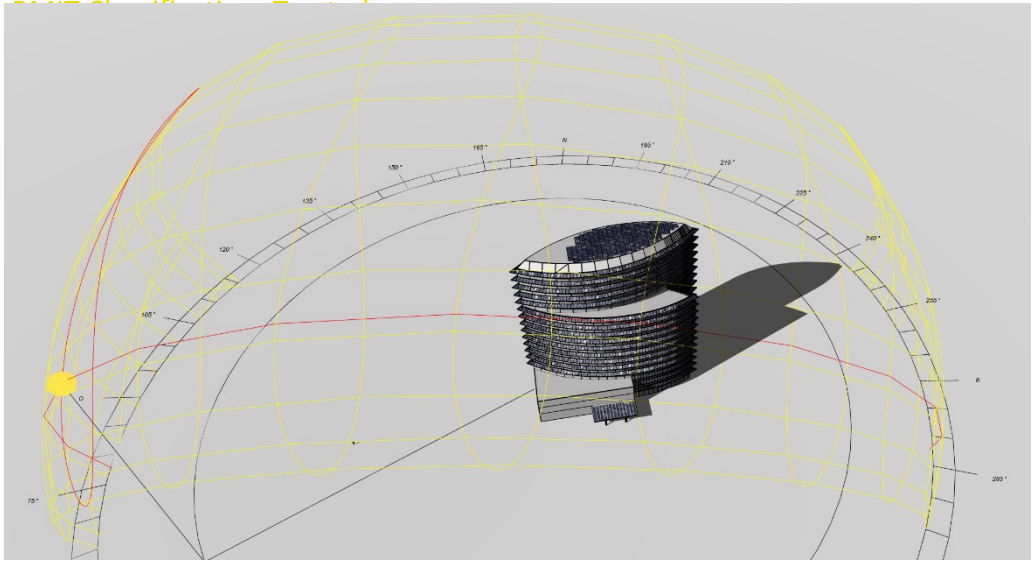

Digitalising BIPV energy simulation: A cross tool investigation

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What is IEA PVPS?

- The International Energy Agency (IEA), founded in 1974, is an autonomous body within the framework of the Organization for Economic Cooperation and Development (OECD).
- The Technology Collaboration Programme was created with a belief that the future of energy security and sustainability starts with global collaboration. The programme is made up of thousands of experts across government, academia, and industry dedicated to advancing common research and the application of specific energy technologies.

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What is IEA PVPS?

- The IEA Photovoltaic Power Systems Programme (PVPS) is one of the Technology Collaboration Programme established within the International Energy Agency in 1993
- 32 members - 27 countries, European Commission, 4 associations
- *"To enhance the international collaborative efforts which facilitate the role of photovoltaic solar energy as a cornerstone in the transition to sustainable energy systems"*

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The simulation process in eight tools

Steps	Skelion	SAM	PVsyst	BIMsolar	Ladybug Tools	PV*SOL	Solarius PV	INSIGHT
Building geometry modelling	Create 3D Model	Create simplified 3D Model	Import 3D Model in COLLADA format	Import 3D Model in Skp format	Create 3D Model	Import 3D Model in COLLADA format	Import 3D Model in IFC format	Create 3D Model
Weather data inputs	Input from Meteonorm 8.1	Built-in Meteonorm 8.1	Built-in Meteonorm 8.1	Input from Meteonorm 8.1	Input from Meteonorm 8.1	Built-in Meteonorm 8.1	Built-in Meteonorm 7.1	Built-in Autodesk Climate Server
PV module and inverter data inputs	Manual input PV module power rating	Manual input detailed specifications	Input detailed specifications via PAN/OND files	Manual input detailed specifications	No input	Input detailed specifications via PAN files and inverter template	Manual input detailed specifications	No input
System layout and array configuration	Reposition but not define array configuration	Reposition and reconfigure façade system array	Reposition and reconfigure façade system array	Reposition and configure case system array	No array configuration defined	Reposition and reconfigure façade system array	Reposition and configure case system array	No array configuration defined
POA irradiance	Perez model	Perez model	Perez model	Ray tracing	Ray tracing	Hay & Davies model	Perez model	Ray tracing
Shading evaluation	Shading factor analysis based on building geometry	Shading calculator based on simplified geometry	Shading factor analysis based on building geometry	Ray tracing	Ray tracing	Near shade calculation based on building geometry	Manual input shading factor	Ray tracing
PV energy conversion simulation	Built-in empirical model	Built-in equivalent circuit model	Built-in equivalent circuit model	Built-in equivalent circuit model	Calculation based on formula	Built-in equivalent circuit model	Built-in empirical model	Calculation based on formula
PV system losses	Manual input based on PVsyst results	Simulation	Simulation	Simulation	Manual input based on PVsyst results	Simulation	Manual input based on PVsyst results	Manual input based on PVsyst results

PVPS

Overview of the study

- Aim to assess the process of eight existing simulation tools for BIPV energy simulation. Based on one existing building project with three different types of BIPV-installations, this study explored the capability of these eight tools in modelling/importing building geometry, selecting weather data, setting system layout and array, evaluating the solar resource, estimating energy losses, and assessing energy generation.

- Conclusion: The selection of weather and solar resource data significantly impacts energy forecasting. PV simulation tools vary in their handling of solar resource input data; some operate as a "black box" and lack flexibility, accepting only specific data formats, such as TMY, or only GHI. Others are more versatile, accepting multiple years of data and different solar irradiance components. During this comparison study, simplifications were necessary to find common ground between the tools, which led to the exclusive use of TMY weather data for simulation and comparison with one year's measured yield.

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