An Intro to **EnergyPLAN** modeling

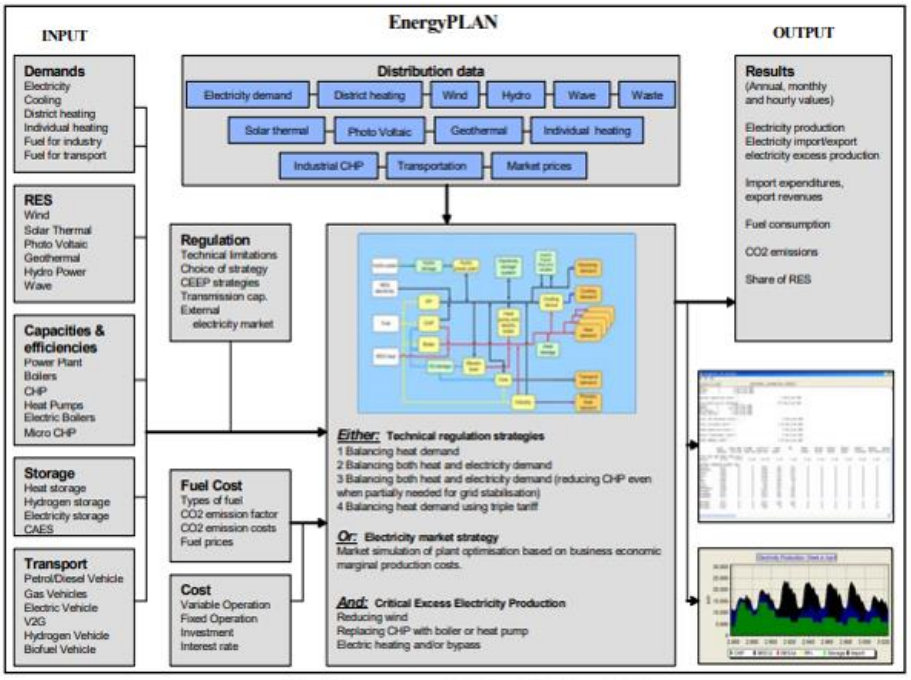
Postgraduate Programme Renewable Energy – PPRE

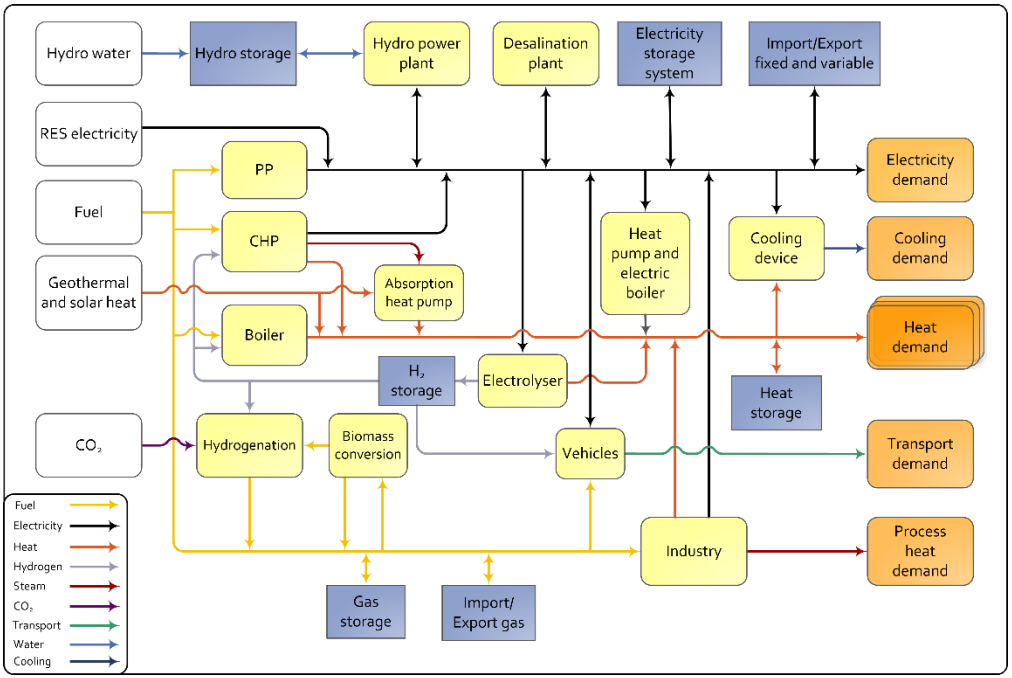
Booklet made for the course: Sustainability of Renewable Energy

Edition: SS 2020

What is the EnergyPLAN Software ?

EnergyPLAN is an open source software that allows you to simulate energy systems in the framework of **Renewable Energy**.

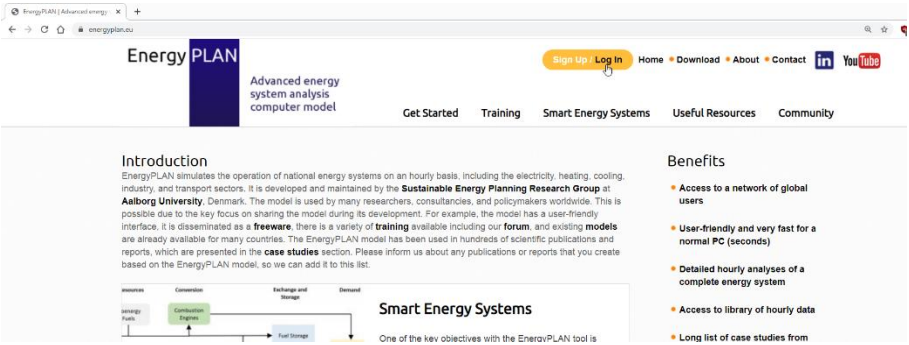




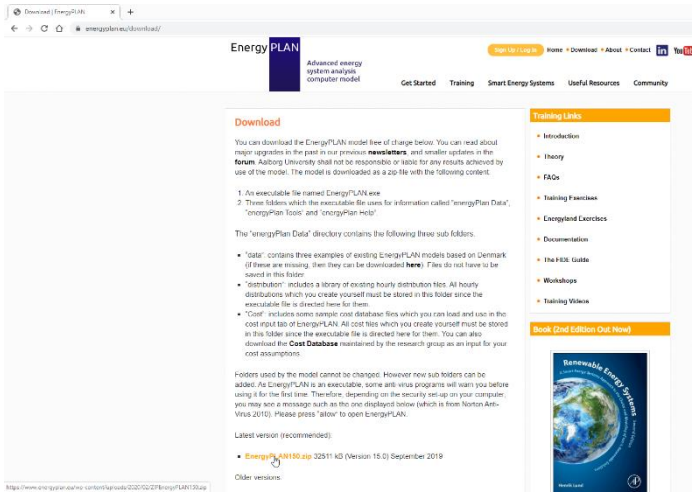
With **EnergyPLAN** is possible to represent a national energy system in hourly basis, including the **electricity, heating, cooling, industry,** and **transport sectors**.

Downloading the EnergyPLAN software

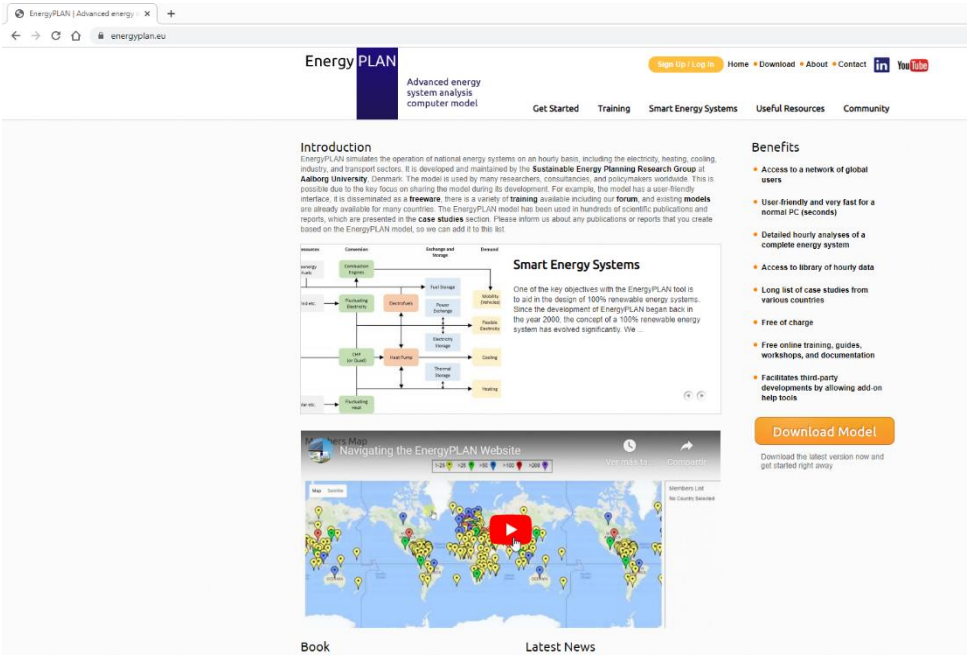
1. Go to the official website **energyplan.eu** and create an account



2. Download the last version

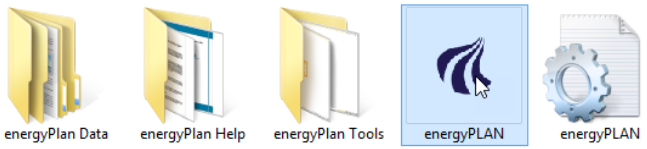


3. Watch the video available in the EnergyPLAN Website



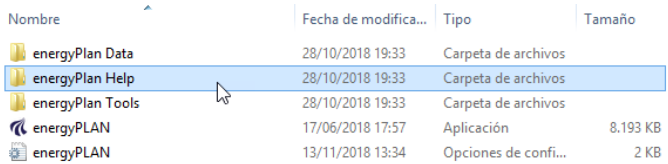
There you will find general and detail information of the site. Where to find data, the existing energy models that you can use as template and also, where to look for research studies that have used **EnergyPLAN.**

Structure of the EnergyPLAN tool



Executable file.
No need of additional software installation

Help files:

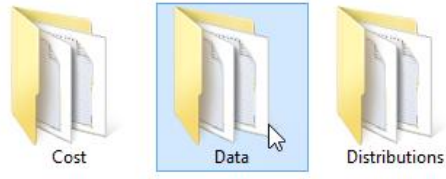


Description and understanding of calculations

Where to find energy system's data and how to entry it in the software

Data folders:

Data files



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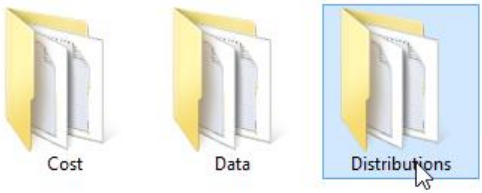
Denmark100%RES	17/06/2018 17:57	Documento de tex...	40 KB
Denmark2030Alternative	17/06/2018 17:57	Documento de tex...	40 KB
Denmark2030Reference	17/06/2018 17:57	Documento de tex...	40 KB
Germany2017_25EV	23/06/2018 23:38	Documento de tex...	53 KB
Germany2017_50EV	23/06/2018 23:36	Documento de tex...	53 KB
Germany2017_75EV	23/06/2018 23:32	Documento de tex...	53 KB
Germany2017_100EV	23/06/2018 23:28	Documento de tex...	53 KB
Germany2017BAU	23/06/2018 23:27	Documento de tex...	53 KB
Germany2027_25EV	23/06/2018 23:49	Documento de tex...	53 KB
Germany2027_50EV	23/06/2018 20:59	Documento de tex...	53 KB
Germany2027_75EV	23/06/2018 21:03	Documento de tex...	53 KB
Germany2027_100EV	23/06/2018 23:46	Documento de tex...	53 KB
Germany2027BAU	23/06/2018 20:56	Documento de tex...	53 KB
Germany2037_25EV	23/06/2018 21:12	Documento de tex...	53 KB
Germany2037_50EV	23/06/2018 23:57	Documento de tex...	53 KB
Germany2037_75EV	23/06/2018 23:56	Documento de tex...	53 KB
Germany2037_100EV	23/06/2018 23:54	Documento de tex...	53 KB
Germany2037BAU	23/06/2018 21:10	Documento de tex...	53 KB
initalize	17/06/2018 20:17	Documento de tex...	52 KB
Paper model Germany 2015	20/06/2018 14:25	Documento de tex...	54 KB

Three **default models** that can serve you as reference for starting.



Distributions files

Nombre	Fecha de modifica...	Tipo	Tamaño
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2H_HP_ECON_OPEN_2008var	17/06/2018 17:57	Documento de tex...	19 KB
2017_TransportP2	23/06/2018 13:12	Documento de tex...	30 KB
2017Demand100EV_P2	23/06/2018 12:53	Documento de tex...	78 KB
2017ElecDemand_100EV	23/06/2018 12:40	Documento de tex...	78 KB
2017GeothermalGermany	21/06/2018 17:45	Documento de tex...	61 KB
2017GermanyDemand_withoutImportE...	21/06/2018 16:14	Documento de tex...	80 KB
2017GermnayHour_transport	22/06/2018 11:26	Documento de tex...	78 KB
2017HydroGermany	21/06/2018 17:54	Documento de tex...	70 KB
2017NuclearGermany	21/06/2018 17:02	Documento de tex...	72 KB
2017OffshoreGermany	21/06/2018 17:03	Documento de tex...	111 KB
2017OtherREGermany	21/06/2018 17:05	Documento de tex...	105 KB
2017RiverHydroGermany	21/06/2018 17:04	Documento de tex...	111 KB
2017SolarPVGermany	21/06/2018 17:04	Documento de tex...	74 KB
2017WasteGermany	21/06/2018 17:05	Documento de tex...	111 KB
2017WindGermany	21/06/2018 17:03	Documento de tex...	111 KB
AAAPV	17/06/2018 17:57	Documento de tex...	71 KB
AAAwind	17/06/2018 17:57	Documento de tex...	95 KB
Aalborg Affald Årstidsvariation	17/06/2018 17:57	Documento de tex...	61 KB
Aalborg El 2007	17/06/2018 17:57	Documento de tex...	75 KB
Aalborg Fjernvarme 25% besparelser	17/06/2018 17:57	Documento de tex...	40 KB
Aalborg Fjernvarme 75% besparelser	17/06/2018 17:57	Documento de tex...	35 KB
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Aalborg Fjernvarme 2050	17/06/2018 17:57	Documento de tex...	37 KB
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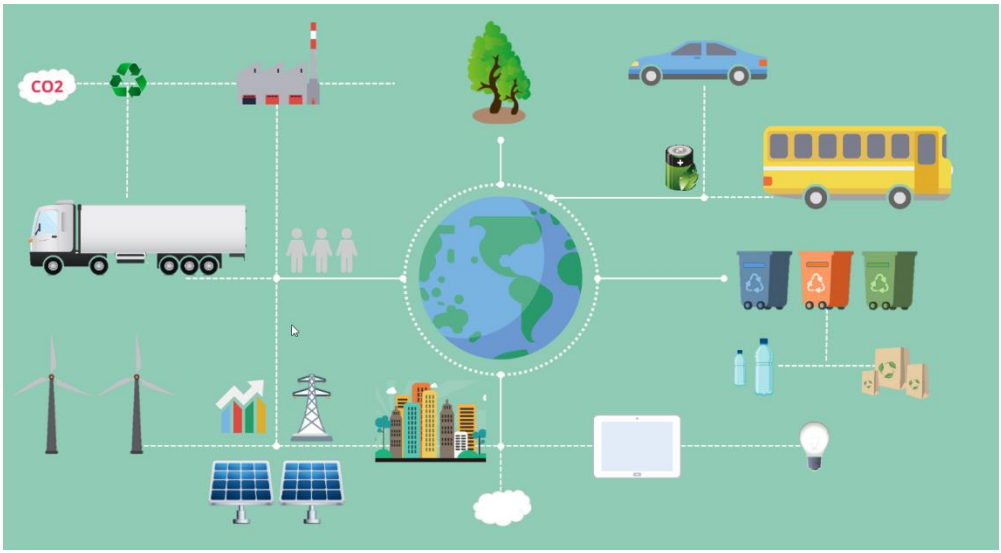
Where you will store the **hourly data** for every sector of your **Energy Model**

Keys when modeling an Energy System



You want to create models that are **simple** but, at the same time they make an **accurate** representation of the energy system.

Therefore in the design of **energy scenarios**, you need to make some simplifications and defined **General** and **Specific assumptions** for the model.

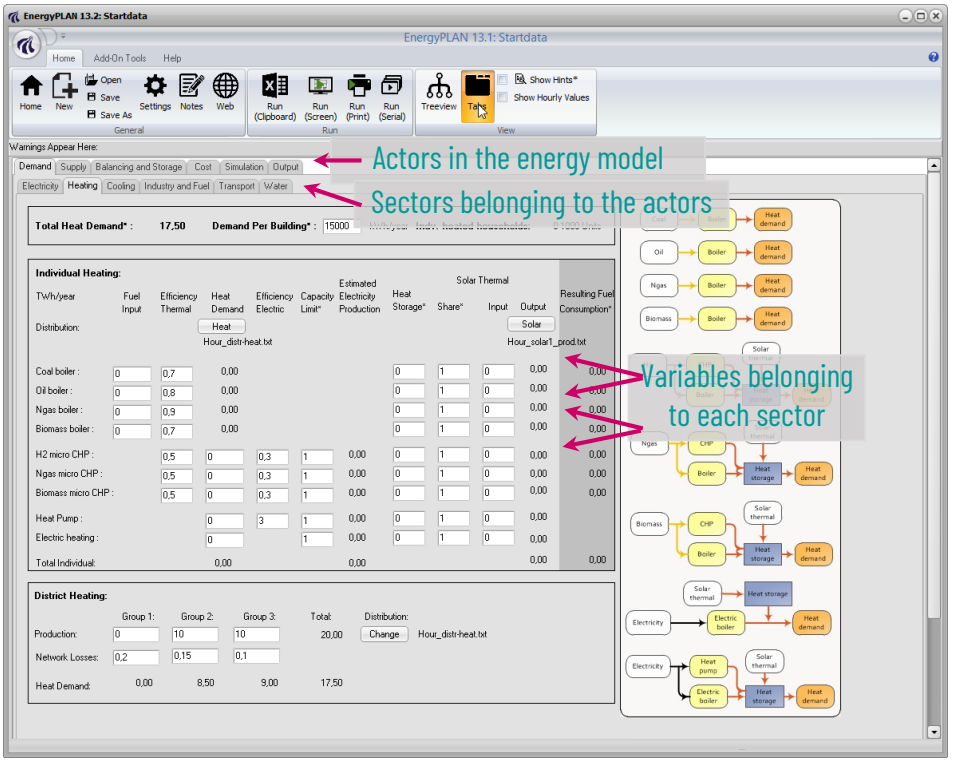
For knowing how realistic are the simplifications and assumptions you have defined, you firstly need to run a simulation using the present state scenario (Business As Usual, BAU).

Check the results of the BAU scenario with the actual state of the energy system and tune the parameters that give you deviations.

Once you know the BAU scenario is a good representation of the energy system, then you can start disturbing the model according to your research question and run further simulations.

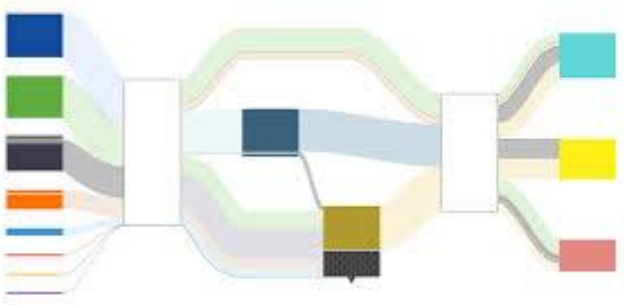
How EneryPLAN works ?

This is how the software looks when you active the **Tabs** view…

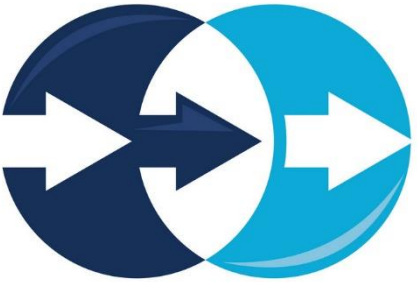


Depending on the energy system and the **focus** of your scenario you will probably not need to define all actors and sectors.

Therefore, I lot of variables will simply **remain empty**.



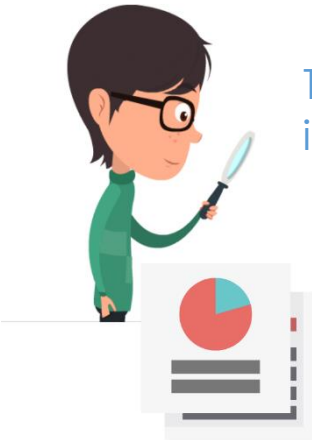
The **EnergyPLAN** software is based in an input-output model. It calculates an **energy balance for every hour during ONE year** between energy demand and energy production



For the analysis of different years you need to run several simulations and probably, you will use the results of your first simulation as your input for the second simulation, and so on.

Data Collection

Before the run of any scenario your starting point is the **hourly data** of all important sectors in the energy system you are modeling.

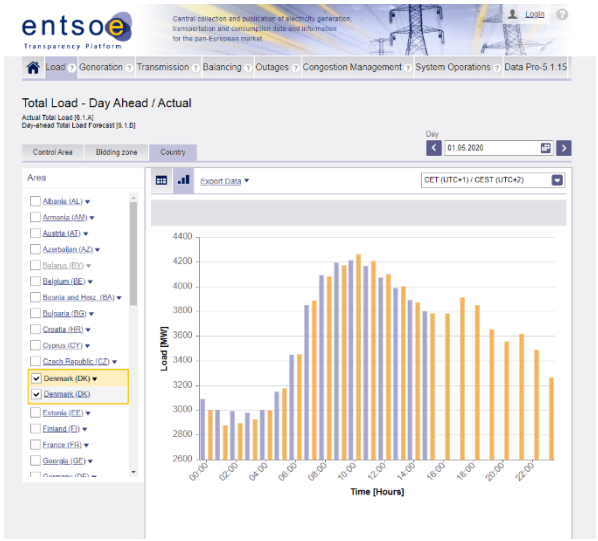


Take a look to your assumptions and from them identify the information you need to search for.

For instance, data of **demand, imports and exports** and **energy generation** will be required.

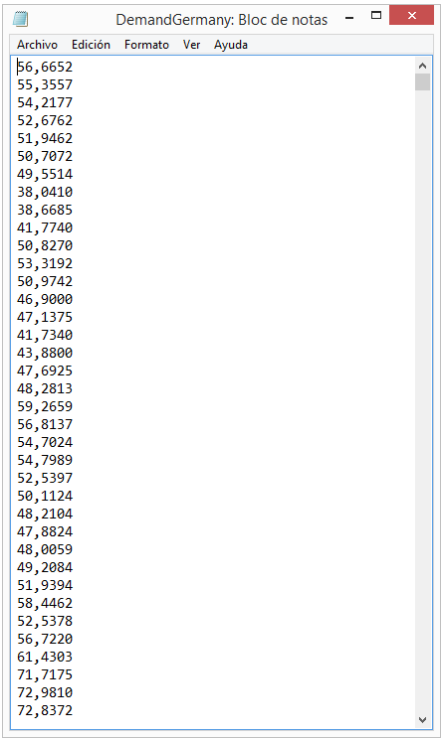
For example, at the **Entsoe portal** you can find and download data of generation and consumption for every nation in the European Union.

There you can even find generation data per technology which is very useful for modeling with EnergyPLAN.



Once you download the energy system data, you need to **organize** it in the proper way before you include it in the folder **Data/Distributions.**

You have to be sure the data is in **hourly resolution** and saved as **.txt file.** The file should include only **one column** with the data of a **complete year (+1 day)** and without the use of **any headers.**



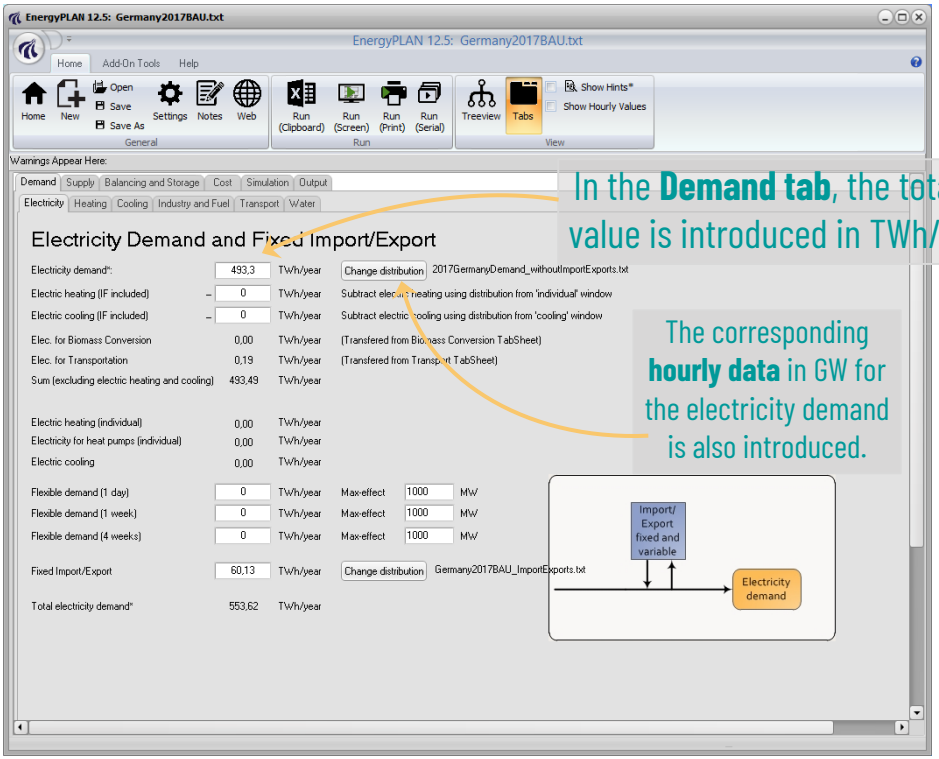
EnergyPLAN includes an extra day, meaning **366 days** of data.

For this last day you can either take the data of the first day of next year or repeat the last day data of the current year.

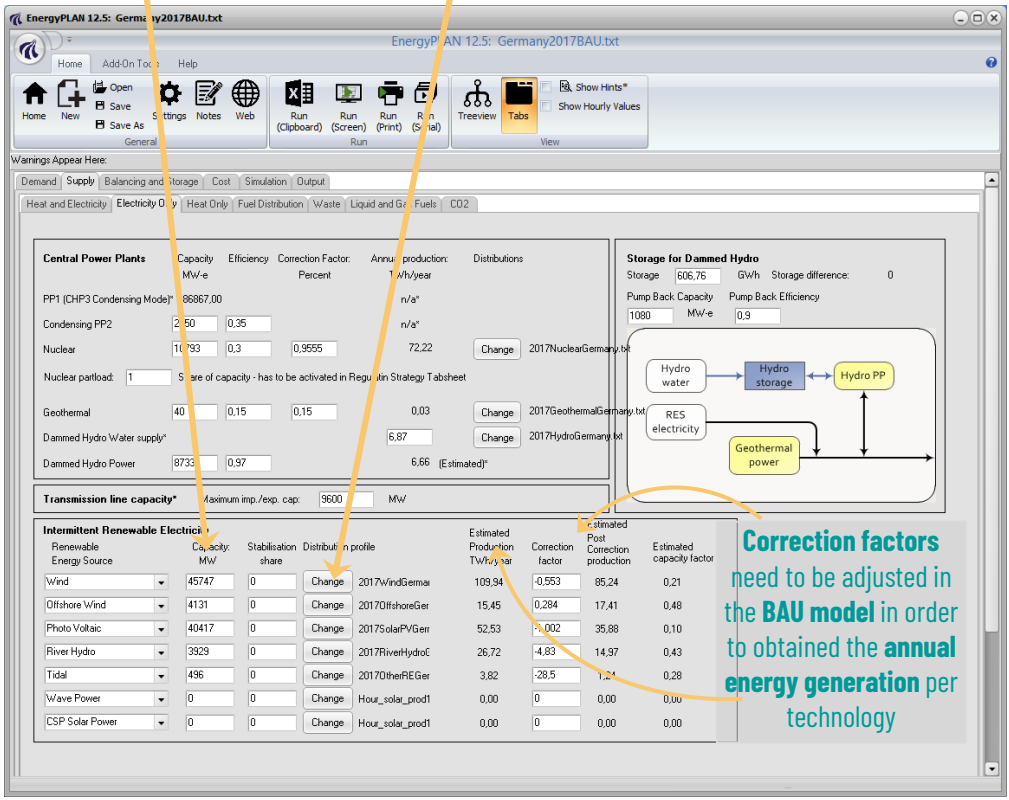
Be Aware of UNITS!

Definition of sectors in EnergyPLAN

For the configuration of every tab in the **EnergyPLAN** software, you need to entry the **total values** together with the **hourly distributions**, meaning the text files.



Similarly for the **Supply tab**, you introduced the **total installed capacity** with its corresponding **hourly distribution file.**

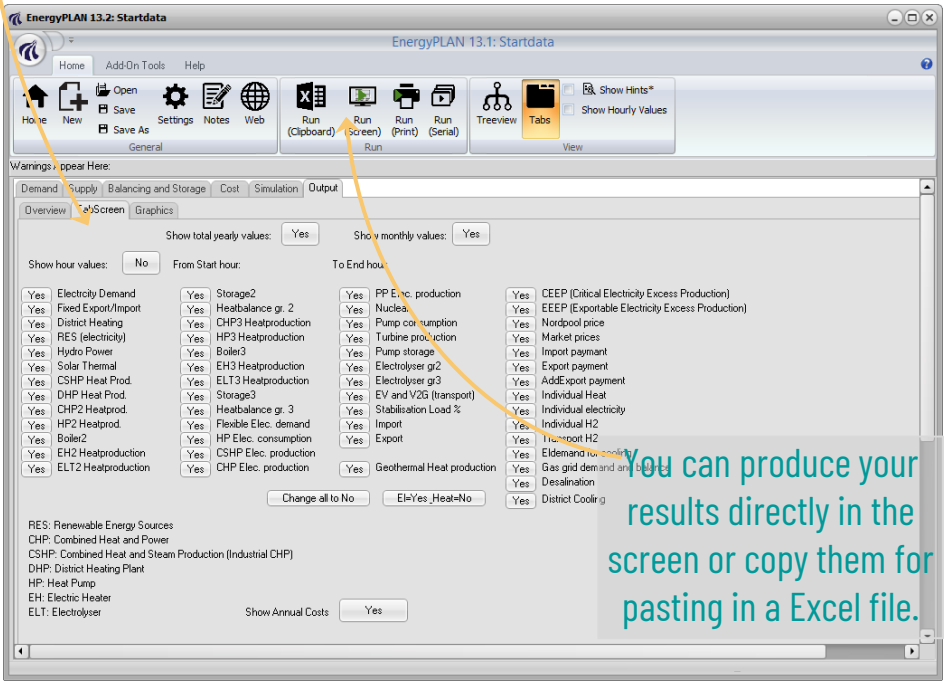


Correction factors need to be adjusted in the **BAU model** in order to obtained the **annual energy generation** per technology

Be sure that energy demand, generation, exports and imports are balanced!

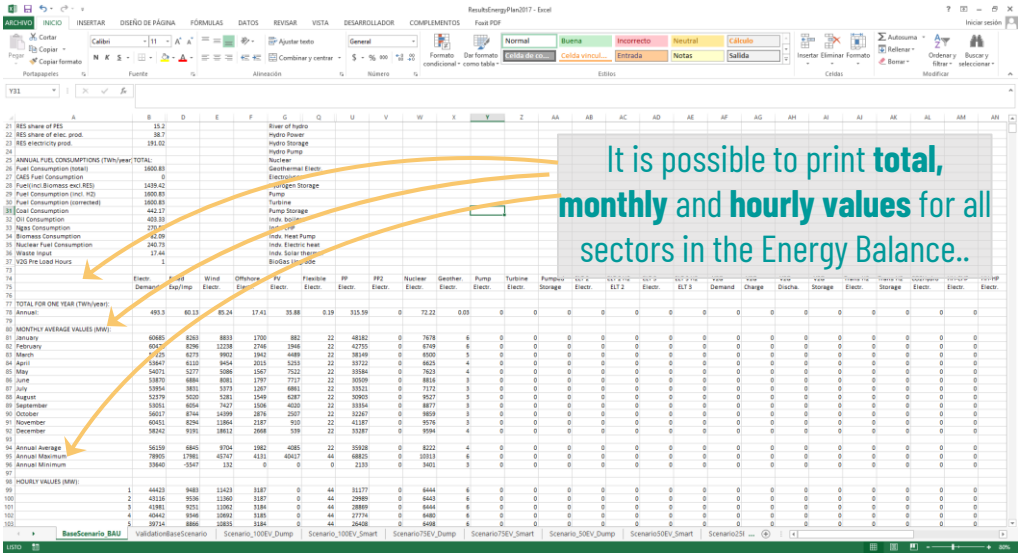
Model results from EnergyPLAN

After all **required sectors** have been configured, you can decide which variables you want to print on your results.



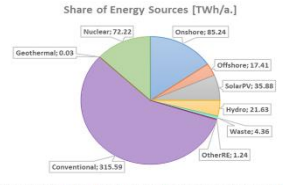
You can produce your results directly in the screen or copy them for pasting in a Excel file.

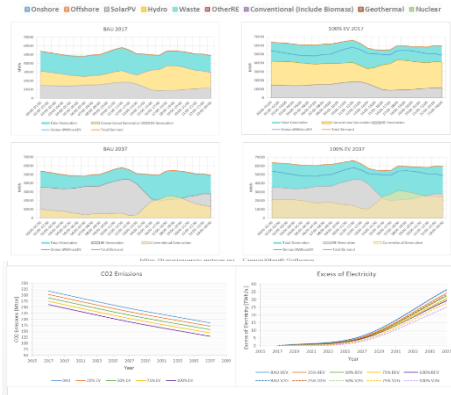
This is an example of how the **EnergyPLAN results** are presented.



It is possible to print **total, monthly** and **hourly values** for all sectors in the Energy Balance..

With the monthly and hourly distributions you are able to plot, calculate energy matrices and make your analysis!





Have Fun!