PGMcpp: PRIMED Grid Modelling (in C++)

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Chapter 1

Hierarchical Index

1.1 Class Hierarchy

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

Controller 9
ElectricalLoad 12
Model 15
Production 17
Combustion 7
Diesel 10
Renewable 19
Solar 21
Tidal 25
Wave 27
Wind 29
Resources 20
Storage 23
LiIon 13

Chapter 2

Class Index

2.1 Class List

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

Combustion
: The root of the Combustion branch of the Production hierarchy. This branch contains derived classes which model the production of energy by way of combustibles 7

Controller
: A class which contains a various dispatch control logic. Intended to serve as a component class of Model 9

Diesel
: A derived class of the Combustion branch of Production which models production using a diesel generator 10

ElectricalLoad
: A class which contains time and electrical load data. Intended to serve as a component class of Model 12

LiIon
: A derived class of Storage which models energy storage by way of lithium-ion batteries 13

Model
: A container class which forms the centre of PGMcpp. The Model class is intended to serve as the primary user interface with the functionality of PGMcpp, and as such it contains all other classes 15

Production
: The base class of the Production hierarchy. This hierarchy contains derived classes which model the production of energy, be it renewable or otherwise 17

Renewable
: The root of the Renewable branch of the Production hierarchy. This branch contains derived classes which model the renewable production of energy 19

Resources
: A class which contains renewable resource data. Intended to serve as a component class of Model 20

Solar
: A derived class of the Renewable branch of Production which models solar production 21

Storage
: The base class of the Storage hierarchy. This hierarchy contains derived classes which model the storage of energy 23

Tidal
: A derived class of the Renewable branch of Production which models tidal production 25

Wave
: A derived class of the Renewable branch of Production which models wave production 27

Wind
: A derived class of the Renewable branch of Production which models wind production 29

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File Index

3.1 File List

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Chapter 4

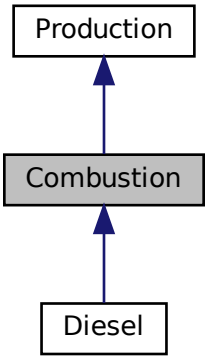
Class Documentation

4.1 Combustion Class Reference

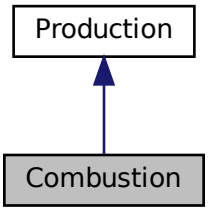
The root of the Combustion branch of the Production hierarchy. This branch contains derived classes which model the production of energy by way of combustibles.

`#include <Combustion.h>`

Inheritance diagram for Combustion:



Collaboration diagram for Combustion:



Public Member Functions

- Combustion (void)

  Constructor for the Combustion class.
- virtual ~Combustion (void)

  Destructor for the Combustion class.

4.1.1 Detailed Description

The root of the Combustion branch of the Production hierarchy. This branch contains derived classes which model the production of energy by way of combustibles.

4.1.2 Constructor & Destructor Documentation

4.1.2.1 Combustion()

```
Combustion::Combustion (
            void  )
```

Constructor for the Combustion class.

```
36                              :
37 Production()
38 {
39     //...
40
41     return;
42 }   /* Combustion() */
```

4.1.2.2 ~Combustion()

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

Destructor for the Combustion class.

```
65 {
66     //...
67
68     return;
69 }   /* ~Combustion() */
```

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

- header/Production/Combustion/Combustion.h
- source/Production/Combustion/Combustion.cpp

4.2 Controller Class Reference

A class which contains a various dispatch control logic. Intended to serve as a component class of Model.

```
#include <Controller.h>
```

Public Member Functions

- Controller (void)

  Constructor for the Controller class.
- ~Controller (void)

  Destructor for the Controller class.

4.2.1 Detailed Description

A class which contains a various dispatch control logic. Intended to serve as a component class of Model.

4.2.2 Constructor & Destructor Documentation

4.2.2.1 Controller()

```
Controller::Controller (
            void  )
```

Constructor for the Controller class.

```
36 {
37     //...
38
39     return;
40 }   /* Controller() */
```

4.2.2.2 ~Controller()

```
Controller::~Controller (
            void  )
```

Destructor for the Controller class.

```
63 {
64     //...
65
66     return;
67 }   /* ~Controller() */
```

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

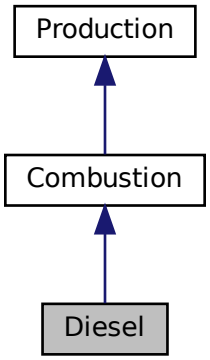
- header/Controller.h
- source/Controller.cpp

4.3 Diesel Class Reference

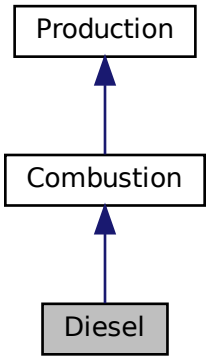
A derived class of the Combustion branch of Production which models production using a diesel generator.

```
#include <Diesel.h>
```

Inheritance diagram for Diesel:



Collaboration diagram for Diesel:



Public Member Functions

- Diesel (void)

  Constructor for the Diesel class.
- ~Diesel (void)

  Destructor for the Diesel class.

4.3.1 Detailed Description

A derived class of the Combustion branch of Production which models production using a diesel generator.

4.3.2 Constructor & Destructor Documentation

4.3.2.1 Diesel()

```
Diesel::Diesel (
            void  )
```

Constructor for the Diesel class.

```
35                      :
36 Combustion()
37 {
38     //...
39
40     return;
41 }   /* Diesel() */
```

4.3.2.2 ~Diesel()

```
Diesel::~Diesel (
            void  )
```

Destructor for the Diesel class.

```
64 {
65     //...
66
67     return;
68 }   /* ~Diesel() */
```

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

- header/Production/Combustion/Diesel.h
- source/Production/Combustion/Diesel.cpp

4.4 ElectricalLoad Class Reference

A class which contains time and electrical load data. Intended to serve as a component class of Model.

```
#include <ElectricalLoad.h>
```

Public Member Functions

- ElectricalLoad (void)

  Constructor for the ElectricalLoad class.
- ~ElectricalLoad (void)

  Destructor for the ElectricalLoad class.

4.4.1 Detailed Description

A class which contains time and electrical load data. Intended to serve as a component class of Model.

4.4.2 Constructor & Destructor Documentation

4.4.2.1 ElectricalLoad()

```
ElectricalLoad::ElectricalLoad (
            void  )
```

Constructor for the ElectricalLoad class.

```
36 {
37     //...
38
39     return;
40 }   /* ElectricalLoad() */
```

4.4.2.2 ~ElectricalLoad()

```
ElectricalLoad::~ElectricalLoad (
            void  )
```

Destructor for the ElectricalLoad class.

```
63 {
64     //...
65
66     return;
67 }   /* ~ElectricalLoad() */
```

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

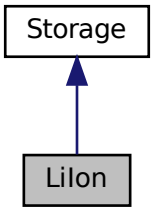
- header/ElectricalLoad.h
- source/ElectricalLoad.cpp

4.5 LiIon Class Reference

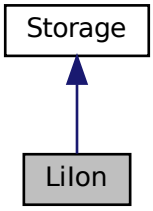
A derived class of Storage which models energy storage by way of lithium-ion batteries.

`#include <LiIon.h>`

Inheritance diagram for LiIon:



Collaboration diagram for LiIon:



Public Member Functions

- LiIon (void)

  Constructor for the LiIon class.
- ~LiIon (void)

  Destructor for the LiIon class.

4.5.1 Detailed Description

A derived class of Storage which models energy storage by way of lithium-ion batteries.

4.5.2 Constructor & Destructor Documentation

4.5.2.1 LiIon()

```
LiIon::LiIon (
            void  )
```

Constructor for the LiIon class.

```
35                  :
36 Storage()
37 {
38     //...
39
40     return;
41 }   /* LiIon() */
```

4.5.2.2 ~LiIon()

```
LiIon::~LiIon (
            void  )
```

Destructor for the LiIon class.

```
64 {
65     //...
66
67     return;
68 }   /* ~LiIon() */
```

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

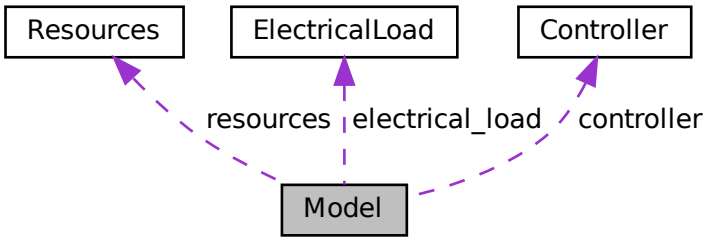
- header/Storage/LiIon.h
- source/Storage/LiIon.cpp

4.6 Model Class Reference

A container class which forms the centre of PGMcpp. The Model class is intended to serve as the primary user interface with the functionality of PGMcpp, and as such it contains all other classes.

`#include <Model.h>`

Collaboration diagram for Model:



Public Member Functions

- Model (void)

  Constructor for the Model class.
- ∼Model (void)

  Destructor for the Model class.

Public Attributes

- Controller controller

  Controller component of Model.
- ElectricalLoad electrical_load

  ElectricalLoad component of Model.
- Resources resources

  Resources component of Model.
- std::vector< Combustion * > combustion_ptr_vec

  A vector of pointers to the various Combustion assets in the Model.
- std::vector< Renewable * > renewable_ptr_vec

  A vector of pointers to the various Renewable assets in the Model.
- std::vector< Storage * > storage_ptr_vec

  A vector of pointers to the various Storage assets in the Model.

4.6.1 Detailed Description

A container class which forms the centre of PGMcpp. The Model class is intended to serve as the primary user interface with the functionality of PGMcpp, and as such it contains all other classes.

4.6.2 Constructor & Destructor Documentation

4.6.2.1 Model()

```
Model::Model (
            void  )
```

Constructor for the Model class.

```
37 {
38     //...
39
40     return;
41 }   /* Model() */
```

4.6.2.2 ~Model()

```
Model::~Model (
            void  )
```

Destructor for the Model class.

```
64 {
65     //...
66
67     return;
68 }   /* ~Model() */
```

4.6.3 Member Data Documentation

4.6.3.1 combustion_ptr_vec

```
std::vector<Combustion*> Model::combustion_ptr_vec
```

A vector of pointers to the various Combustion assets in the Model.

4.6.3.2 controller

```
Controller Model::controller
```

Controller component of Model.

4.6.3.3 electrical_load

`ElectricalLoad Model::electrical_load`

ElectricalLoad component of Model.

4.6.3.4 renewable_ptr_vec

`std::vector<Renewable*> Model::renewable_ptr_vec`

A vector of pointers to the various Renewable assets in the Model.

4.6.3.5 resources

`Resources Model::resources`

Resources component of Model.

4.6.3.6 storage_ptr_vec

`std::vector<Storage*> Model::storage_ptr_vec`

A vector of pointers to the various Storage assets in the Model.

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

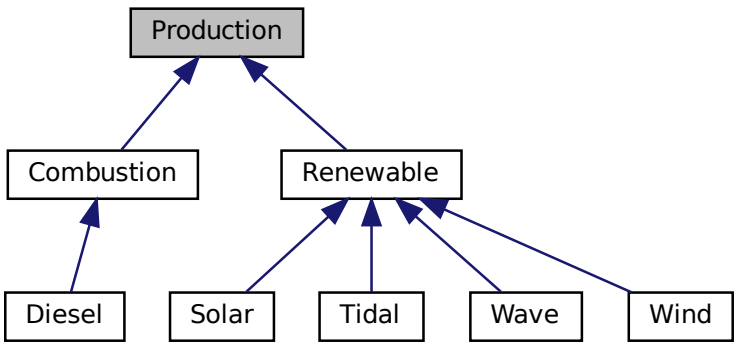
- header/Model.h
- source/Model.cpp

4.7 Production Class Reference

The base class of the Production hierarchy. This hierarchy contains derived classes which model the production of energy, be it renewable or otherwise.

`#include <Production.h>`

Inheritance diagram for Production:



Public Member Functions

- Production (void)

  Constructor for the Production class.
- virtual ~Production (void)

  Destructor for the Production class.

4.7.1 Detailed Description

The base class of the Production hierarchy. This hierarchy contains derived classes which model the production of energy, be it renewable or otherwise.

4.7.2 Constructor & Destructor Documentation

4.7.2.1 Production()

```
Production::Production (
              void  )
```

Constructor for the Production class.

```
36 {
37     //...
38
39     return;
40 }   /* Production() */
```

4.7.2.2 ~Production()

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

Destructor for the Production class.

```
63 {
64     //...
65
66     return;
67 }   /* ~Production() */
```

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

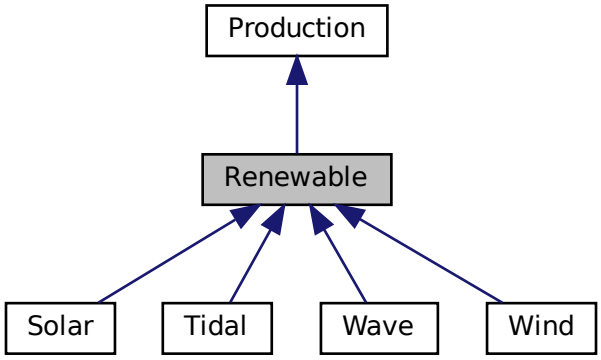
- header/Production/Production.h
- source/Production/Production.cpp

4.8 Renewable Class Reference

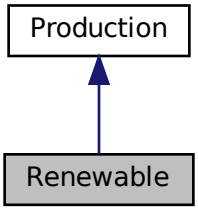
The root of the Renewable branch of the Production hierarchy. This branch contains derived classes which model the renewable production of energy.

`#include <Renewable.h>`

Inheritance diagram for Renewable:



Collaboration diagram for Renewable:



Public Member Functions

- Renewable (void)

  Constructor for the Renewable class.
- virtual ~Renewable (void)

  Destructor for the Renewable class.

4.8.1 Detailed Description

The root of the Renewable branch of the Production hierarchy. This branch contains derived classes which model the renewable production of energy.

4.8.2 Constructor & Destructor Documentation

4.8.2.1 Renewable()

```
Renewable::Renewable (
            void  )
```

Constructor for the Renewable class.

```
35                              :
36 Production()
37 {
38     //...
39
40     return;
41 }   /* Renewable() */
```

4.8.2.2 ~Renewable()

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

Destructor for the Renewable class.

```
64 {
65     //...
66
67     return;
68 }   /* ~Renewable() */
```

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

- header/Production/Renewable/Renewable.h
- source/Production/Renewable/Renewable.cpp

4.9 Resources Class Reference

A class which contains renewable resource data. Intended to serve as a component class of Model.

```
#include <Resources.h>
```

Public Member Functions

- Resources (void)

  Constructor for the Resources class.
- ~Resources (void)

  Destructor for the Resources class.

4.9.1 Detailed Description

A class which contains renewable resource data. Intended to serve as a component class of Model.

4.9.2 Constructor & Destructor Documentation

4.9.2.1 Resources()

```
Resources::Resources (
            void  )
```

Constructor for the Resources class.

```
36 {
37     //...
38
39     return;
40 }   /* Resources() */
```

4.9.2.2 ~Resources()

```
Resources::~Resources (
            void  )
```

Destructor for the Resources class.

```
63 {
64     //...
65
66     return;
67 }   /* ~Resources() */
```

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

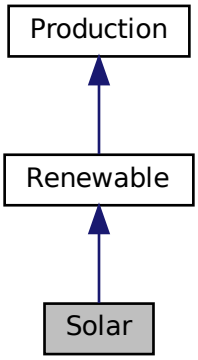
- header/Resources.h
- source/Resources.cpp

4.10 Solar Class Reference

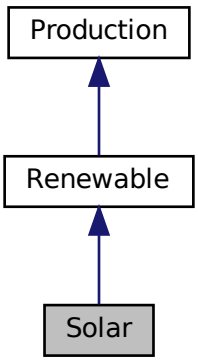
A derived class of the Renewable branch of Production which models solar production.

```
#include <Solar.h>
```

Inheritance diagram for Solar:



Collaboration diagram for Solar:



Public Member Functions

- Solar (void)

  Constructor for the Solar class.
- ~Solar (void)

  Destructor for the Solar class.

4.10.1 Detailed Description

A derived class of the Renewable branch of Production which models solar production.

4.10.2 Constructor & Destructor Documentation

4.10.2.1 Solar()

```
Solar::Solar (
             void  )
```

Constructor for the Solar class.

```
35                  :
36 Renewable()
37 {
38     //...
39
40     return;
41 }   /* Solar() */
```

4.10.2.2 ~Solar()

```
Solar::~Solar (
             void  )
```

Destructor for the Solar class.

```
64 {
65     //...
66
67     return;
68 }   /* ~Solar() */
```

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

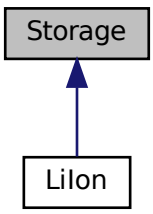
- header/Production/Renewable/Solar.h
- source/Production/Renewable/Solar.cpp

4.11 Storage Class Reference

The base class of the Storage hierarchy. This hierarchy contains derived classes which model the storage of energy.

`#include <Storage.h>`

Inheritance diagram for Storage:



Public Member Functions

- Storage (void)

  Constructor for the Storage class.
- virtual ~Storage (void)

  Destructor for the Storage class.

4.11.1 Detailed Description

The base class of the Storage hierarchy. This hierarchy contains derived classes which model the storage of energy.

4.11.2 Constructor & Destructor Documentation

4.11.2.1 Storage()

```
Storage::Storage (
            void  )
```

Constructor for the Storage class.

```
36 {
37     //...
38
39     return;
40 }   /* Storage() */
```

4.11.2.2 ~Storage()

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

Destructor for the Storage class.

```
63 {
64     //...
65
66     return;
67 }   /* ~Storage() */
```

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

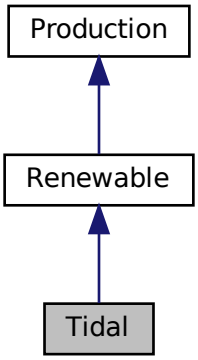
- header/Storage/Storage.h
- source/Storage/Storage.cpp

4.12 Tidal Class Reference

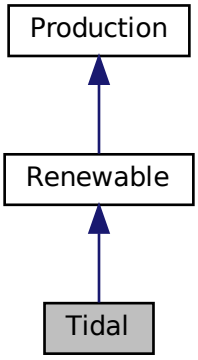
A derived class of the Renewable branch of Production which models tidal production.

`#include <Tidal.h>`

Inheritance diagram for Tidal:



Collaboration diagram for Tidal:



Public Member Functions

- Tidal (void)

  Constructor for the Tidal class.
- ~Tidal (void)

  Destructor for the Tidal class.

4.12.1 Detailed Description

A derived class of the Renewable branch of Production which models tidal production.

4.12.2 Constructor & Destructor Documentation

4.12.2.1 Tidal()

```
Tidal::Tidal (
            void  )
```

Constructor for the Tidal class.

```
35                  :
36 Renewable()
37 {
38     //...
39
40     return;
41 }   /* Tidal() */
```

4.12.2.2 ~Tidal()

```
Tidal::~Tidal (
            void  )
```

Destructor for the Tidal class.

```
64 {
65     //...
66
67     return;
68 }   /* ~Tidal() */
```

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

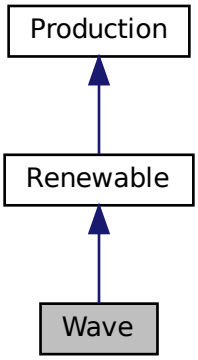
- header/Production/Renewable/Tidal.h
- source/Production/Renewable/Tidal.cpp

4.13 Wave Class Reference

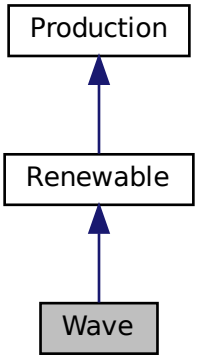
A derived class of the Renewable branch of Production which models wave production.

`#include <Wave.h>`

Inheritance diagram for Wave:



Collaboration diagram for Wave:



Public Member Functions

- Wave (void)

  Constructor for the Wave class.
- ~Wave (void)

  Destructor for the Wave class.

4.13.1 Detailed Description

A derived class of the Renewable branch of Production which models wave production.

4.13.2 Constructor & Destructor Documentation

4.13.2.1 Wave()

```
Wave::Wave (
            void  )
```

Constructor for the Wave class.

```
35                  :
36 Renewable()
37 {
38     //...
39
40     return;
41 }   /* Wave() */
```

4.13.2.2 ~Wave()

```
Wave::~Wave (
            void  )
```

Destructor for the Wave class.

```
64 {
65     //...
66
67     return;
68 }   /* ~Wave() */
```

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

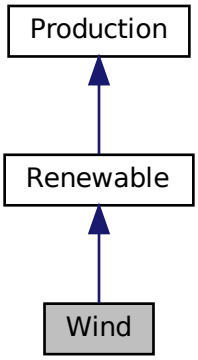
- header/Production/Renewable/Wave.h
- source/Production/Renewable/Wave.cpp

4.14 Wind Class Reference

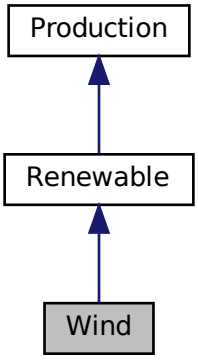
A derived class of the Renewable branch of Production which models wind production.

`#include <Wind.h>`

Inheritance diagram for Wind:



Collaboration diagram for Wind:



Public Member Functions

- Wind (void)

  Constructor for the Wind class.
- ~Wind (void)

  Destructor for the Wind class.

4.14.1 Detailed Description

A derived class of the Renewable branch of Production which models wind production.

4.14.2 Constructor & Destructor Documentation

4.14.2.1 Wind()

```
Wind::Wind (
            void  )
```

Constructor for the Wind class.

```
35                  :
36 Renewable()
37 {
38     //...
39
40     return;
41 }   /* Wind() */
```

4.14.2.2 ~Wind()

```
Wind::~Wind (
            void  )
```

Destructor for the Wind class.

```
64 {
65     //...
66
67     return;
68 }   /* ~Wind() */
```

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

- header/Production/Renewable/Wind.h
- source/Production/Renewable/Wind.cpp

Chapter 5

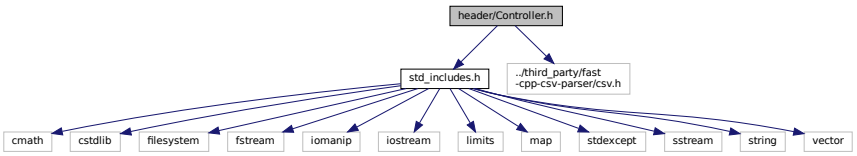
File Documentation

5.1 header/Controller.h File Reference

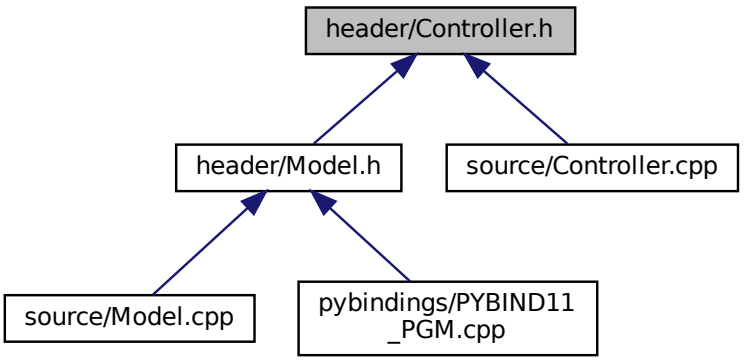
Header file the Controller class.

```
#include "std_includes.h"
#include "../third_party/fast-cpp-csv-parser/csv.h"
```

Include dependency graph for Controller.h:



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



Classes

- class Controller

  A class which contains a various dispatch control logic. Intended to serve as a component class of Model.

5.1.1 Detailed Description

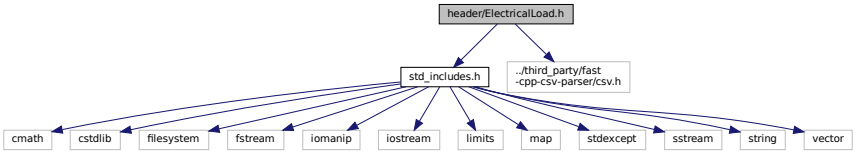
Header file the Controller class.

5.2 header/ElectricalLoad.h File Reference

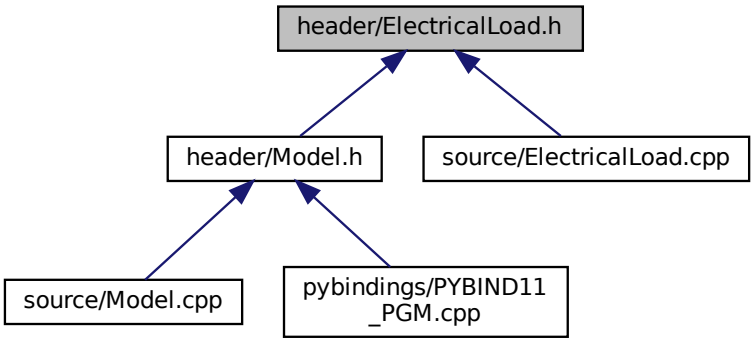
Header file the ElectricalLoad class.

```
#include "std_includes.h"
#include "../third_party/fast-cpp-csv-parser/csv.h"
```

Include dependency graph for ElectricalLoad.h:



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



Classes

- class ElectricalLoad

  A class which contains time and electrical load data. Intended to serve as a component class of Model.

5.2.1 Detailed Description

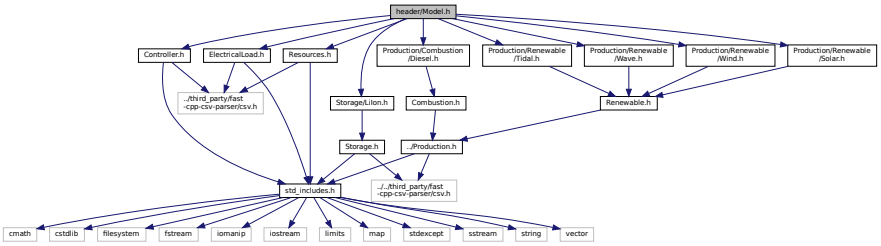
Header file the ElectricalLoad class.

5.3 header/Model.h File Reference

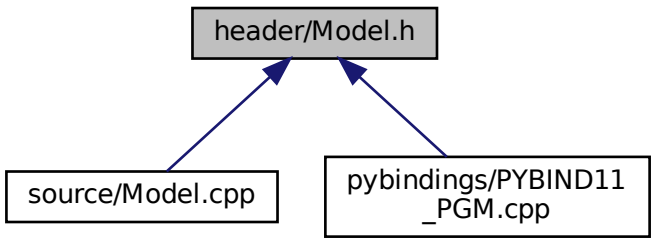
Header file the Model class.

```
#include "Controller.h"
#include "ElectricalLoad.h"
#include "Resources.h"
#include "Production/Combustion/Diesel.h"
#include "Production/Renewable/Solar.h"
#include "Production/Renewable/Tidal.h"
#include "Production/Renewable/Wave.h"
#include "Production/Renewable/Wind.h"
#include "Storage/LiIon.h"
```

Include dependency graph for Model.h:



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



Classes

- class Model

  A container class which forms the centre of PGMcpp. The Model class is intended to serve as the primary user interface with the functionality of PGMcpp, and as such it contains all other classes.

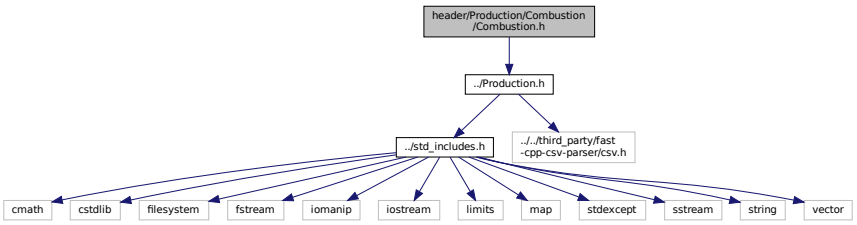
5.3.1 Detailed Description

Header file the Model class.

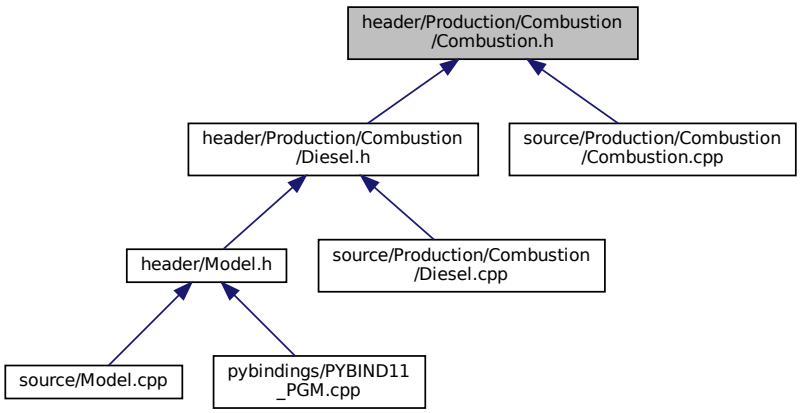
5.4 header/Production/Combustion/Combustion.h File Reference

Header file the Combustion class.

`#include "../Production.h"`
Include dependency graph for Combustion.h:



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



Classes

- class Combustion

  The root of the Combustion branch of the Production hierarchy. This branch contains derived classes which model the production of energy by way of combustibles.

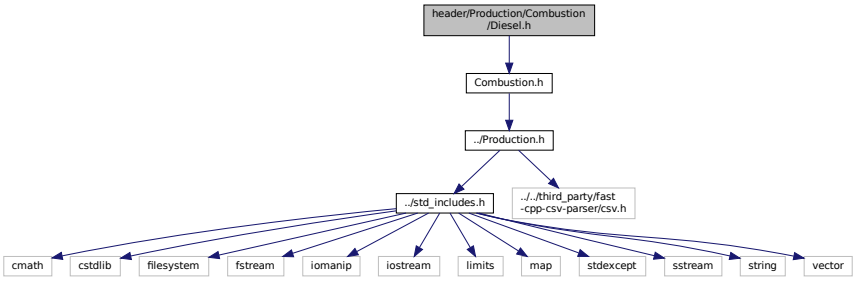
5.4.1 Detailed Description

Header file the Combustion class.

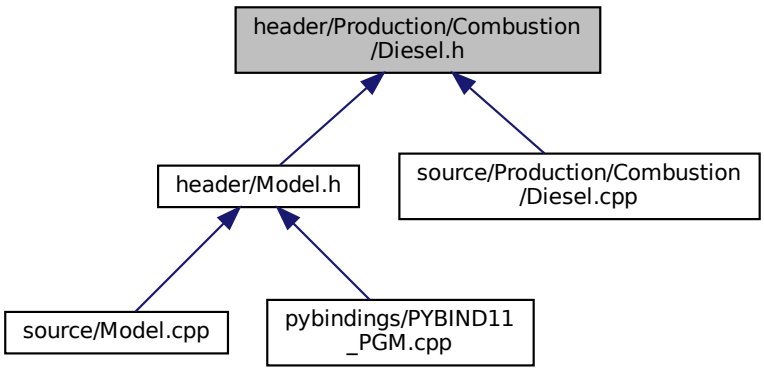
5.5 header/Production/Combustion/Diesel.h File Reference

Header file the Diesel class.

`#include "Combustion.h"`
Include dependency graph for Diesel.h:



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



Classes

- class Diesel

  A derived class of the Combustion branch of Production which models production using a diesel generator.

5.5.1 Detailed Description

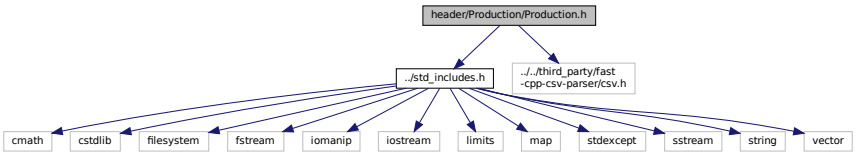
Header file the Diesel class.

5.6 header/Production/Production.h File Reference

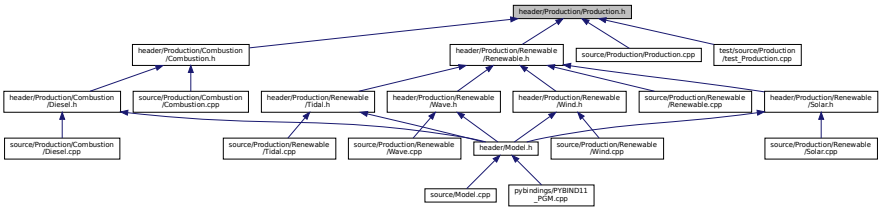
Header file the Production class.

```
#include "../std_includes.h"
#include "../../third_party/fast-cpp-csv-parser/csv.h"
```

Include dependency graph for Production.h:



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



Classes

- class Production

  The base class of the Production hierarchy. This hierarchy contains derived classes which model the production of energy, be it renewable or otherwise.

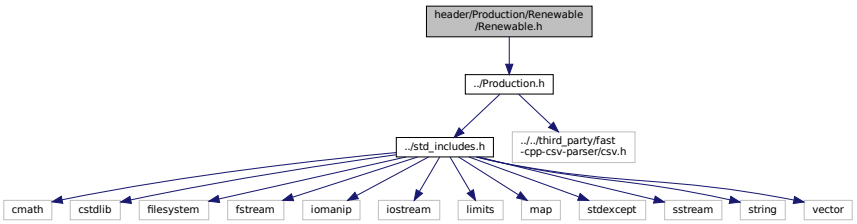
5.6.1 Detailed Description

Header file the Production class.

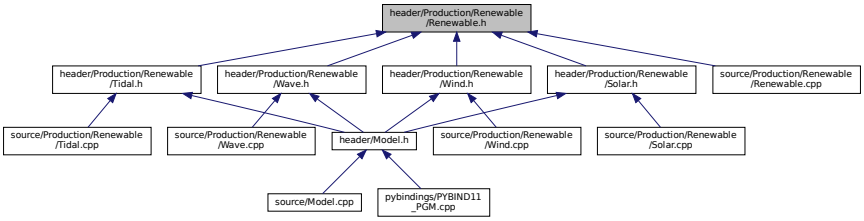
5.7 header/Production/Renewable/Renewable.h File Reference

Header file the Renewable class.

`#include "../Production.h"`
Include dependency graph for Renewable.h:



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



Classes

- class Renewable

  The root of the Renewable branch of the Production hierarchy. This branch contains derived classes which model the renewable production of energy.

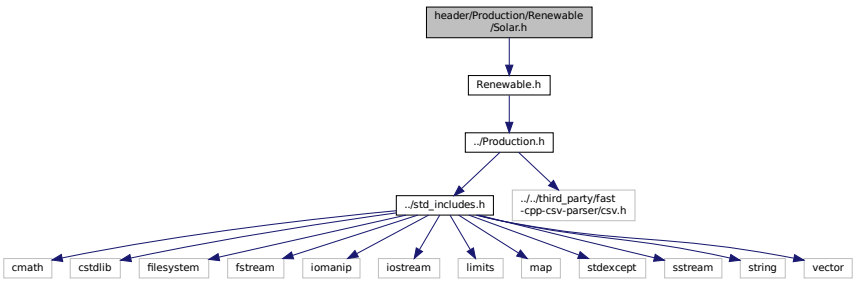
5.7.1 Detailed Description

Header file the Renewable class.

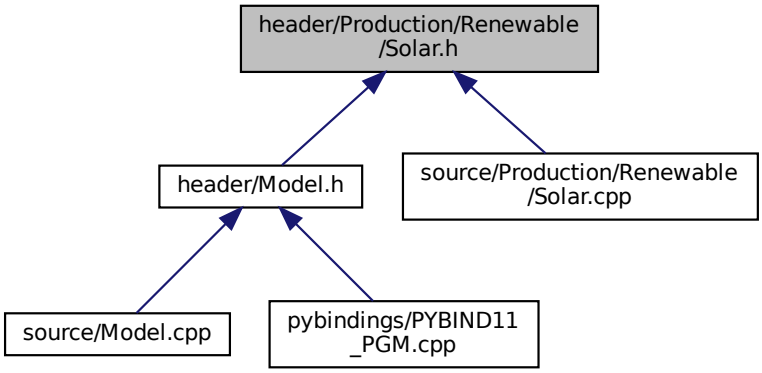
5.8 header/Production/Renewable/Solar.h File Reference

Header file the Solar class.

`#include "Renewable.h"`
Include dependency graph for Solar.h:



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



Classes

- class Solar

  A derived class of the Renewable branch of Production which models solar production.

5.8.1 Detailed Description

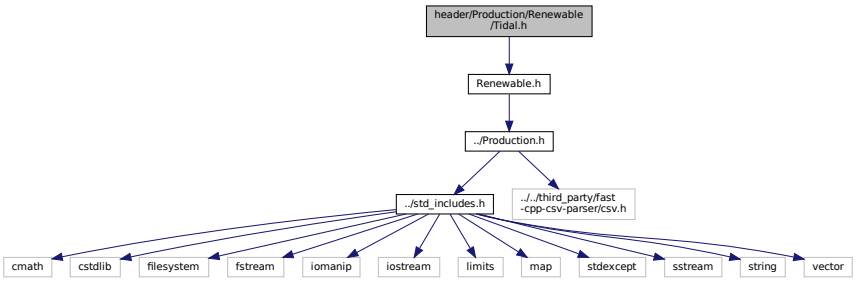
Header file the Solar class.

5.9 header/Production/Renewable/Tidal.h File Reference

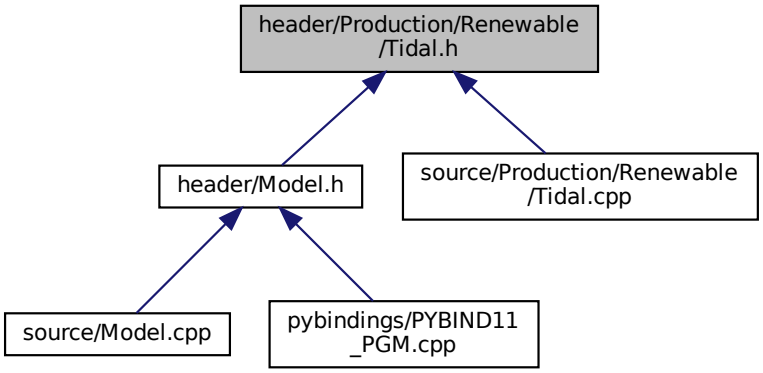
Header file the Tidal class.

```
#include "Renewable.h"
```

Include dependency graph for Tidal.h:



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



Classes

- class Tidal

  A derived class of the Renewable branch of Production which models tidal production.

5.9.1 Detailed Description

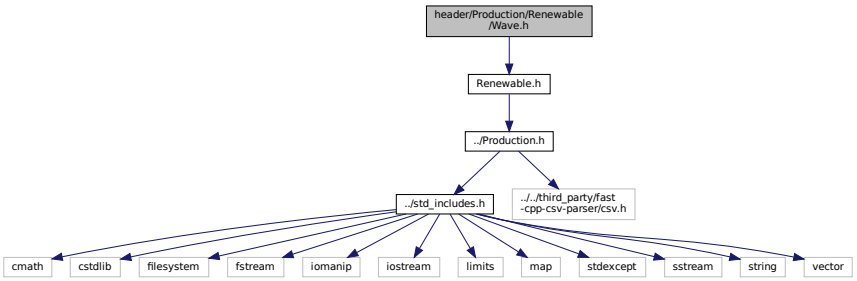
Header file the Tidal class.

5.10 header/Production/Renewable/Wave.h File Reference

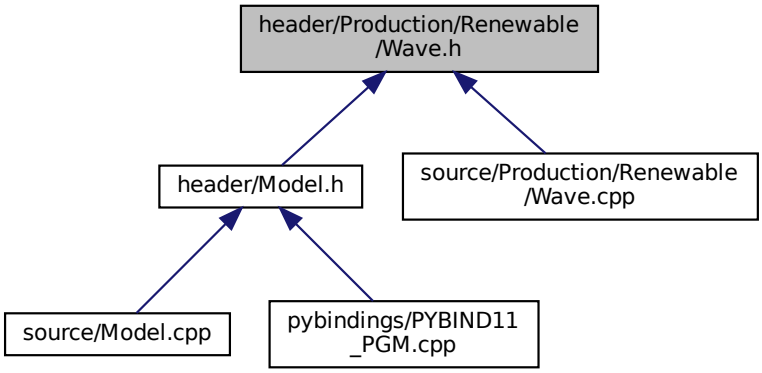
Header file the Wave class.

```
#include "Renewable.h"
```

Include dependency graph for Wave.h:



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



Classes

- class Wave

  A derived class of the Renewable branch of Production which models wave production.

5.10.1 Detailed Description

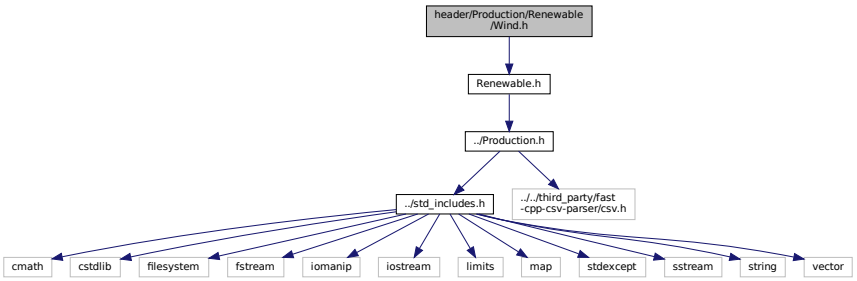
Header file the Wave class.

5.11 header/Production/Renewable/Wind.h File Reference

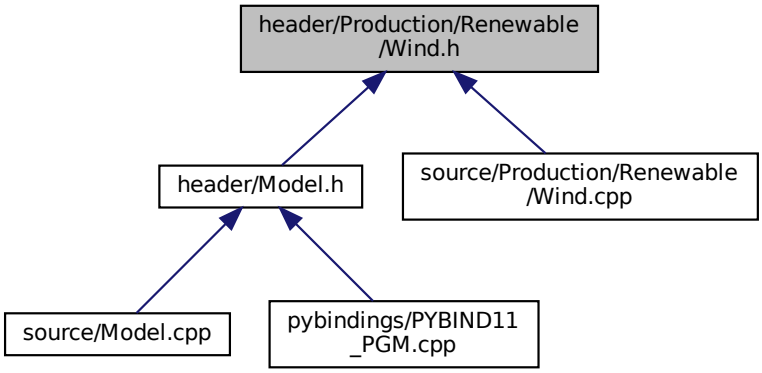
Header file the Wind class.

```
#include "Renewable.h"
```

Include dependency graph for Wind.h:



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



Classes

- class Wind

  A derived class of the Renewable branch of Production which models wind production.

5.11.1 Detailed Description

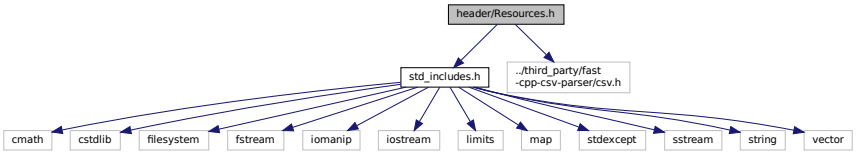
Header file the Wind class.

5.12 header/Resources.h File Reference

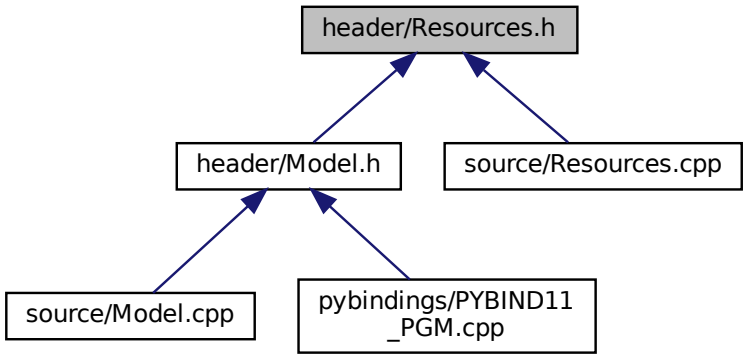
Header file the Resources class.

```
#include "std_includes.h"
#include "../third_party/fast-cpp-csv-parser/csv.h"
```

Include dependency graph for Resources.h:



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



Classes

- class Resources

  A class which contains renewable resource data. Intended to serve as a component class of Model.

5.12.1 Detailed Description

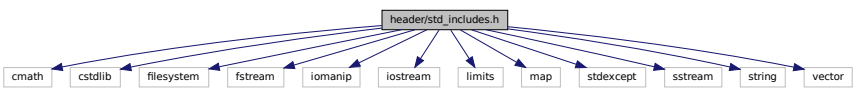
Header file the Resources class.

5.13 header/std_includes.h File Reference

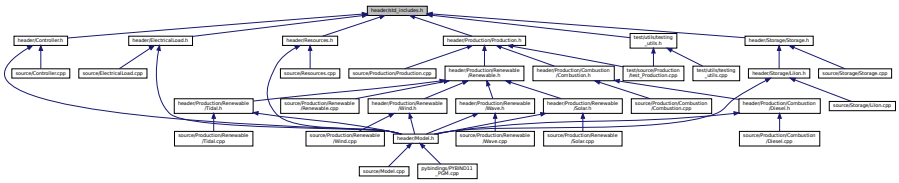
Header file which simply batches together the usual, standard includes.

```
#include <cmath>
#include <cstdlib>
#include <filesystem>
#include <fstream>
#include <iomanip>
#include <iostream>
#include <limits>
#include <map>
#include <stdexcept>
#include <sstream>
#include <string>
#include <vector>
```

Include dependency graph for std_includes.h:



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



5.13.1 Detailed Description

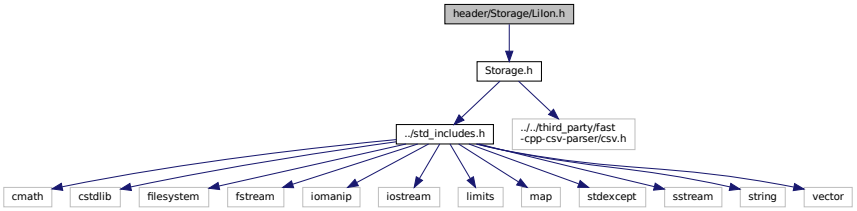
Header file which simply batches together the usual, standard includes.

5.14 header/Storage/LiIon.h File Reference

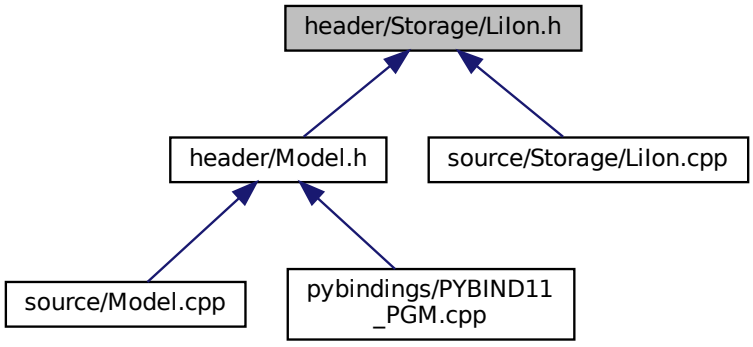
Header file the LiIon class.

```
#include "Storage.h"
```

Include dependency graph for LiIon.h:



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



Classes

- class LiIon

  A derived class of Storage which models energy storage by way of lithium-ion batteries.

5.14.1 Detailed Description

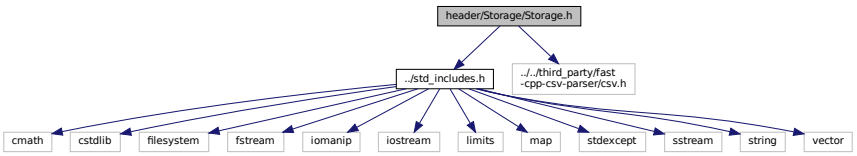
Header file the LiIon class.

5.15 header/Storage/Storage.h File Reference

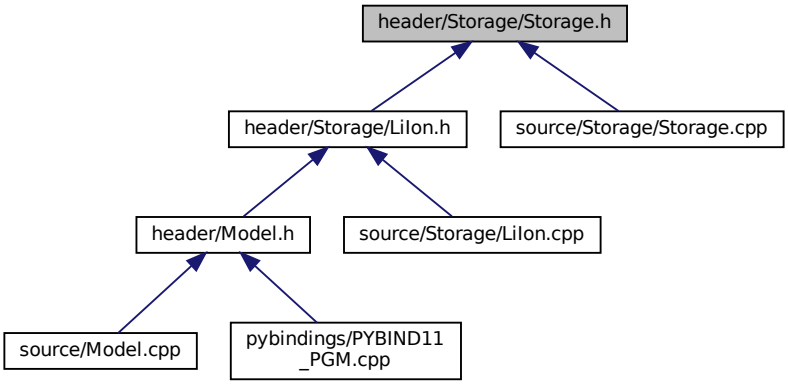
Header file the Storage class.

```
#include "../std_includes.h"
#include "../../third_party/fast-cpp-csv-parser/csv.h"
```

Include dependency graph for Storage.h:



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



Classes

- class Storage

  The base class of the Storage hierarchy. This hierarchy contains derived classes which model the storage of energy.

5.15.1 Detailed Description

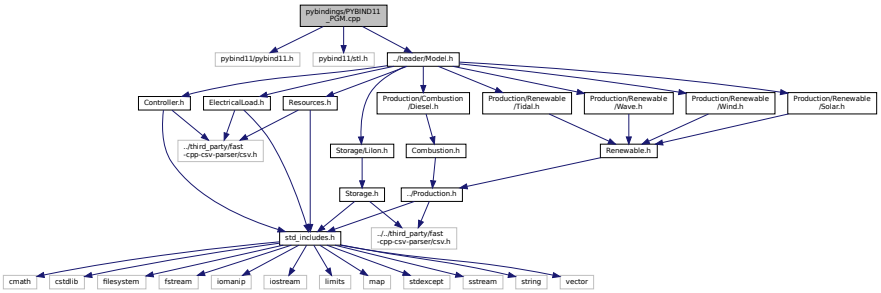
Header file the Storage class.

5.16 pybindings/PYBIND11_PGM.cpp File Reference

Python 3 bindings file for PGMcpp.

```
#include <pybind11/pybind11.h>
#include <pybind11/stl.h>
#include "../header/Model.h"
```

Include dependency graph for PYBIND11_PGM.cpp:



Functions

- PYBIND11_MODULE (PGMcpp, m)

5.16.1 Detailed Description

Python 3 bindings file for PGMcpp.

This is a file which defines the Python 3 bindings to be generated for PGMcpp. To generate bindings, use the provided setup.py.

ref: https://pybind11.readthedocs.io/en/stable/

5.16.2 Function Documentation

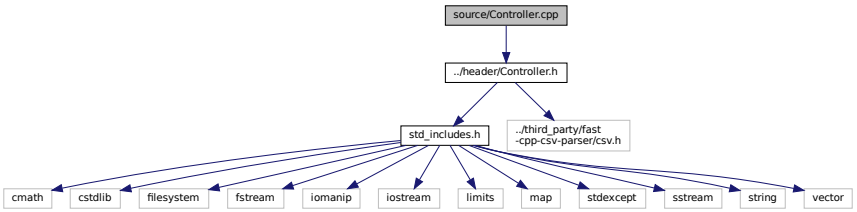
5.16.2.1 PYBIND11_MODULE()

```
PYBIND11_MODULE (
             PGMcpp ,
             m  )
30                           {
31
32 // ================ Controller ================ //
33 /*
34 pybind11::class_<Controller>(m, "Controller")
35     .def(pybind11::init());
36 */
37 // ================ END Controller ================ //
38
39
40
41 // ================ ElectricalLoad ================ //
42 /*
43 pybind11::class_<ElectricalLoad>(m, "ElectricalLoad")
44     .def_readwrite("n_points", &ElectricalLoad::n_points)
45     .def_readwrite("max_load_kW", &ElectricalLoad::max_load_kW)
46     .def_readwrite("mean_load_kW", &ElectricalLoad::mean_load_kW)
47     .def_readwrite("min_load_kW", &ElectricalLoad::min_load_kW)
48     .def_readwrite("dt_vec_hrs", &ElectricalLoad::dt_vec_hrs)
49     .def_readwrite("load_vec_kW", &ElectricalLoad::load_vec_kW)
50     .def_readwrite("time_vec_hrs", &ElectricalLoad::time_vec_hrs)
51
52     .def(pybind11::init<std::string>());
53 */
54 // ================ END ElectricalLoad ================ //
55
56
57
58 // ================ Model ================ //
59 /*
60 pybind11::class_<Model>(m, "Model")
61     .def(
62         pybind11::init<
63             ElectricalLoad*,
64             RenewableResources*
65         >()
66     );
67 */
68 // ================ END Model ================ //
69
70
71
72 // ================ RenewableResources ================ //
73 /*
74 pybind11::class_<RenewableResources>(m, "RenewableResources")
75     .def(pybind11::init());
76     /*
77     .def(pybind11::init<>());
78     */
79 */
80 // ================ END RenewableResources ================ //
81
82 }   /* PYBIND11_MODULE() */
```

5.17 source/Controller.cpp File Reference

Implementation file for the Controller class.

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



5.17.1 Detailed Description

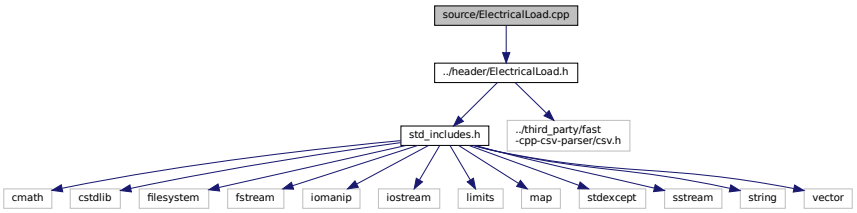
Implementation file for the Controller class.

A class which contains a various dispatch control logic. Intended to serve as a component class of Controller.

5.18 source/ElectricalLoad.cpp File Reference

Implementation file for the ElectricalLoad class.

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



5.18.1 Detailed Description

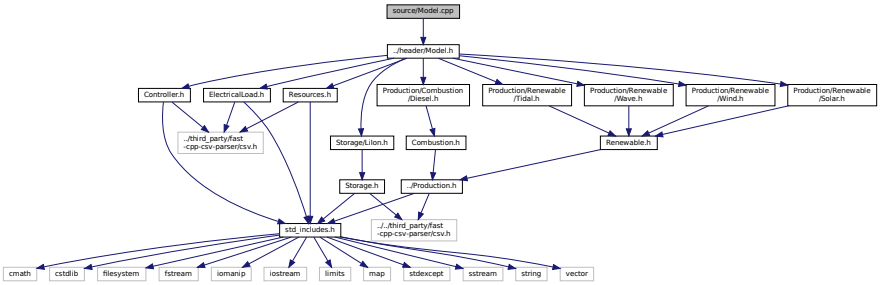
Implementation file for the ElectricalLoad class.

A class which contains time and electrical load data. Intended to serve as a component class of Model.

5.19 source/Model.cpp File Reference

Implementation file for the Model class.

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



5.19.1 Detailed Description

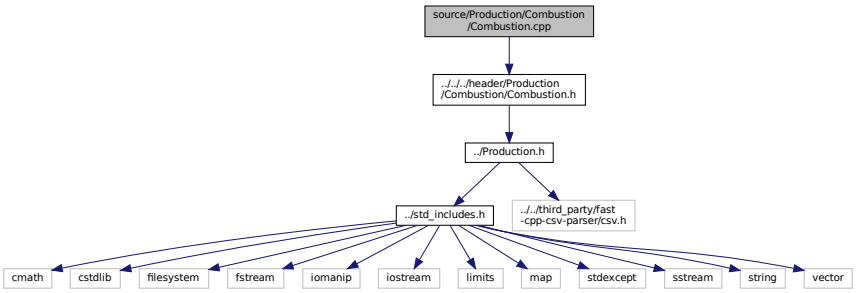
Implementation file for the Model class.

A container class which forms the centre of PGMcpp. The Model class is intended to serve as the primary user interface with the functionality of PGMcpp, and as such it contains all other classes.

5.20 source/Production/Combustion/Combustion.cpp File Reference

Implementation file for the Combustion class.

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



5.20.1 Detailed Description

Implementation file for the Combustion class.

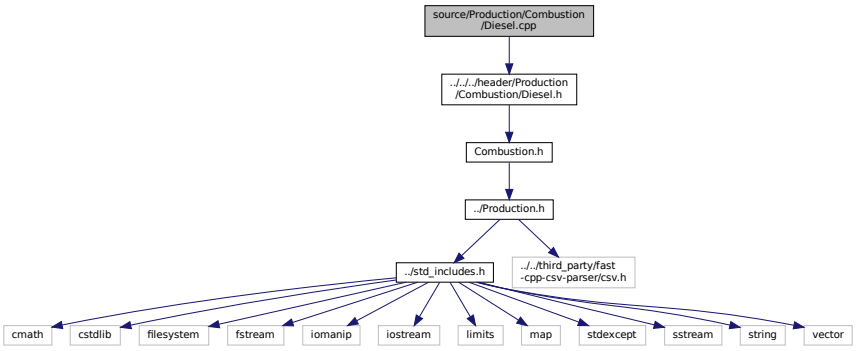
The root of the Combustion branch of the Production hierarchy. This branch contains derived classes which model the production of energy by way of combustibles.

5.21 source/Production/Combustion/Diesel.cpp File Reference

Implementation file for the Diesel class.

```
#include "../../../header/Production/Combustion/Diesel.h"
```

Include dependency graph for Diesel.cpp:



5.21.1 Detailed Description

Implementation file for the Diesel class.

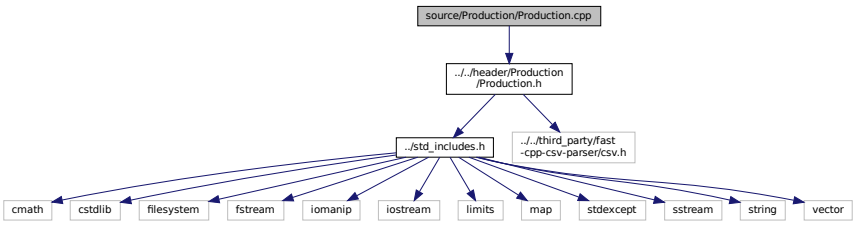
A derived class of the Combustion branch of Production which models production using a diesel generator.

5.22 source/Production/Production.cpp File Reference

Implementation file for the Production class.

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

Include dependency graph for Production.cpp:



5.22.1 Detailed Description

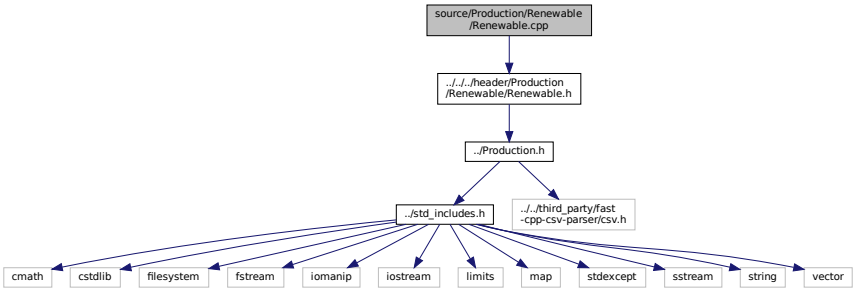
Implementation file for the Production class.

The base class of the Production hierarchy. This hierarchy contains derived classes which model the production of energy, be it renewable or otherwise.

5.23 source/Production/Renewable/Renewable.cpp File Reference

Implementation file for the Renewable class.

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



5.23.1 Detailed Description

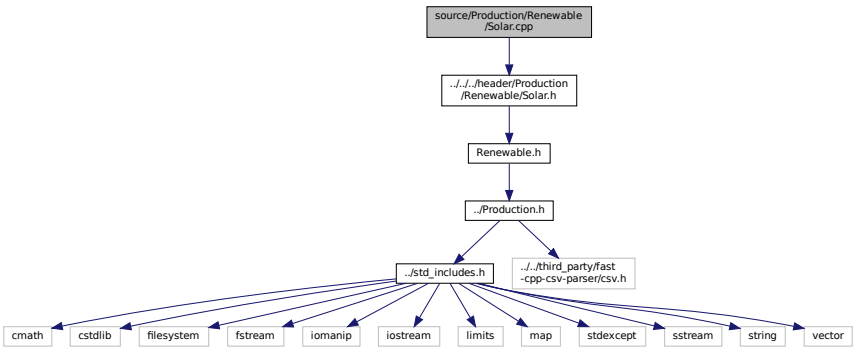
Implementation file for the Renewable class.

The root of the Renewable branch of the Production hierarchy. This branch contains derived classes which model the renewable production of energy.

5.24 source/Production/Renewable/Solar.cpp File Reference

Implementation file for the Solar class.

`#include "../../../header/Production/Renewable/Solar.h"`
Include dependency graph for Solar.cpp:



5.24.1 Detailed Description

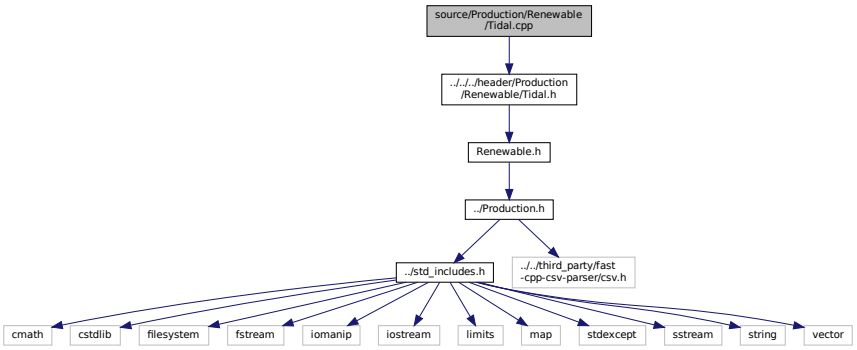
Implementation file for the Solar class.

A derived class of the Renewable branch of Production which models solar production.

5.25 source/Production/Renewable/Tidal.cpp File Reference

Implementation file for the Tidal class.

```
#include "../../../header/Production/Renewable/Tidal.h"
```
Include dependency graph for Tidal.cpp:



5.25.1 Detailed Description

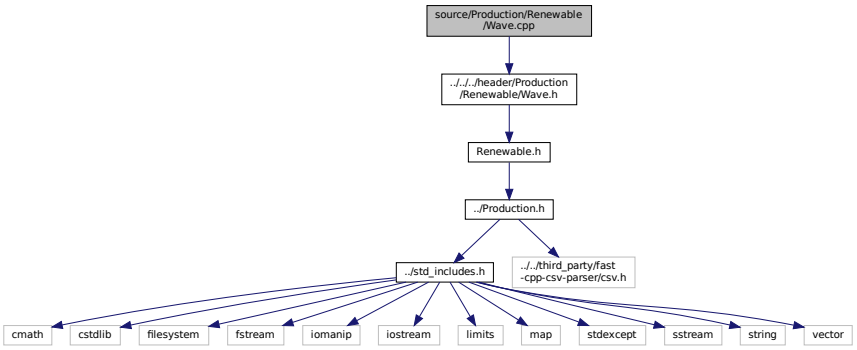
Implementation file for the Tidal class.

A derived class of the Renewable branch of Production which models tidal production.

5.26 source/Production/Renewable/Wave.cpp File Reference

Implementation file for the Wave class.

```
#include "../../../header/Production/Renewable/Wave.h"
```
Include dependency graph for Wave.cpp:



5.26.1 Detailed Description

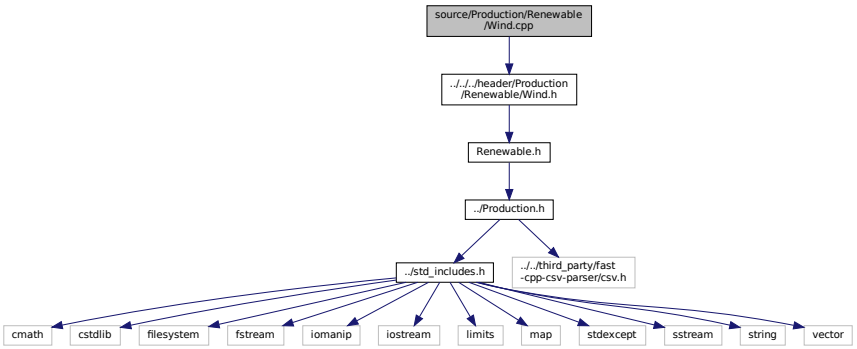
Implementation file for the Wave class.

A derived class of the Renewable branch of Production which models wave production.

5.27 source/Production/Renewable/Wind.cpp File Reference

Implementation file for the Wind class.

```
#include "../../../header/Production/Renewable/Wind.h"
```
Include dependency graph for Wind.cpp:



5.27.1 Detailed Description

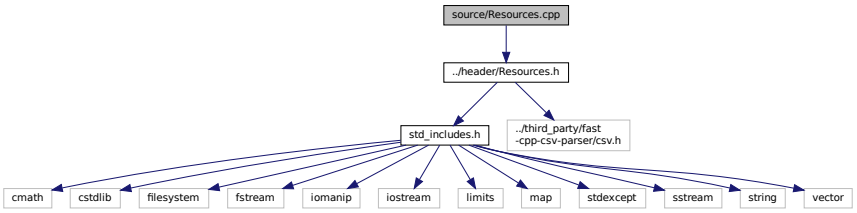
Implementation file for the Wind class.

A derived class of the Renewable branch of Production which models wind production.

5.28 source/Resources.cpp File Reference

Implementation file for the Resources class.

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



5.28.1 Detailed Description

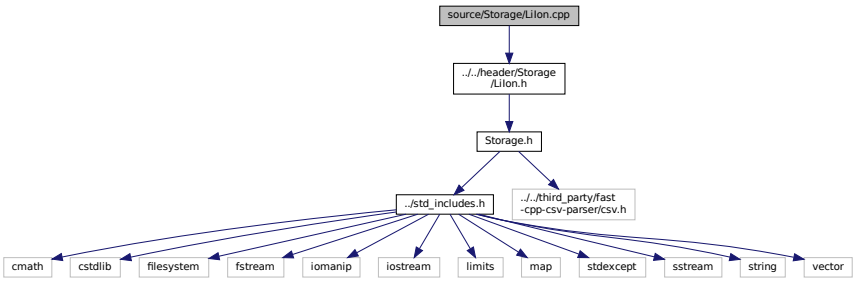
Implementation file for the Resources class.

A class which contains renewable resource data. Intended to serve as a component class of Model.

5.29 source/Storage/LiIon.cpp File Reference

Implementation file for the LiIon class.

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



5.29.1 Detailed Description

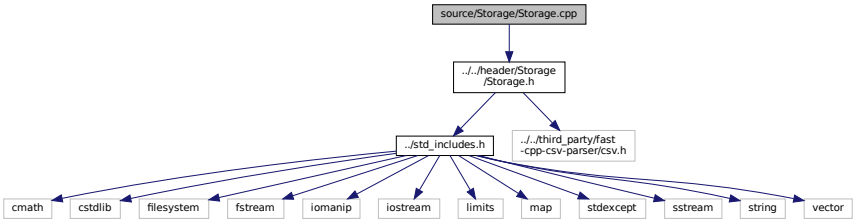
Implementation file for the LiIon class.

A derived class of Storage which models energy storage by way of lithium-ion batteries.

5.30 source/Storage/Storage.cpp File Reference

Implementation file for the Storage class.

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



5.30.1 Detailed Description

Implementation file for the Storage class.

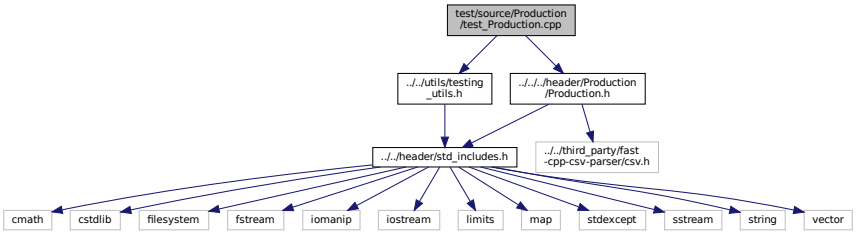
The base class of the Storage hierarchy. This hierarchy contains derived classes which model the storage of energy.

5.31 test/source/Production/test_Production.cpp File Reference

Testing suite for Production class.

```
#include "../../utils/testing_utils.h"
#include "../../../header/Production/Production.h"
```

Include dependency graph for test_Production.cpp:



Functions

- int main (int argc, char **argv)

5.31.1 Detailed Description

Testing suite for Production class.

A suite of tests for the Production class.

5.31.2 Function Documentation

5.31.2.1 main()

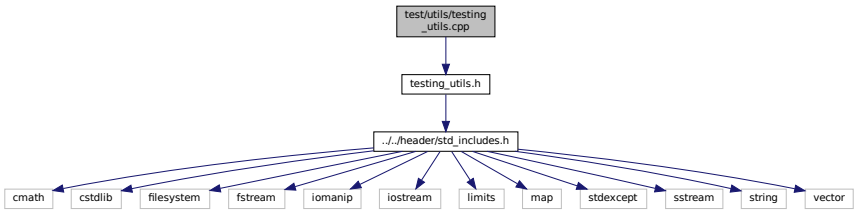
```
int main (
              int argc,
              char ** argv )
27 {
28     #ifdef _WIN32
29         activateVirtualTerminal();
30     #endif  /* _WIN32 */
31
32     printGold("\tTesting Production class ... ");
33
34     srand(time(NULL));
35
36
37     try {
38         //...
39     }
40
41     catch (...) {
42         //...
43
44         printRed("\tFAIL");
45         std::cout « std::endl;
46         throw;
47     }
48
49
50     printGreen("\tPASS");
51     std::cout « std::endl
52     return 0;
53 }   /* main() */
```

5.32 test/utils/testing_utils.cpp File Reference

Header file for various PGMcpp testing utilities.

```
#include "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.

5.32.1 Detailed Description

Header file for various PGMcpp testing utilities.

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

5.32.2 Function Documentation

5.32.2.1 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__").

```
432 {
433     std::string error_str = "\n ERROR  failed to throw expected error prior to line ";
434     error_str += std::to_string(line);
435     error_str += " of ";
436     error_str += file;
437 
438     #ifdef _WIN32
439         std::cout « error_str « std::endl;
440     #endif
441 
442     throw std::runtime_error(error_str);
443     return;
444 }   /* expectedErrorNotDetected() */
```

5.32.2.2 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.

```
84 {
85     std::cout « "\x1B[33m" « input_str « "\033[0m";
86     return;
87 }   /* printGold() */
```

5.32.2.3 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.

```
64 {
65     std::cout « "\x1B[32m" « input_str « "\033[0m";
66     return;
67 }   /* printGreen() */
```

5.32.2.4 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.

```
104 {
105     std::cout « "\x1B[31m" « input_str « "\033[0m";
106     return;
107 }   /* printRed() */
```

5.32.2.5 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__").

```
138 {
139     if (fabs(x - y) <= FLOAT_TOLERANCE) {
140         return;
141     }
142
143     std::string error_str = "ERROR: testFloatEquals():\t in ";
144     error_str += file;
145     error_str += "\tline ";
146     error_str += std::to_string(line);
147     error_str += ":\t\n";
148     error_str += std::to_string(x);
149     error_str += " and ";
150     error_str += std::to_string(y);
151     error_str += " are not equal to within +/- ";
152     error_str += std::to_string(FLOAT_TOLERANCE);
153     error_str += "\n";
154
155     #ifdef _WIN32
156         std::cout « error_str « std::endl;
157     #endif
158
159     throw std::runtime_error(error_str);
160     return;
161 }   /* testFloatEquals() */
```

5.32.2.6 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__").

```
191 {
192     if (x > y) {
193         return;
194     }
195
196     std::string error_str = "ERROR: testGreaterThan():\t in ";
197     error_str += file;
198     error_str += "\tline ";
```

```
199     error_str += std::to_string(line);
200     error_str += ":\t\n";
201     error_str += std::to_string(x);
202     error_str += " is not greater than ";
203     error_str += std::to_string(y);
204     error_str += "\n";
205 
206     #ifdef _WIN32
207         std::cout « error_str « std::endl;
208     #endif
209 
210     throw std::runtime_error(error_str);
211     return;
212 }   /* testGreaterThan() */
```

5.32.2.7 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__").

```
242 {
243     if (x >= y) {
244         return;
245     }
246 
247     std::string error_str = "ERROR: testGreaterThanOrEqualTo():\t in ";
248     error_str += file;
249     error_str += "\tline ";
250     error_str += std::to_string(line);
251     error_str += ":\t\n";
252     error_str += std::to_string(x);
253     error_str += " is not greater than or equal to ";
254     error_str += std::to_string(y);
255     error_str += "\n";
256 
257     #ifdef _WIN32
258         std::cout « error_str « std::endl;
259     #endif
260 
261     throw std::runtime_error(error_str);
262     return;
263 }   /* testGreaterThanOrEqualTo() */
```

5.32.2.8 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__").

```
293 {
294     if (x < y) {
295         return;
296     }
297
298     std::string error_str = "ERROR: testLessThan():\t in ";
299     error_str += file;
300     error_str += "\tline ";
301     error_str += std::to_string(line);
302     error_str += ":\t\n";
303     error_str += std::to_string(x);
304     error_str += " is not less than ";
305     error_str += std::to_string(y);
306     error_str += "\n";
307
308     #ifdef _WIN32
309         std::cout << error_str << std::endl;
310     #endif
311
312     throw std::runtime_error(error_str);
313     return;
314 }   /* testLessThan() */
```

5.32.2.9 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__").

```
344 {
345     if (x <= y) {
346         return;
347     }
348
349     std::string error_str = "ERROR: testLessThanOrEqualTo():\t in ";
350     error_str += file;
351     error_str += "\tline ";
352     error_str += std::to_string(line);
353     error_str += ":\t\n";
354     error_str += std::to_string(x);
355     error_str += " is not less than or equal to ";
356     error_str += std::to_string(y);
357     error_str += "\n";
358
359     #ifdef _WIN32
360         std::cout << error_str << std::endl;
361     #endif
362
363     throw std::runtime_error(error_str);
```

```
364     return;
365 }   /* testLessThanOrEqualTo() */
```

5.32.2.10 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__").

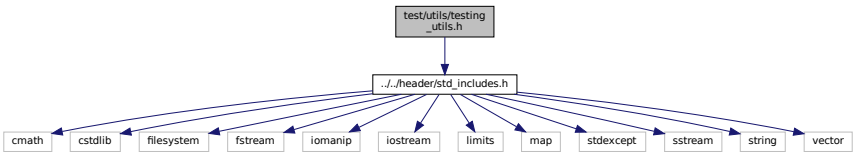
```
392 {
393     if (statement) {
394         return;
395     }
396 
397     std::string error_str = "ERROR: testTruth():\t in ";
398     error_str += file;
399     error_str += "\tline ";
400     error_str += std::to_string(line);
401     error_str += ":\t\n";
402     error_str += "Given statement is not true";
403 
404     #ifdef _WIN32
405         std::cout « error_str « std::endl;
406     #endif
407 
408     throw std::runtime_error(error_str);
409     return;
410 }   /* testTruth() */
```

5.33 test/utils/testing_utils.h File Reference

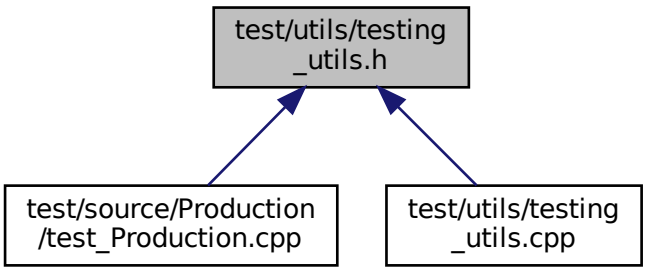
Header file for various PGMcpp testing utilities.

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

Include dependency graph for testing_utils.h:



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



Macros

- #define FLOAT_TOLERANCE 1e-6

  A tolerance for application to floating point equality tests.

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.

5.33.1 Detailed Description

Header file for various PGMcpp testing utilities.

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

5.33.2 Macro Definition Documentation

5.33.2.1 FLOAT_TOLERANCE

```
#define FLOAT_TOLERANCE 1e-6
```

A tolerance for application to floating point equality tests.

5.33.3 Function Documentation

5.33.3.1 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__").

```
432 {
433     std::string error_str = "\n ERROR  failed to throw expected error prior to line ";
434     error_str += std::to_string(line);
435     error_str += " of ";
436     error_str += file;
437 
438     #ifdef _WIN32
439         std::cout « error_str « std::endl;
440     #endif
441 
442     throw std::runtime_error(error_str);
443     return;
444 }   /* expectedErrorNotDetected() */
```

5.33.3.2 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.

```
84 {
85     std::cout « "\x1B[33m" « input_str « "\033[0m";
86     return;
87 }   /* printGold() */
```

5.33.3.3 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.

```
64 {
65     std::cout « "\x1B[32m" « input_str « "\033[0m";
66     return;
67 }   /* printGreen() */
```

5.33.3.4 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.

```
104 {
105     std::cout « "\x1B[31m" « input_str « "\033[0m";
106     return;
107 }   /* printRed() */
```

5.33.3.5 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.

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__").

```
138 {
139     if (fabs(x - y) <= FLOAT_TOLERANCE) {
140         return;
141     }
142 
143     std::string error_str = "ERROR: testFloatEquals():\t in ";
144     error_str += file;
145     error_str += "\tline ";
146     error_str += std::to_string(line);
147     error_str += ":\t\n";
148     error_str += std::to_string(x);
149     error_str += " and ";
150     error_str += std::to_string(y);
151     error_str += " are not equal to within +/- ";
152     error_str += std::to_string(FLOAT_TOLERANCE);
153     error_str += "\n";
154 
155     #ifdef _WIN32
156         std::cout << error_str << std::endl;
157     #endif
158 
159     throw std::runtime_error(error_str);
160     return;
161 }   /* testFloatEquals() */
```

5.33.3.6 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__").

```
191 {
192     if (x > y) {
193         return;
194     }
195 
196     std::string error_str = "ERROR: testGreaterThan():\t in ";
197     error_str += file;
198     error_str += "\tline ";
199     error_str += std::to_string(line);
200     error_str += ":\t\n";
201     error_str += std::to_string(x);
202     error_str += " is not greater than ";
203     error_str += std::to_string(y);
204     error_str += "\n";
205 
206     #ifdef _WIN32
207         std::cout << error_str << std::endl;
208     #endif
209 
```

```
210     throw std::runtime_error(error_str);
211     return;
212 }   /* testGreaterThan() */
```

5.33.3.7 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__").

```
242 {
243     if (x >= y) {
244         return;
245     }
246
247     std::string error_str = "ERROR: testGreaterThanOrEqualTo():\t in ";
248     error_str += file;
249     error_str += "\tline ";
250     error_str += std::to_string(line);
251     error_str += ":\t\n";
252     error_str += std::to_string(x);
253     error_str += " is not greater than or equal to ";
254     error_str += std::to_string(y);
255     error_str += "\n";
256
257     #ifdef _WIN32
258         std::cout << error_str << std::endl;
259     #endif
260
261     throw std::runtime_error(error_str);
262     return;
263 }   /* testGreaterThanOrEqualTo() */
```

5.33.3.8 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__").

```
293 {
294     if (x < y) {
295         return;
296     }
297 
298     std::string error_str = "ERROR: testLessThan():\t in ";
299     error_str += file;
300     error_str += "\tline ";
301     error_str += std::to_string(line);
302     error_str += ":\t\n";
303     error_str += std::to_string(x);
304     error_str += " is not less than ";
305     error_str += std::to_string(y);
306     error_str += "\n";
307 
308     #ifdef _WIN32
309         std::cout « error_str « std::endl;
310     #endif
311 
312     throw std::runtime_error(error_str);
313     return;
314 }   /* testLessThan() */
```

5.33.3.9 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__").

```
344 {
345     if (x <= y) {
346         return;
347     }
348 
349     std::string error_str = "ERROR: testLessThanOrEqualTo():\t in ";
350     error_str += file;
351     error_str += "\tline ";
352     error_str += std::to_string(line);
353     error_str += ":\t\n";
354     error_str += std::to_string(x);
355     error_str += " is not less than or equal to ";
356     error_str += std::to_string(y);
357     error_str += "\n";
358 
359     #ifdef _WIN32
360         std::cout « error_str « std::endl;
361     #endif
362 
363     throw std::runtime_error(error_str);
364     return;
365 }   /* testLessThanOrEqualTo() */
```

5.33.3.10 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__").

```
392 {
393     if (statement) {
394         return;
395     }
396
397     std::string error_str = "ERROR: testTruth():\t in ";
398     error_str += file;
399     error_str += "\tline ";
400     error_str += std::to_string(line);
401     error_str += ":\t\n";
402     error_str += "Given statement is not true";
403
404     #ifdef _WIN32
405         std::cout « error_str « std::endl;
406     #endif
407
408     throw std::runtime_error(error_str);
409     return;
410 }   /* testTruth() */
```

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