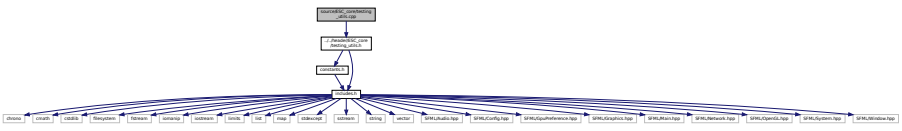
Implementation file for the MessageHub class.

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

5.24 source/ESC_core/testing_utils.cpp File Reference

Implementation file for various testing utilities.

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



Functions

- void printGreen (std::string input_str)

  A function that sends green text to std::cout.
- void printGold (std::string input_str)

  A function that sends gold text to std::cout.
- void printRed (std::string input_str)

  A function that sends red text to std::cout.
- void testFloatEquals (double x, double y, std::string file, int line)

  Tests for the equality of two floating point numbers x and y (to within FLOAT_TOLERANCE).
- void testGreaterThan (double x, double y, std::string file, int line)

  Tests if x > y.
- void testGreaterThanOrEqualTo (double x, double y, std::string file, int line)

  Tests if x >= y.
- void testLessThan (double x, double y, std::string file, int line)

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

  Tests if x <= y.
- void testTruth (bool statement, std::string file, int line)

  Tests if the given statement is true.
- void expectedErrorNotDetected (std::string file, int line)

  A utility function to print out a meaningful error message whenever an expected error fails to be thrown/caught/detected.

5.24.1 Detailed Description

Implementation file for various testing utilities.

This is a library of utility functions used throughout the various test suites.

5.24.2 Function Documentation

5.24.2.1 expectedErrorNotDetected()

```
void expectedErrorNotDetected (
            std::string file,
            int line )
```

A utility function to print out a meaningful error message whenever an expected error fails to be thrown/caught/detected.

Parameters

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

```
462 {
463     std::string error_str = "\n ERROR  failed to throw expected error prior to line ";
464     error_str += std::to_string(line);
```

```
465     error_str += " of ";
466     error_str += file;
467
468     #ifdef _WIN32
469         std::cout « error_str « std::endl;
470     #endif
471
472     throw std::runtime_error(error_str);
473     return;
474 }   /* expectedErrorNotDetected() */
```

5.24.2.2 printGold()

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

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

Parameters

input_str	The text of the string to be sent to std::cout.

```
114 {
115     std::cout « "\x1B[33m" « input_str « "\033[0m";
116     return;
117 }   /* printGold() */
```

5.24.2.3 printGreen()

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

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

Parameters

input_str	The text of the string to be sent to std::cout.

```
94 {
95     std::cout « "\x1B[32m" « input_str « "\033[0m";
96     return;
97 }   /* printGreen() */
```

5.24.2.4 printRed()

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

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

Parameters

input_str	The text of the string to be sent to std::cout.

```
134 {
135     std::cout « "\x1B[31m" « input_str « "\033[0m";
136     return;
137 }   /* printRed() */
```

5.24.2.5 testFloatEquals()

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

Tests for the equality of two floating point numbers *x* and *y* (to within FLOAT_TOLERANCE).

Parameters

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

```
168 {
169     if (fabs(x - y) <= FLOAT_TOLERANCE) {
170         return;
171     }
172 
173     std::string error_str = "ERROR: testFloatEquals():\t in ";
174     error_str += file;
175     error_str += "\tline ";
176     error_str += std::to_string(line);
177     error_str += ":\t\n";
178     error_str += std::to_string(x);
179     error_str += " and ";
180     error_str += std::to_string(y);
181     error_str += " are not equal to within +/- ";
182     error_str += std::to_string(FLOAT_TOLERANCE);
183     error_str += "\n";
184 
185     #ifdef _WIN32
186         std::cout « error_str « std::endl;
187     #endif
188 
189     throw std::runtime_error(error_str);
190     return;
191 }   /* testFloatEquals() */
```

5.24.2.6 testGreaterThan()

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

Tests if x $>$ y.

Parameters

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

```
221 {
222     if (x > y) {
223         return;
224     }
225
226     std::string error_str = "ERROR: testGreaterThan():\t in ";
227     error_str += file;
228     error_str += "\tline ";
229     error_str += std::to_string(line);
230     error_str += ":\t\n";
231     error_str += std::to_string(x);
232     error_str += " is not greater than ";
233     error_str += std::to_string(y);
234     error_str += "\n";
235
236     #ifdef _WIN32
237         std::cout « error_str « std::endl;
238     #endif
239
240     throw std::runtime_error(error_str);
241     return;
242 }   /* testGreaterThan() */
```

5.24.2.7 testGreaterThanOrEqualTo()

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

Tests if x >= y.

Parameters

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

```
272 {
273     if (x >= y) {
274         return;
275     }
276
277     std::string error_str = "ERROR: testGreaterThanOrEqualTo():\t in ";
278     error_str += file;
279     error_str += "\tline ";
280     error_str += std::to_string(line);
281     error_str += ":\t\n";
282     error_str += std::to_string(x);
283     error_str += " is not greater than or equal to ";
284     error_str += std::to_string(y);
285     error_str += "\n";
286
287     #ifdef _WIN32
288         std::cout « error_str « std::endl;
289     #endif
290
291     throw std::runtime_error(error_str);
```

```
292     return;
293 }   /* testGreaterThanOrEqualTo() */
```

5.24.2.8 testLessThan()

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

Tests if x < y.

Parameters

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

```
323 {
324     if (x < y) {
325         return;
326     }
327 
328     std::string error_str = "ERROR: testLessThan():\t in ";
329     error_str += file;
330     error_str += "\tline ";
331     error_str += std::to_string(line);
332     error_str += ":\t\n";
333     error_str += std::to_string(x);
334     error_str += " is not less than ";
335     error_str += std::to_string(y);
336     error_str += "\n";
337 
338     #ifdef _WIN32
339         std::cout « error_str « std::endl;
340     #endif
341 
342     throw std::runtime_error(error_str);
343     return;
344 }   /* testLessThan() */
```

5.24.2.9 testLessThanOrEqualTo()

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

Tests if x <= y.

Parameters

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

```
374 {
375     if (x <= y) {
376         return;
377     }
378 
379     std::string error_str = "ERROR: testLessThanOrEqualTo():\t in ";
380     error_str += file;
381     error_str += "\tline ";
382     error_str += std::to_string(line);
383     error_str += ":\t\n";
384     error_str += std::to_string(x);
385     error_str += " is not less than or equal to ";
386     error_str += std::to_string(y);
387     error_str += "\n";
388 
389     #ifdef _WIN32
390         std::cout « error_str « std::endl;
391     #endif
392 
393     throw std::runtime_error(error_str);
394     return;
395 }   /* testLessThanOrEqualTo() */
```

5.24.2.10 testTruth()

```
void testTruth (
              bool statement,
              std::string file,
              int line )
```

Tests if the given statement is true.

Parameters

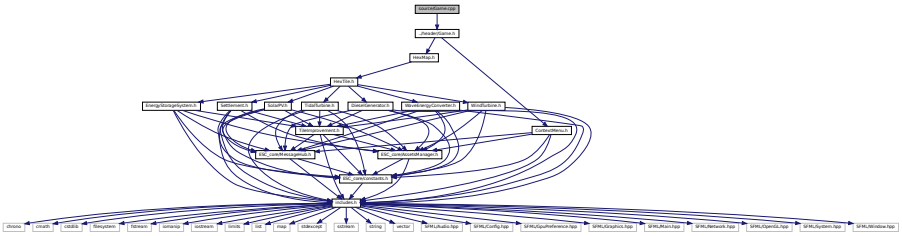
statement	The statement whose truth is to be tested ("1 == 0", for example).
file	The file in which the test is applied (you should be able to just pass in "__FILE__").
line	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```
422 {
423     if (statement) {
424         return;
425     }
426 
427     std::string error_str = "ERROR: testTruth():\t in ";
428     error_str += file;
429     error_str += "\tline ";
430     error_str += std::to_string(line);
431     error_str += ":\t\n";
432     error_str += "Given statement is not true";
433 
434     #ifdef _WIN32
435         std::cout « error_str « std::endl;
436     #endif
437 
438     throw std::runtime_error(error_str);
439     return;
440 }   /* testTruth() */
```

5.25 source/Game.cpp File Reference

Implementation file for the Game class.

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



5.25.1 Detailed Description

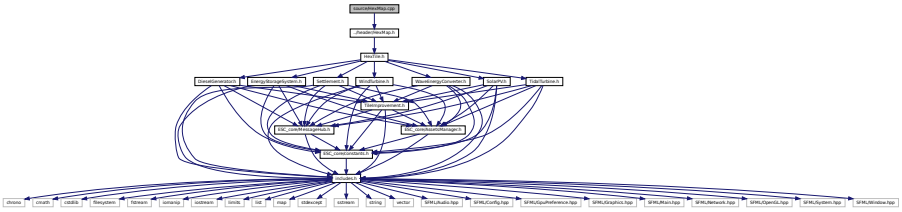
Implementation file for the Game class.

A class which defines a tile of a hex map.

5.26 source/HexMap.cpp File Reference

Implementation file for the HexMap class.

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



5.26.1 Detailed Description

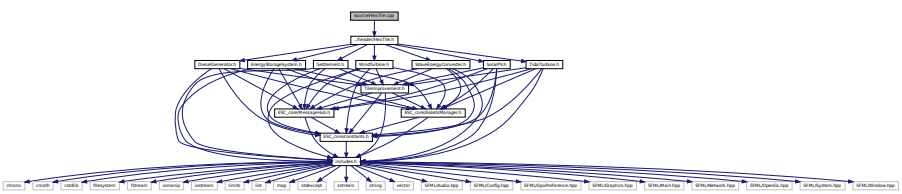
Implementation file for the HexMap class.

A class which defines a hex map of hex tiles.

5.27 source/HexTile.cpp File Reference

Implementation file for the HexTile class.

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



5.27.1 Detailed Description

Implementation file for the HexTile class.

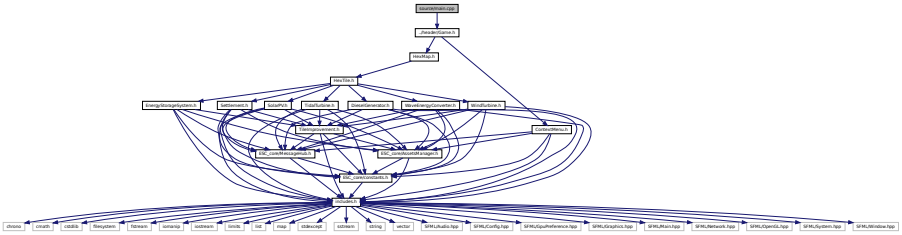
A class which defines a tile of a hex map.

5.28 source/main.cpp File Reference

Implementation file for main() for Road To Zero.

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

Include dependency graph for main.cpp:



Functions

- void loadAssets (AssetsManager *assets_manager_ptr)

  Helper function to load game assets.
- sf::RenderWindow * constructRenderWindow (void)

  Helper function to construct render window.
- int main (int argc, char **argv)

5.28.1 Detailed Description

Implementation file for main() for Road To Zero.

5.28.2 Function Documentation

5.28.2.1 constructRenderWindow()

```
sf::RenderWindow * constructRenderWindow (
            void  )
```

Helper function to construct render window.

Returns

Pointer to the render window.

```
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()

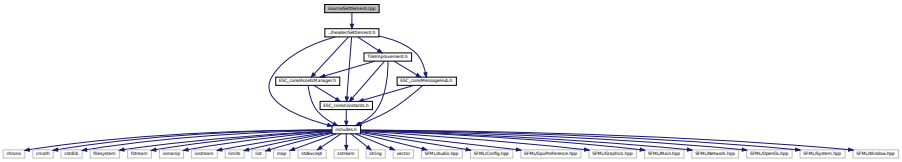
```
int main (
              int argc,
              char ** argv )
315 {
316     //  1. load assets
317     AssetsManager assets_manager;
318     loadAssets(&assets_manager);
319
320     //  2. construct render window
321     sf::RenderWindow* render_window_ptr = constructRenderWindow();
322
323   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

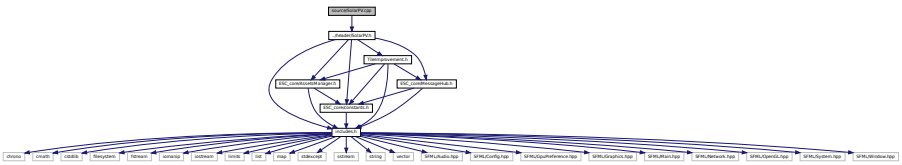
Implementation file for the Settlement class.

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.

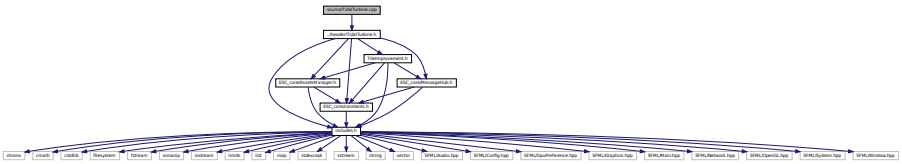
A base class for the tile improvement hierarchy.

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.

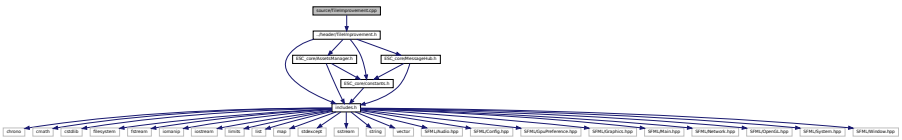
A base class for the tile improvement hierarchy.

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.

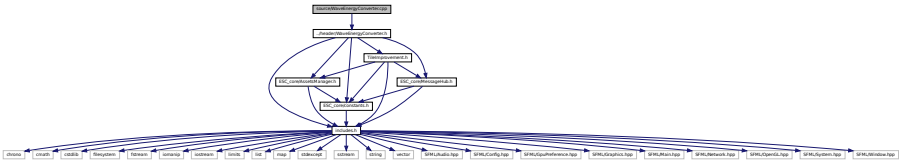
A base class for the tile improvement hierarchy.

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.

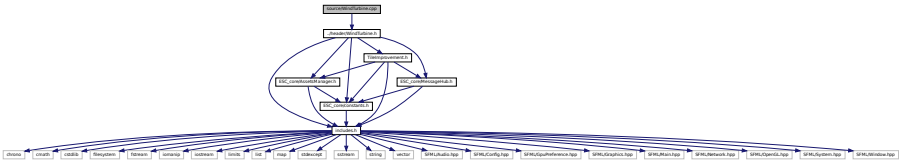
A base class for the tile improvement hierarchy.

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

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