

# »A real-world business model for solar electricity«

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10th Int. Conference on Heat Engines and Environmental Protection  
Balatonfüred May 2011



**Hochschule Ulm**  
Technik – Informatik - Medien

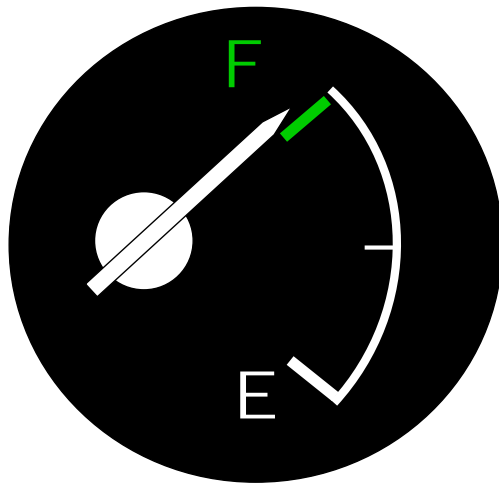
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12 Institute  
21 Bachelor-Studiengänge  
4 Master-Studiengänge  
3 Standorte  
50 Jahre Hochschule Ulm



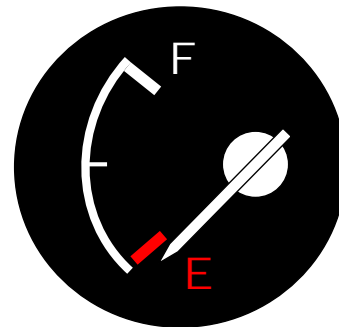
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**100%**  
**Know - How**



**Against  
decreasing  
energy resources**



Renewable Energies and Efficient Energy Use

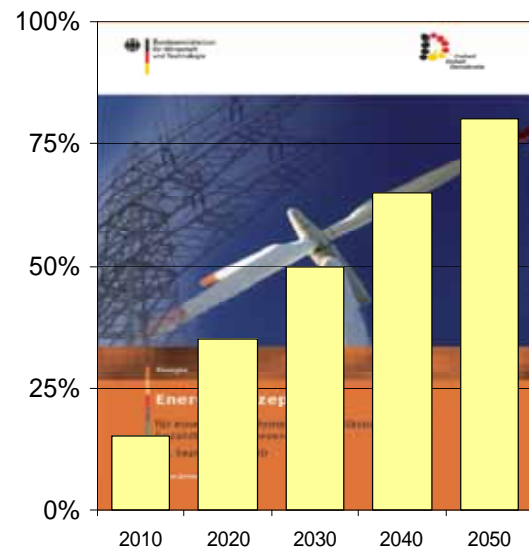
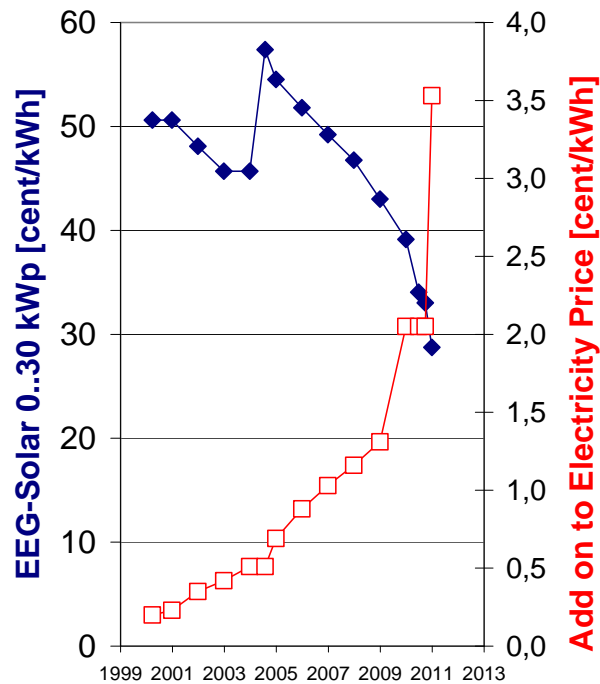


A real-world business model for solar electricity

## Agenda



- ▶ Introduction
- ▶ Energy economics
- ▶ The value of photovoltaic solar energy
- ▶ Real world business models
- ▶ Conclusion & outlook
- ▶ Final personal comment



- 80% of electricity demand covered by RE until 2050

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Source: BMWI, BMU

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Foto: Bausparkasse Schwäbisch Hall / Lorenz-Behälterbau

## ESP

### Energy Bill 2010

Cost: 758 €

Energy: 3.500 kWh

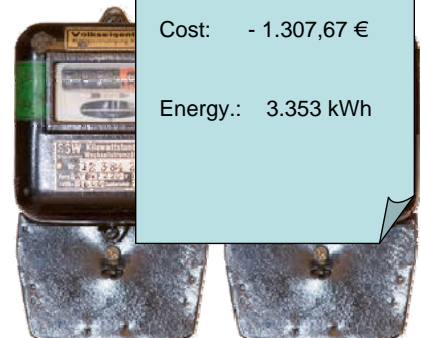
Last Year:

## ESP

### Photovoltaic 2010

Cost: - 1.307,67 €

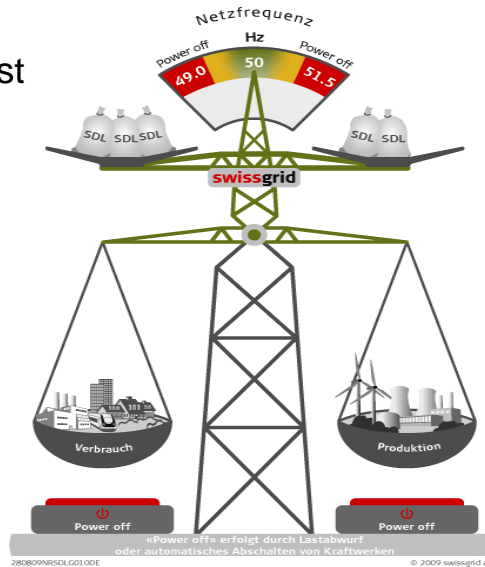
Energy.: 3.353 kWh



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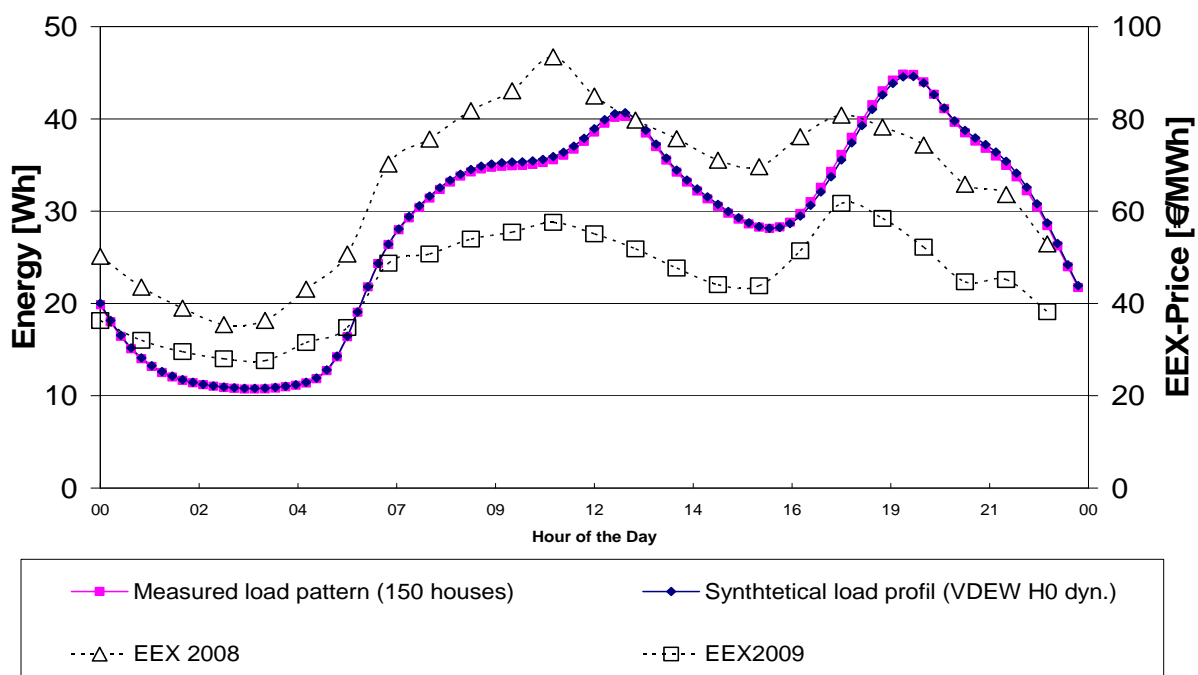


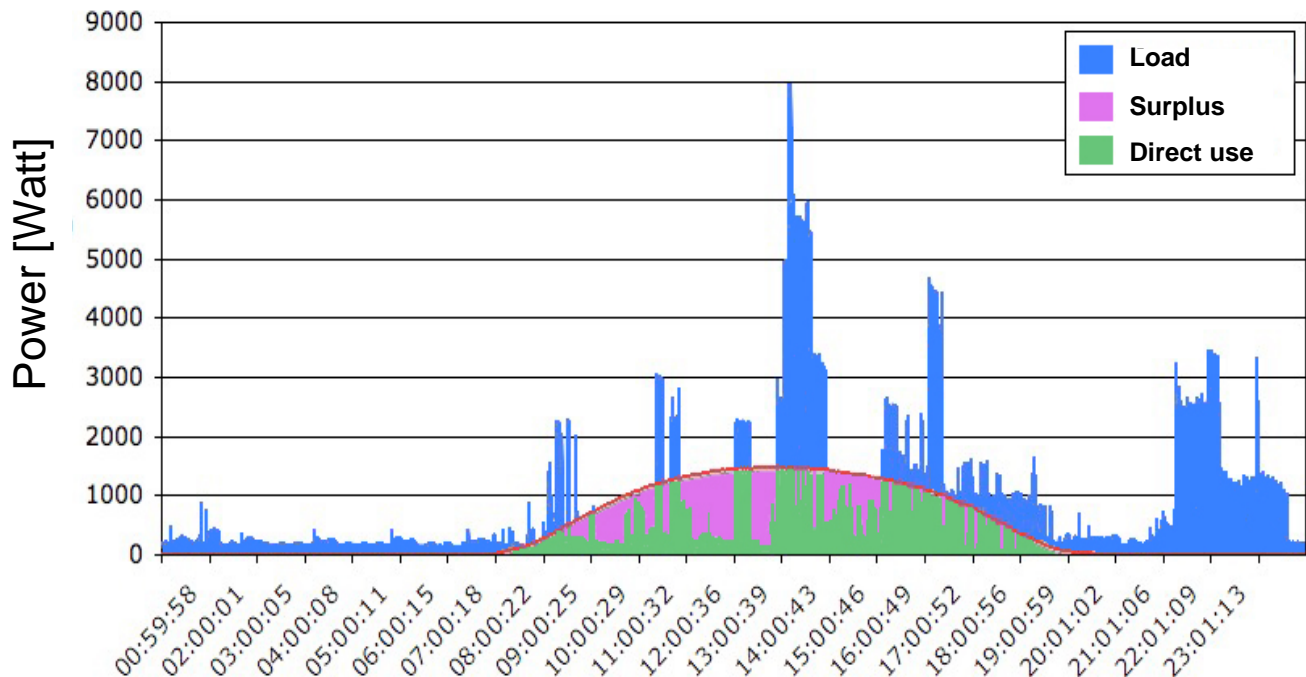
- Quarter hourly forecast of load profiles for each single client
- Differences between supply and demand have to be matched with backup power stations in real time



- Quarter hourly forecast of supply for all power input
- PV, RE, DRE are a negative load
- Solar power forecast has to become as precise as load forecast

**There is only a monetary value of electricity when its needed  
This has to be respected also by solar electricity!**

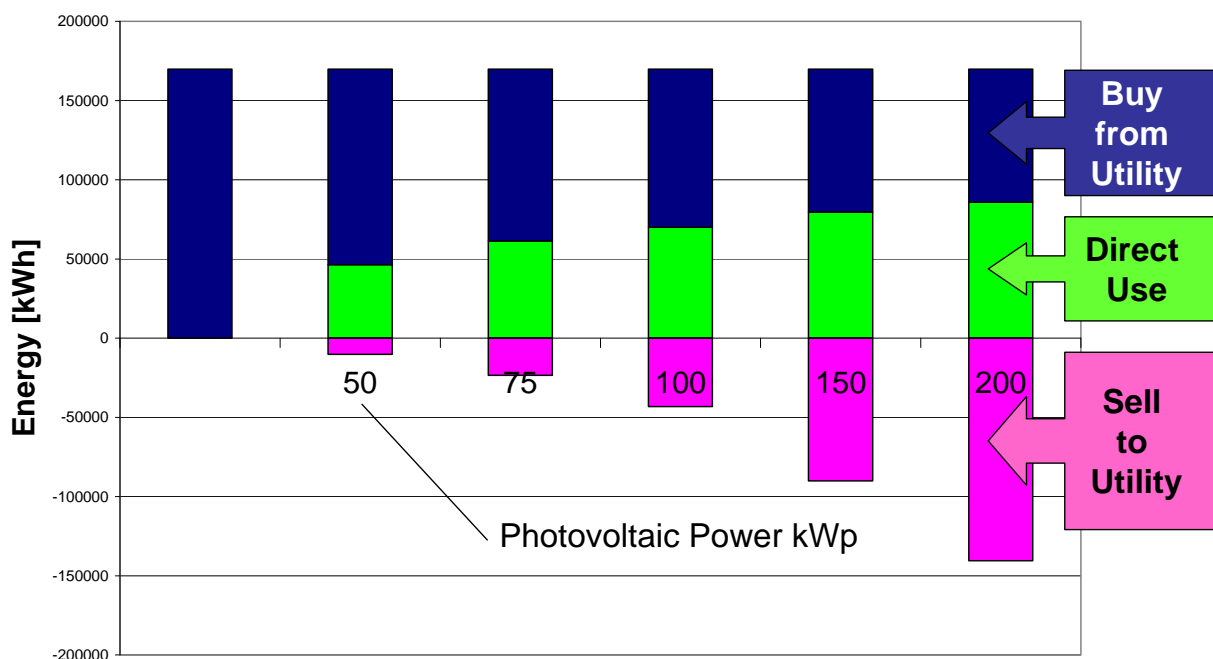




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Source: Studienarbeit, J. Conrad, Ulm 2010

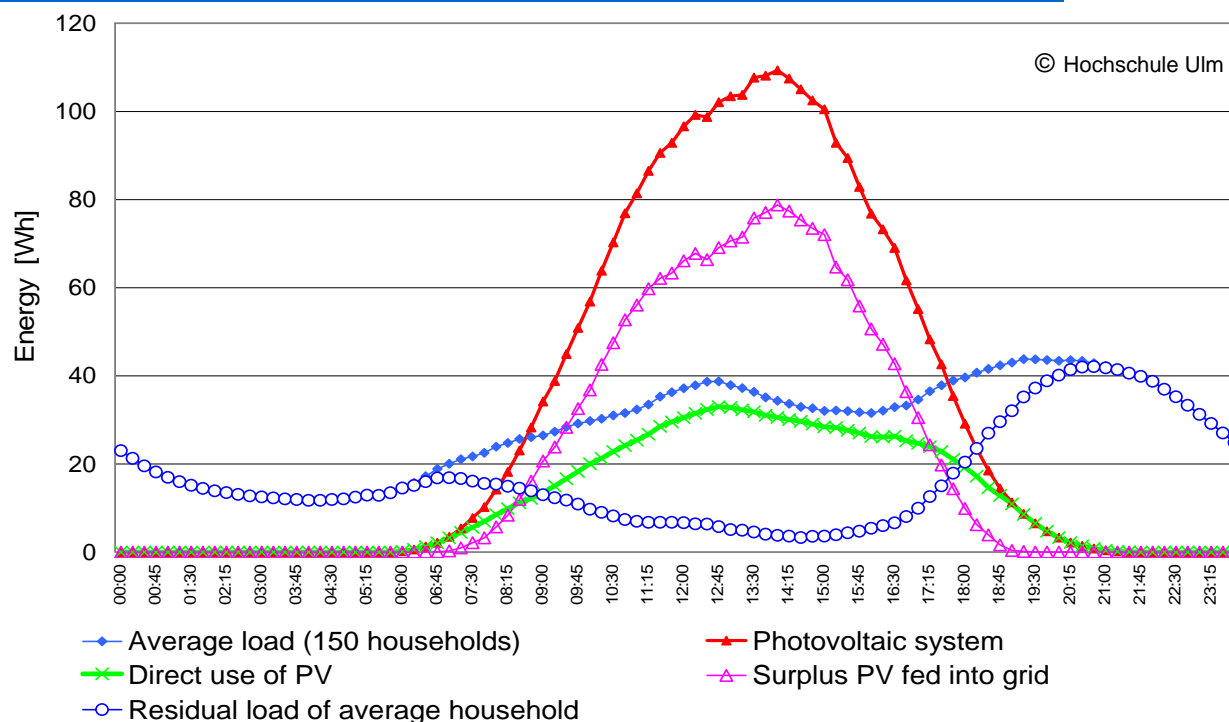
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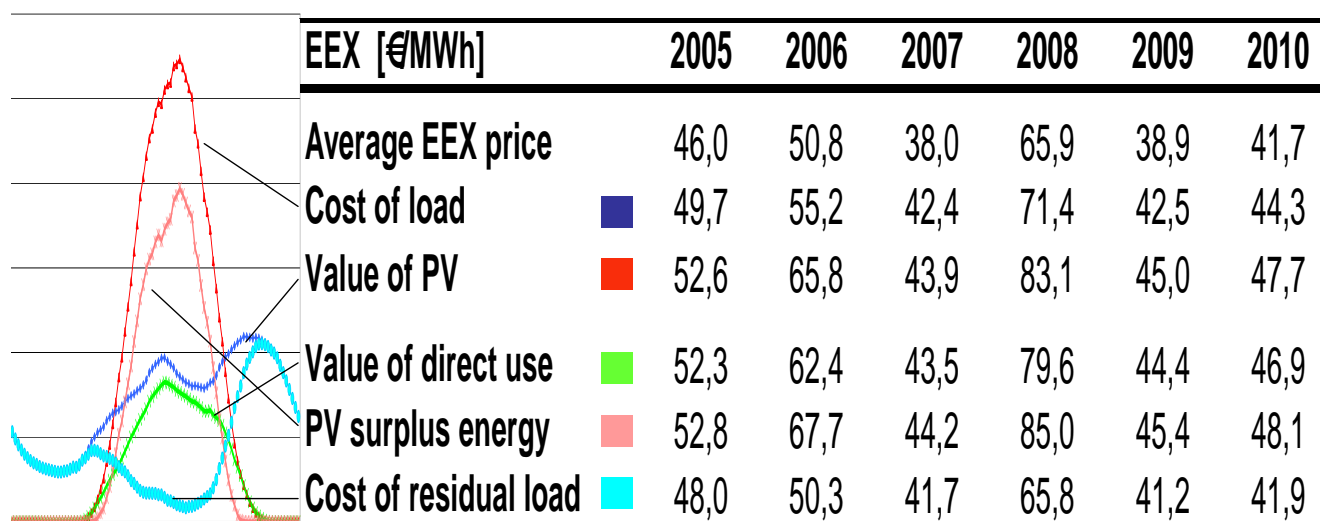
Source: Energy demand WEHA GmbH, Königsbrunn

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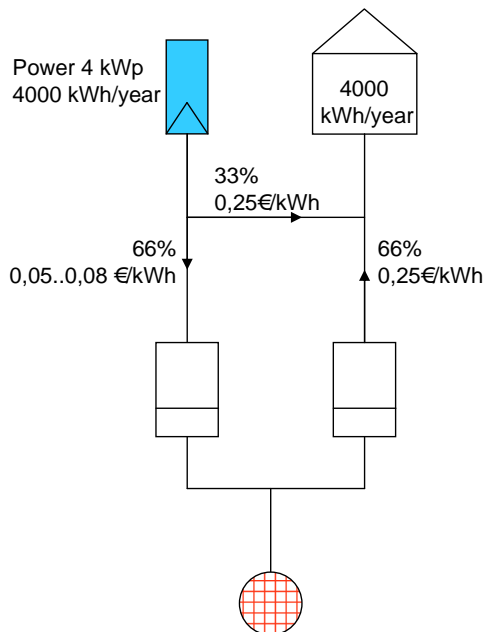
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Source: EEX, own calculation

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# Utility Photovoltaic Tariff



## Photovoltaic System

- ▶ 1/3 direct use, reduces energy bill
- ▶ 2/3 sales to Utility  
EEX value 0,05 to 0,08 €/kWh
- ▶ Average value 11,6 ..13,6 ct/kWh
- ▶ Option: Add on for "green electricity"

## Utility Advantage

- ▶ Load profile of residual load is cheaper
- ▶ Average Saving 7,32€/ household
- ▶ Saving = 15% of average profit
- ▶ Strengthening customer relationship

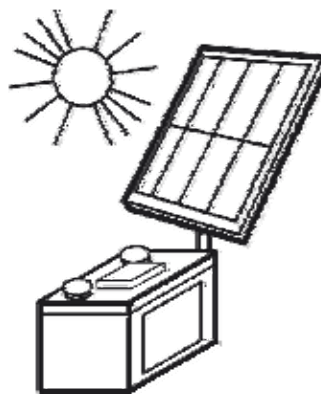
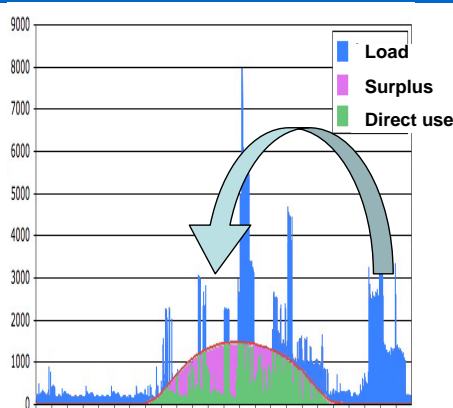
## Today's Real Value of Photovoltaic: 11,6..13,6 ct/kWh

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# Increase Direct Use



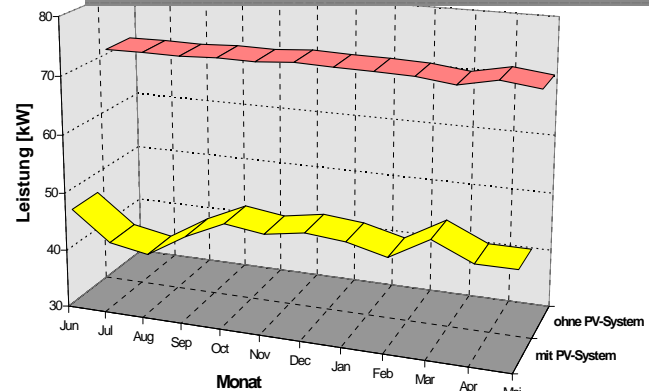
- ▶ Shift load to solar time
- ▶ Washing with solar is cheaper
- ▶ Shift solar energy to the time of load
- ▶ Store surplus energy into battery
- ▶ Use solar energy also for heat demand
- ▶ Connect PV to heat pump

# „Load Shifting in the Industry...

...1995“



- ▶ Trautwein GmbH
- ▶ Thermoforming of bathtubs
- ▶ with photovoltaic power

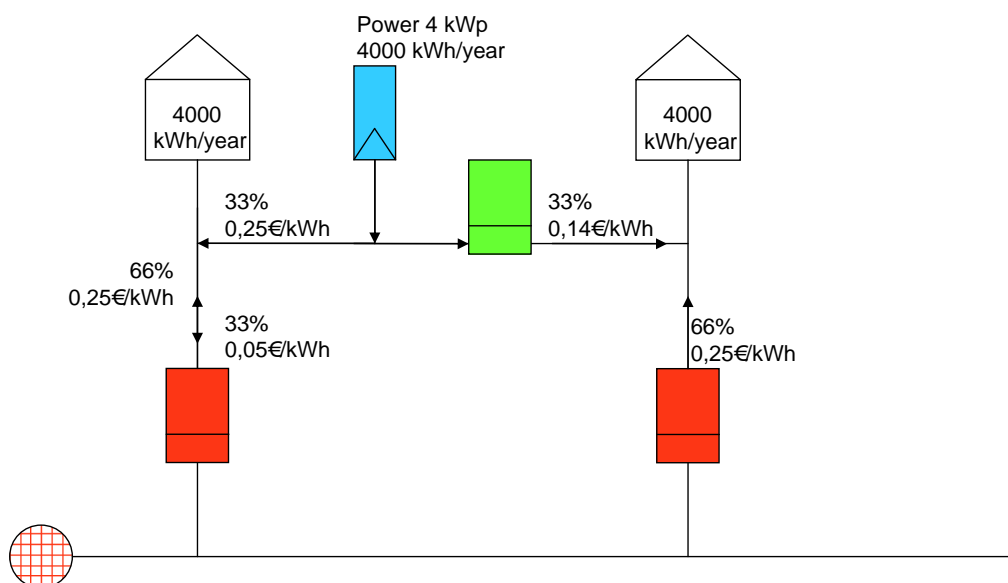


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# Decentralized Energy...

...needs Local Markets



Sell to your neighbour

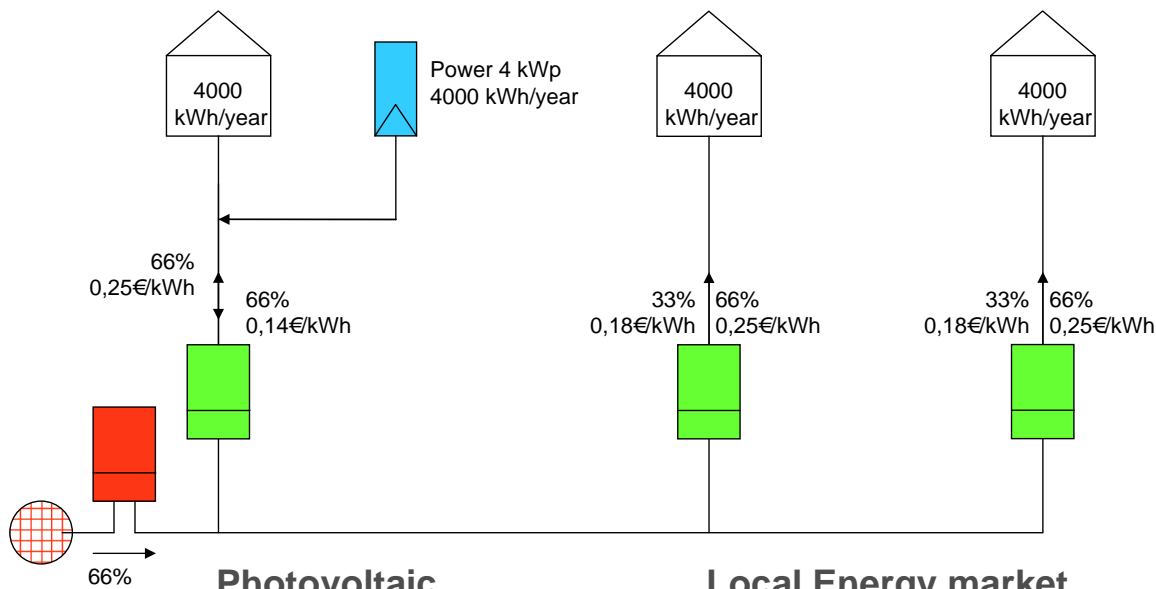
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# Decentralized Energy...

## ...needs Local Markets



### Photovoltaic

- Higher value of energy
- Avoided distribution loss

### Local Energy market

- Cost reduction 10...20%
- Long term price security
- Chance for new services

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## Conclusion



- Standard load profiles are no longer useful with direct use of solar energy
- For the valuation in monetary terms of load and supply we need to know the real load profiles
- The value of today's photovoltaic solar energy is 12..14 cent/kWh
- Decentralized power systems need local markets
- In a local markets the value of photovoltaic solar energy is 15..20 cent/kWh

**Photovoltaic systems are able to become a cost effective energy source in the energy market**

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# Outlook – Energy Meteorology

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How much of my load  
I can cover  
with solar energy ?

Investment  
decision

Quarter hourly  
solar radiation data

How do I know  
when it will be sunny  
and for how long ?

Load shifting  
demand side  
management

Adapt forecasting  
to  
home automation

What to do with surplus  
solar energy when  
feed in tariff drops to 0 ?

Sell or store ?

Connect forecasting  
with electricity stock  
exchange information

Energy meteorology  
New research field to make use of RE

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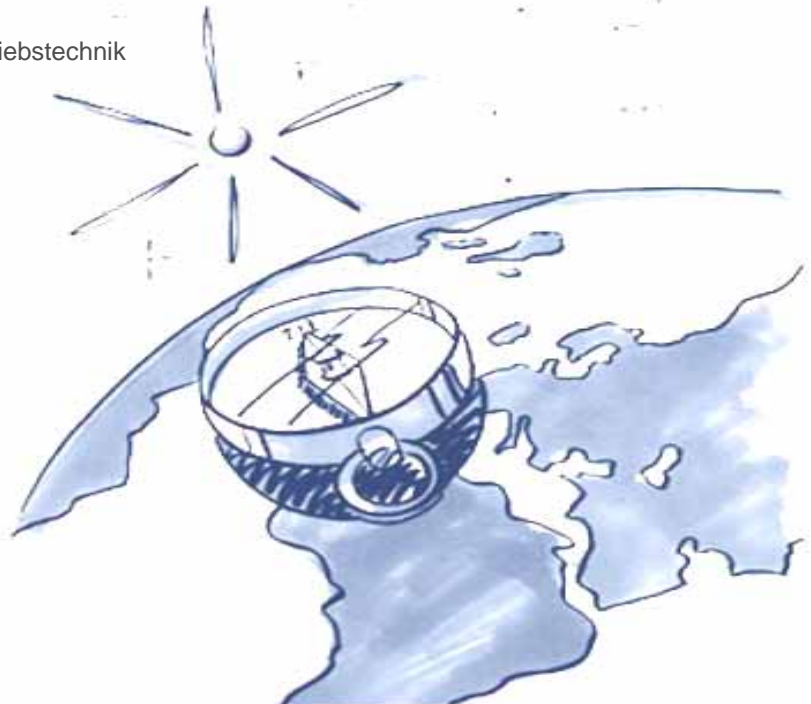
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