Co-funded by the Horizon 2020
Framework Programme
of the European Union

Software suite for scenario independent calculation and geographical mapping of viability and impact results: PHESIMA

+

PHES investment parameters database

Work package 1
Public Executive Summary (D1.4, D1.5)

Grant number: 696140

2017-10-15

H2020-EE-2014-2015/H2020-EE-2015-3

TrustEE

INNOVATIVE MARKET BASED TRUST FOR ENERGY EFFICIENCY INVESTEMENTS IN INDUSTRY

Table of Contents

1 Executive Summary

PHESIMA (PHES[1] potential Impact and Market Analyser) is a software tool that enables the estimation of the market potential and impacts of implementing PHES technologies under different framework scenarios. The tool was developed by the TrustEE consortium and covers both energy efficiency measures and renewable energies (namely, solid biomass, biogas and solar thermal). It is essentially a Geographical Information System tool composed of modelling scripts in python and a mapping component, which includes:

- numerical models that enable the estimation of PHES potential and impacts under prescribed conditions for system layouts and technology parameters, technology and energy costs and available incentives;
- a mapping tool that allows the visualization of the geographical distribution of the results.

For PHESIMA to produce accurate results, a **database** with the required inputs for the analyses was constructed. Examples of input variables contained in the database are: technology costs and performance parameters, fuel costs and properties or resource availability. This information was compiled from several sources (e.g., Eurostat, national statistics, technical reports or scientific papers). The TrustEE database will be updated on a yearly basis, so that the results produced are meaningful and up-to-date.

Figure 1 shows the main components of PHESIMA and its linkage with the database.
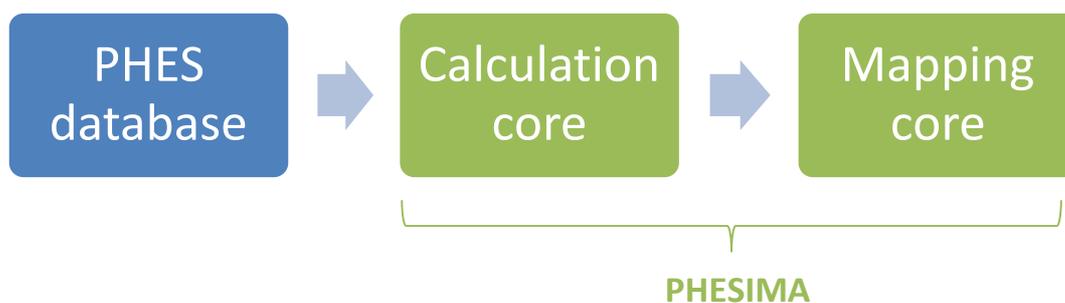

Figure 1. Main components of PHESIMA and link to the PHES database.

The calculations that enable the estimation of the PHES market potential and impacts are based on the definition of reference PHES systems. For all technologies covered, TrustEE partners have defined **reference system layouts**, which define the

---

[1] PHES stands for Process Heat Efficiency and Sustainability.

equipment that composes a certain system and how it is connected. An example of such layouts can be found in Figure 2, for the case of biogas.
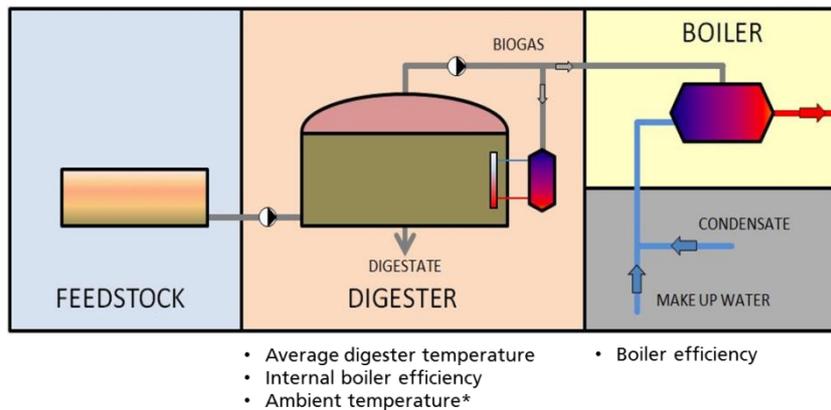

Figure 2. Example of biogas reference system components and layout.

Having the reference systems in mind, **technical assessment models** were implemented for each of the technologies considered. These models enable the assessment of the annual energy yield of a specific PHES system, which is used by the software tool for the estimation of the environmental and economic impacts of promoting PHES technologies under prescribed scenarios. Figure 3 shows as an example the solar annual yield.
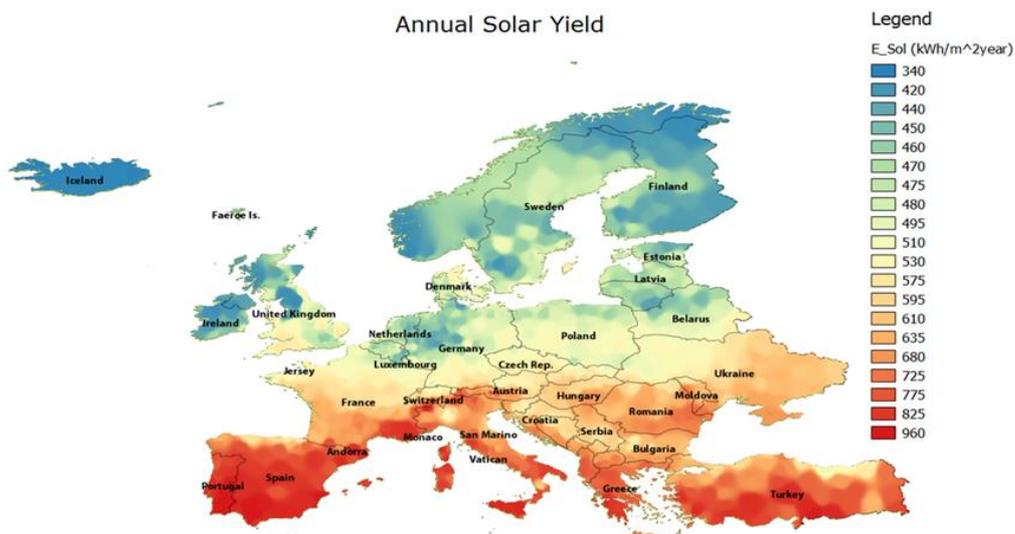

Figure 3. Solar yield calculation and mapped results (1200 locations in Europe).

The discounted cash-flow method is the basis of the **investment assessment model** of PHESIMA. It runs having as inputs the estimated yield results derived from the

corresponding technical assessment model and the definition of investment (investment and operation costs, lifetime, discount rate) and macroeconomic parameters (inflation, energy costs).

The investment assessment model enables the calculation of discounted payback and critical LCOH (levelized cost of heat) upon a target IRR (internal rate of return) (or vice-versa), enabling a critical IRR expectation (investor driven) or LCOH requirement (end-user driven) approach.

PHESIMA also contains an **environmental impact model** that calculates the impacts of substituting conventional process heat generation by PHES technologies. Avoided GHG (greenhouse gas emissions) and reduction on primary energy imports are estimated from the fossil fuel savings calculated by the technical assessment model and local energy mix inputs.

Prescribing different scenarios, generated from different perspectives, allows PHESIMA to produce target oriented results to end-users, technology suppliers, investors or public bodies. For example, PHESIMA is able to give an answer to the following questions (among others):

- Which are the public incentive levels needed to achieve a prescribed market penetration of a certain PHES technology under a prescribed market scenario and what are the associated environmental and economic benefits?
- Which are the expected IRR of investors when financing a given PHES technology in different European countries under a prescribed market scenario?
- Which is the critical LCOH, so that an end-user makes an informed decision to proceed with the implementation of a certain PHES system?