

# Environmental evaluation of PV on buildings: market stimulus or market barrier?

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## 1. Introduction

PV systems are a key component for the design of net-zero energy houses. But adding PV panels to the building will require extra materials and thus extra environmental impacts from the PV system production. The present Dutch Building Code requires two types of assessments for a new building:

- 1) an environmental impact assessment of the **building materials** (MPG indicator),
- 2) an **energy performance** assessment (EPG indicator).

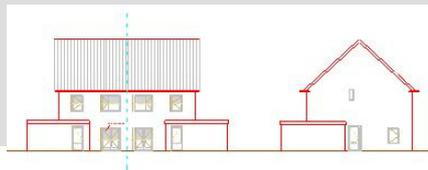
In case of PV systems the presentation of two different indicators gives rise to confusion among building designers. We will show how an integrated indicator combining energy and material impacts resolves this issue.

## 2. Case study

We consider a semi-detached house with a usable floor area of 150 m<sup>2</sup>, an energy consumption of 7440 kWh/yr (50 kWh/m<sup>2</sup>/yr, excl. household appliances). The energy-related CO<sub>2</sub>-emission from the building is 2600 kg/yr, if no PV is installed.

We consider 4 variants of this house:

- no PV
- with 3 kWp mono-Si panels
- with 3 kWp CdTe panels
- with 3 kWp a-Si solar cell foil



## 3. Results

Energy and Material Performance  
of Building

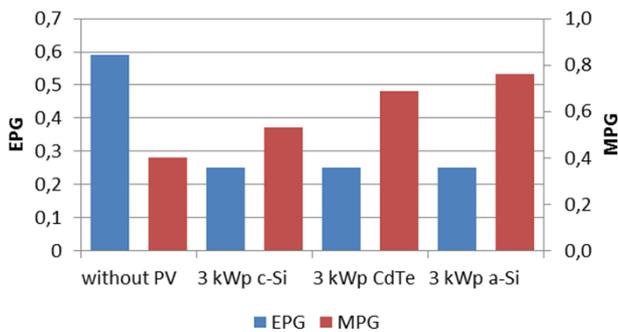


Fig. 1: Materials impact score (MPG) and Energy Performance Score (EPG) of house with different PV installations. N.B. EPG and MPG scores have different units.

We can observe that the energy performance score (EPG) improves (decreases) after installation of PV panels, while the materials impact score (MPG) deteriorates (increases). This is confusing for building designers: is it good or bad to include PV in the building design?

Combining the impacts from materials with the **impacts** from operational energy consumption will give an integrated building impact indicator that is much more informative than two separate indicators.

In figure 2 below the energy consumption data from the EPG calculation have been multiplied with environmental impact factors per energy carrier (i.e. gas or electricity) according to the same assessment method as for the MPG impact scores. The sum of MPG and EPG\* impact scores give a clear view on the life-cycle environmental benefits of solar panels.

Integrated Performance score of Building

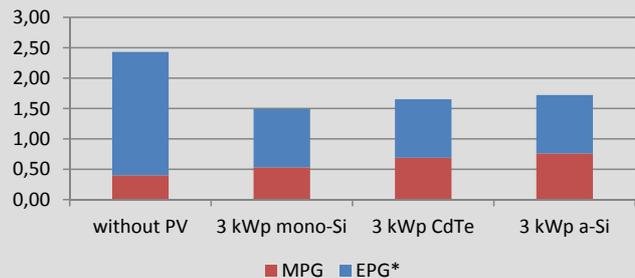


Fig. 2. Integrated score of life-cycle environmental impacts combining the MPG material score and a weighted energy consumption indicator (EPG\*). Differences between solar cell types result from the data available in the National Environmental Database of building products. Impacts from glass are a major contributor to MPG scores of mono-Si and CdTe PV panels.

## 4. Conclusions

- An integrated assessment method for energy performance and material performance of a building will help to achieve optimal building designs.
- Representative data for different solar technologies is needed in the National Environmental Database