



E.ON Energy Research Center



E.ON Energy Research Center Series

Optimized System Efficiency of the Photovoltaic System for the E.ON Energy Research Department Main Building

Gontran Pâques, Christian Dick
Rik W. De Doncker

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2 Executive Summary

The goal of this research project is to optimize the electrical interconnection of the photovoltaic system for the new main building of the E.ON Energy Research Center. The integral optimization yields a maximization of energy output at the grid terminals with regard to the special architecture of the building.

Today, photovoltaic (PV) systems are mainly sold as string or central system. For example, a series connection of PV panels forms a string, which feeds its energy via a string converter into the mains. With the planned 1300 m² or $\approx 130 \text{ kW}_{\text{peak}}$ output power, more than 650 PV panels will be mounted on the roofs and facades of the building. In principle, one central converter could feed the power into the grid. However, other interconnection possibilities might offer a higher overall energy output. For example, module integrated converter systems are superior to string or central systems when the PV panels have a different orientation to the sky or when a degree of partial shading is exceeded. With the special architecture of the main building, designed by Zaha Hadid Architects, these effects are expected.

A model to quantify these effects and to optimize the energy output is proposed. The major input data are the building geometries and the hourly mapped radiation data. This project is first meant to quantify the overall energy output of the different classic electrical interconnection possibilities. For simple geometries, where shading occurs, a gain of 3 % seems to be realistic for the output energy, when modular interconnections and commercial available module converters are used. For the E.ON ERC main building, different interconnection topologies are considered as well. All configurations are compared based on the overall energy output.

The results show, that based on technology that is commercially available a string interconnection on each fin of the building offers the best tradeoff between maximal output energy and low converter losses. The net efficiency gain compared with a central interconnection is estimated to be over 1.5 %. Future module converter technology can result in a net gain of over 6 %.

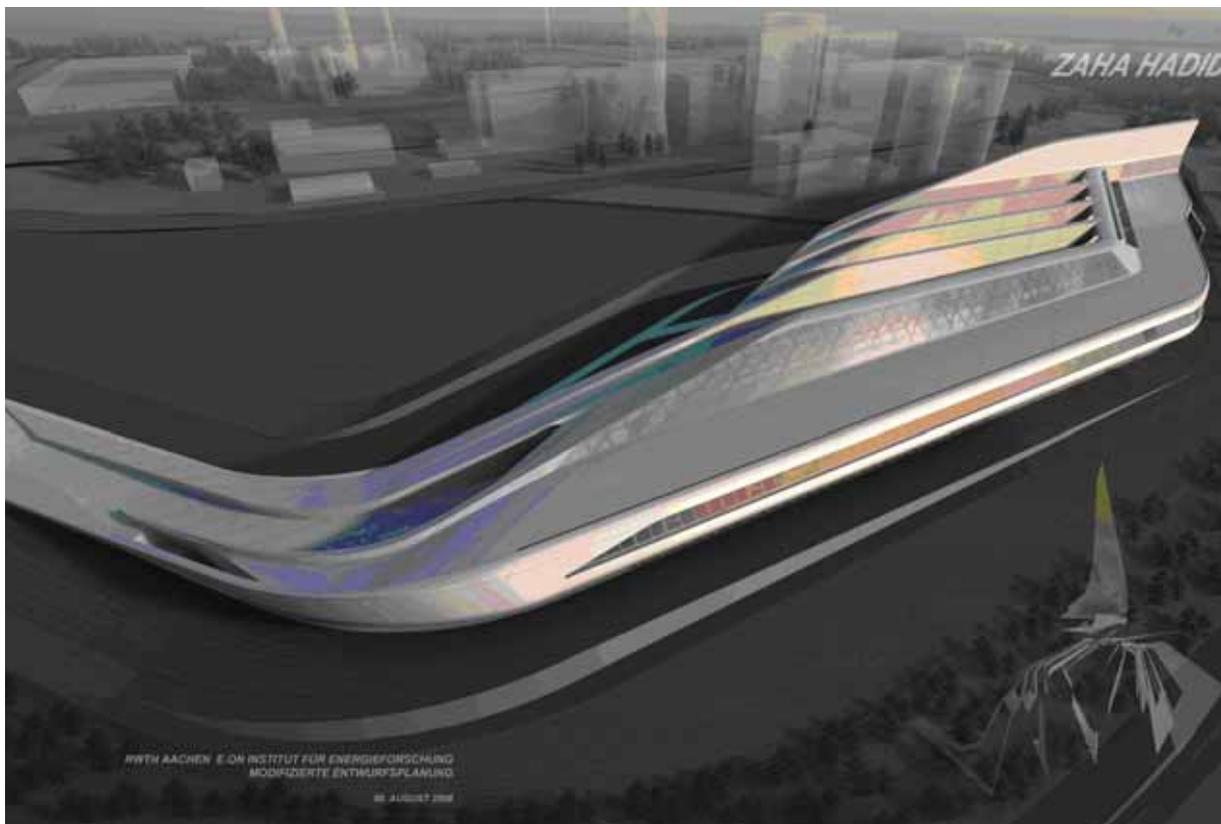


Fig. 1: E.ON Energy Research Center building designed by Zaha Hadid Architects



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E.ON Energy Research Center,
RWTH Aachen University

Jägerstraße 17/19
52066 Aachen
Germany

T +49 (0)241 80 99590

F +49 (0)241 80 92560

post_erc@eonerc.rwth-aachen.de

www.eonerc.rwth-aachen.de