SustainHuts

Stand-Alone Renewable Energy Systems

Josip Julijo Franz, Rok Stropnik, Boštjan Drobnič , Mihael Sekavčnik, Mitja Mori

University *of Ljubljana*

FUNDACIÓN PARA EL DESARROLLO DE LAS NUEVAS TECNOLOGÍAS DEL HIDRÓGENO EN ARAGÓN

ENVIRONMENT PARK Parco Scientifico Tecnologico per l'Ambiente

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LIFE15 CCA/ES/000058

Objectives-project

- Energy consumption is proportional to emissions and releases of pollutants.
- Huts are placed in sensitive ecosystems.
- 9 European huts involved in 4 different countries (hydrogen storage system in one hut).
- Replicated in other isolated systems.

↓21 t/ CO_2	↓0,5 t/a NOx	↓20% Energy	↓1 t/a Kerosene

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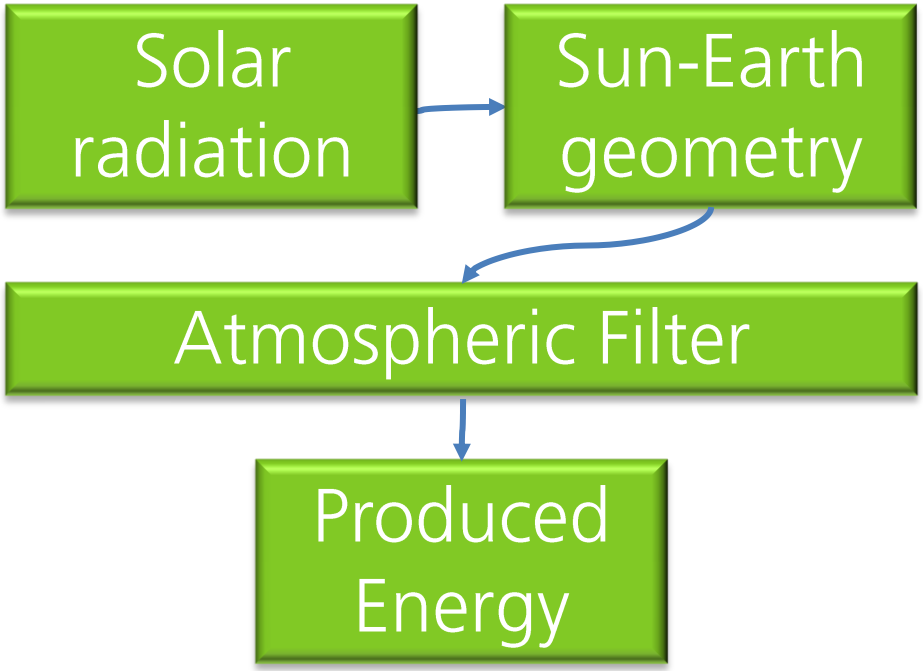
Objectives-study

Create a mathematical model for calculation of available sun energy based on location and orientation of photovoltaic system.

- Solar radiation.
- Sun-Earth geometry.
- Collecting input data.
- Mathematical experiment.
- Two-stage results verification.



Theoretical background

- Mathematical model is based on extended Bird Clear Sky model.
- To calculate electricity yield we need 28 input data (ie. In Bird model we need aprox. 15 inputs).
- Simpler models are useful for basic calculations.
- In autonomous systems hourly dynamics is very important.

Key Parameters and teh hut involved

- Extra-terrestrial radiation.
- Air Mass Index (AM Index).
- Atmospheric filter.
- Clearness Index.
  - Two algorithms.

Latitude: 46.355651 N
Longitude: 14.639763 E
Altitude: 1808 m

Rated power of PV system: 0,7 kW
Inclination of PV system: 20°
Azimuth of PV system: -105°

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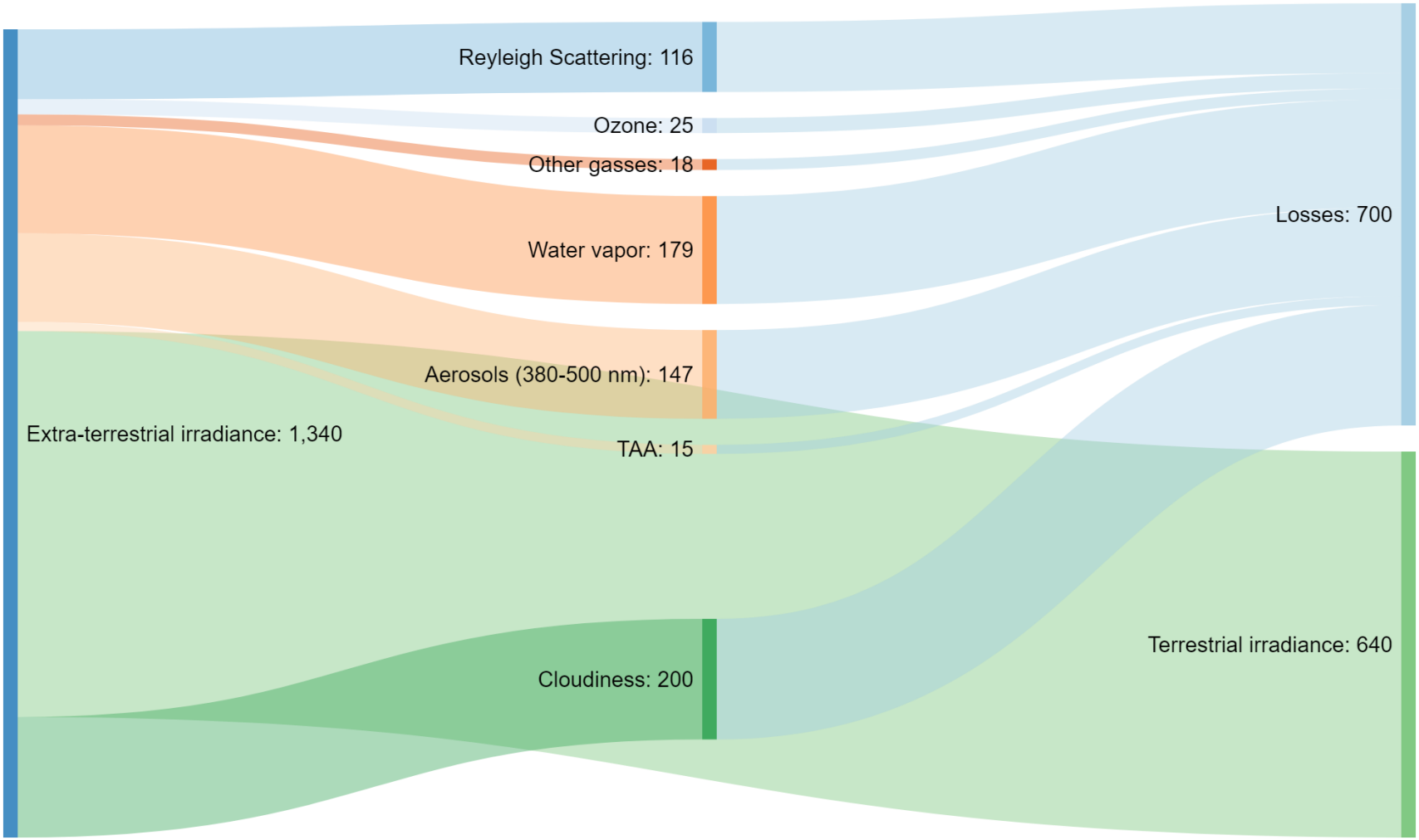
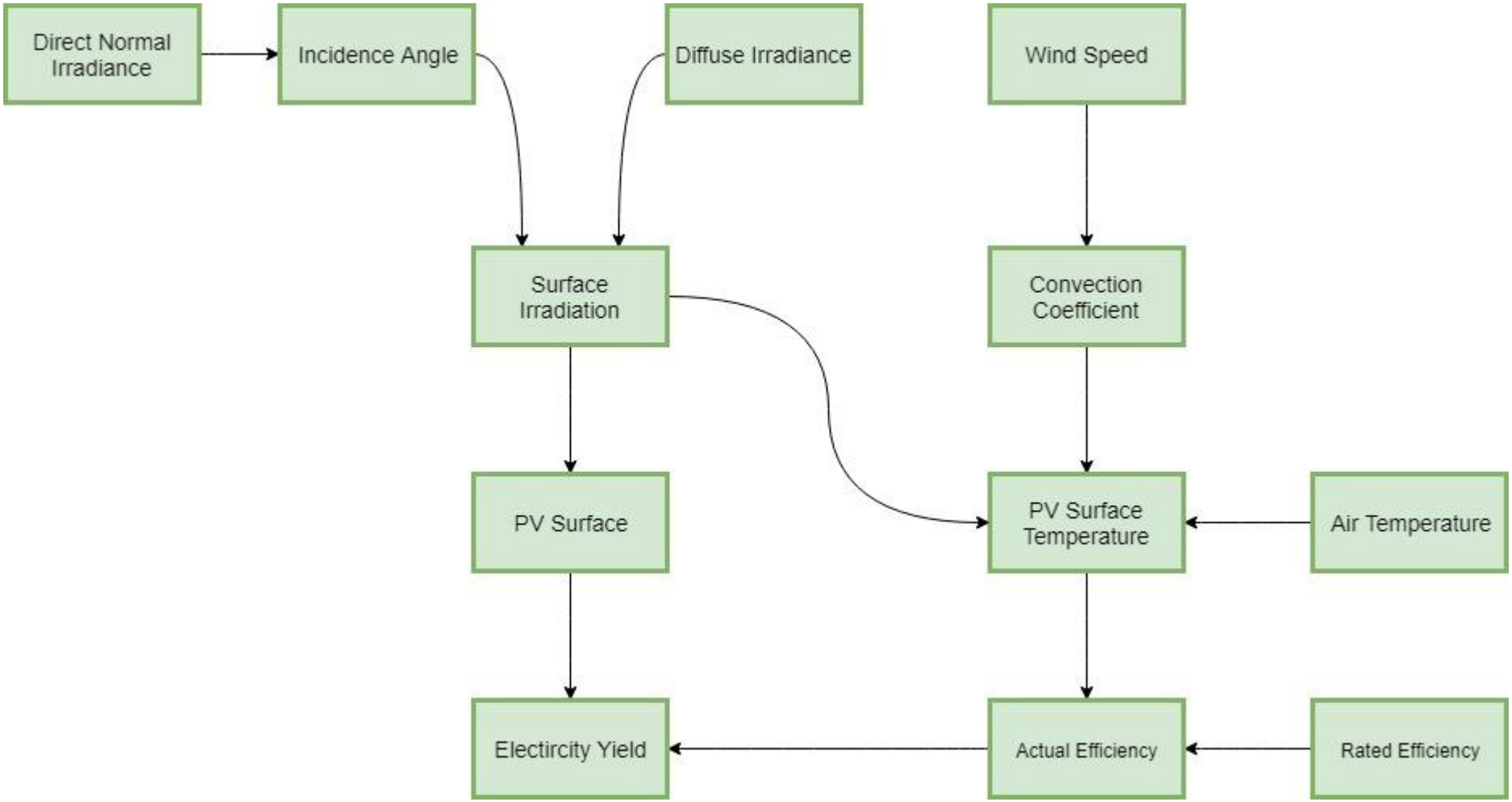
Results: Sankey diagram

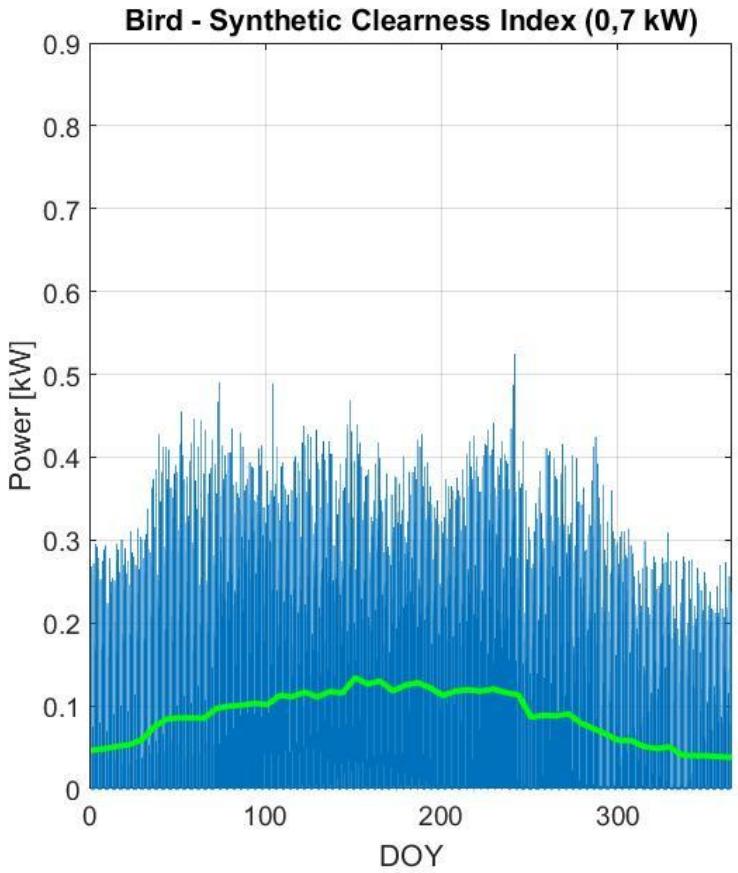


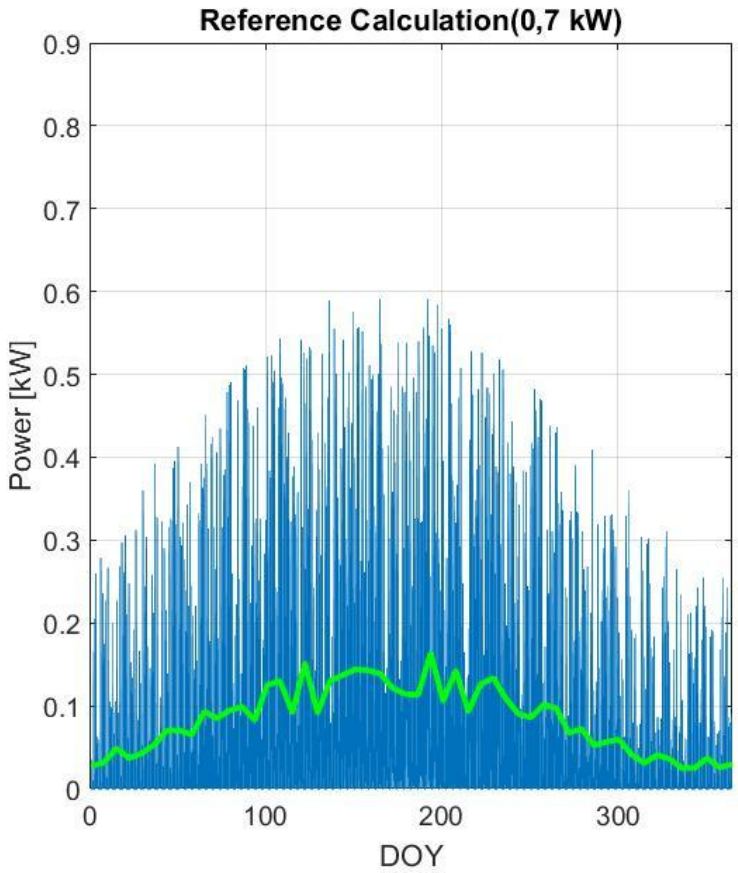
Results:electricity generation



Results verification

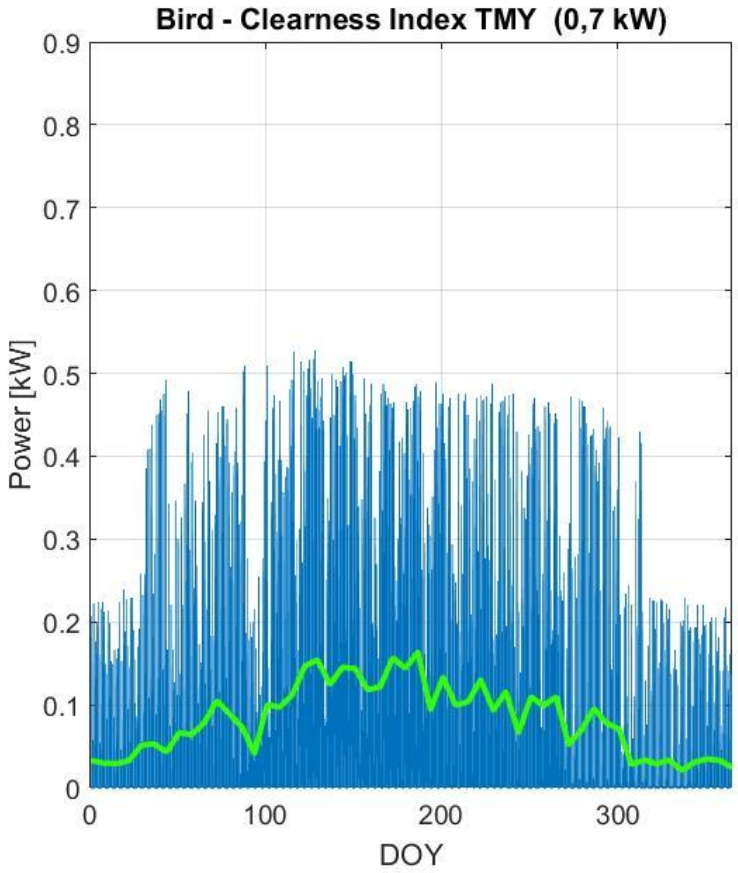
- Synthetic Clearness Index.

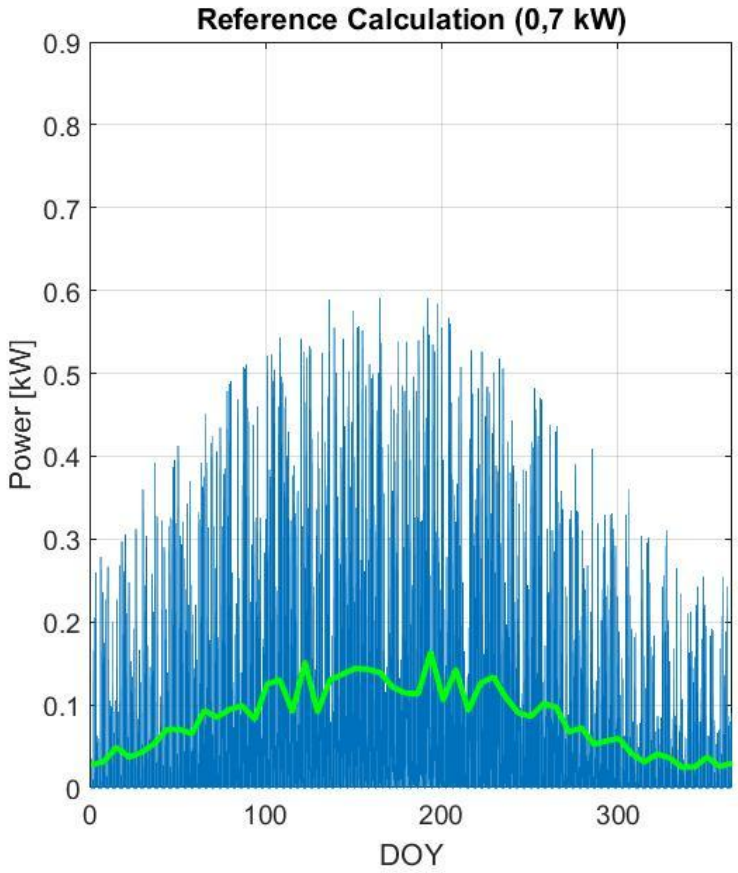




Results verification

- Clearness Index based on TMY.

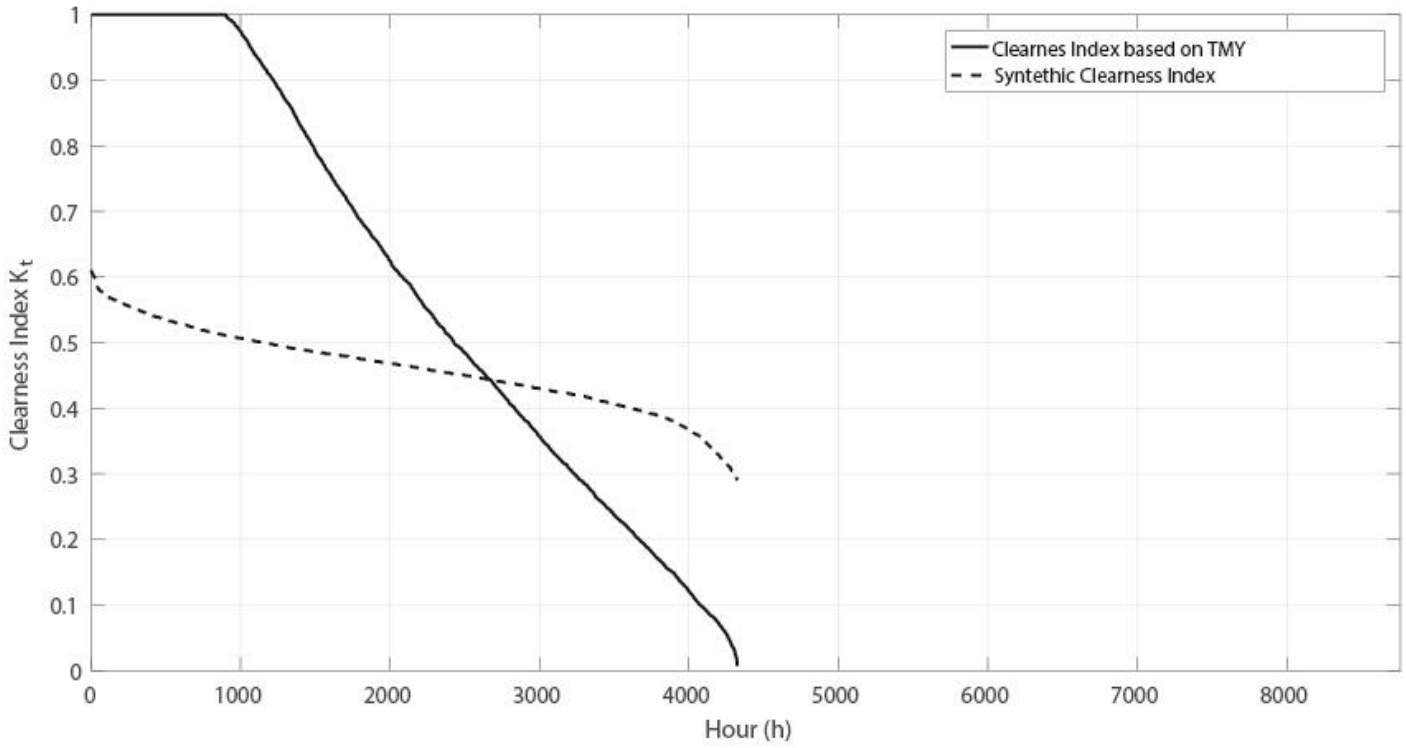




Results: syntetic vs.

Both methods return results within **±5%** of reference calculation on yearly scale.

- Different hourly dynamics due to different Clearness Index distribution.



Conclusions

Mathematical model for terrestrial irradiance was developed;

The model includes more input data than basic mathematical models;

Mathematical model returns good results that are inline with other models: reference model in Homer Pro and other matematical models;

- More detailed metrological data would return better results.

Verification with measurements was not possible due to fire damage in Kocbek hut;

Next step: To add algorithm for energy storage and consumption;

Contact: Mitja Mori (mitja.mori@fs.uni-lj.si)
coordinator: Pedro Casero (pcasero@hidrogenoaragon.org)
Web page: http://sustainhuts.eu/