




# Does ‘Affordable’ Solar PV really change everything?

A2SE Summer Study, 2013

Gordon Weiss and Gilles Walgenwitz, Energetics

energetics<sup>•</sup>

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“Solar Electricity  
Now Under Half  
The Cost of Grid  
Power For Australian  
Households.”

Title of a recent blog

energetics<sup>o</sup>

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FACT

”Sydney's best solar deals”

[www.??????.com.au/](http://www.??????.com.au/)

1.5 kW solar for \$1979

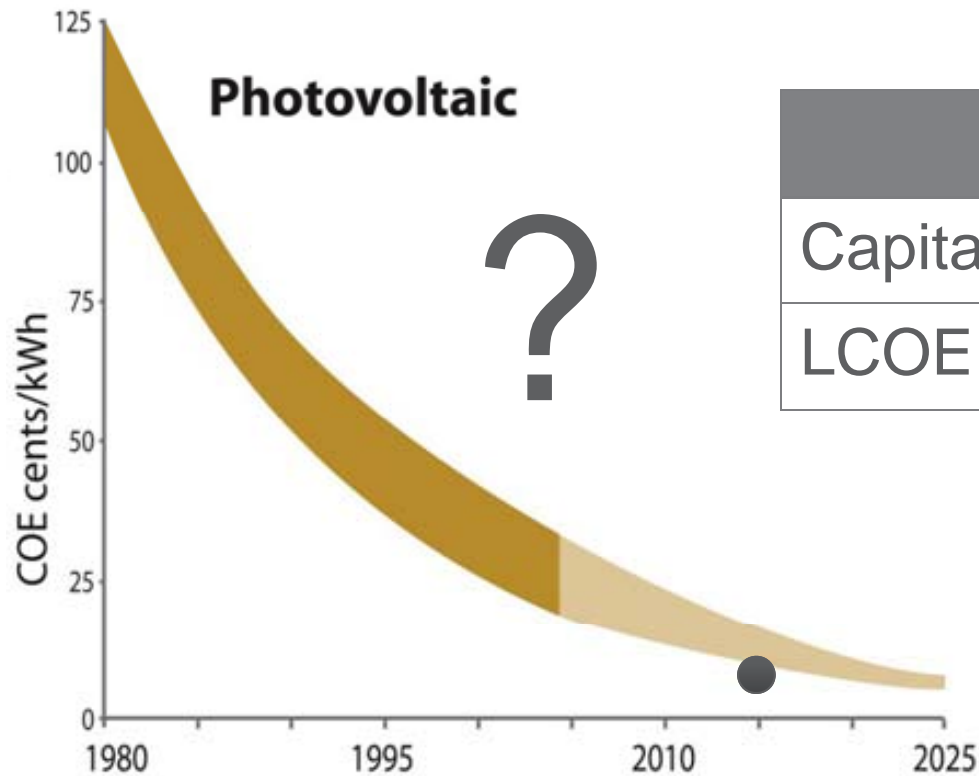
3.0 kW solar for \$4399

# Is Solar PV really affordable?

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# Levelised Cost of Electricity



	1.5kW	3.0kW
Capital cost	\$1979	\$4399
LCOE (c/kWh)	10.8	11.7

## Assumptions:

Capacity factor of 14%

Discount rate of 7%

30 year economic life

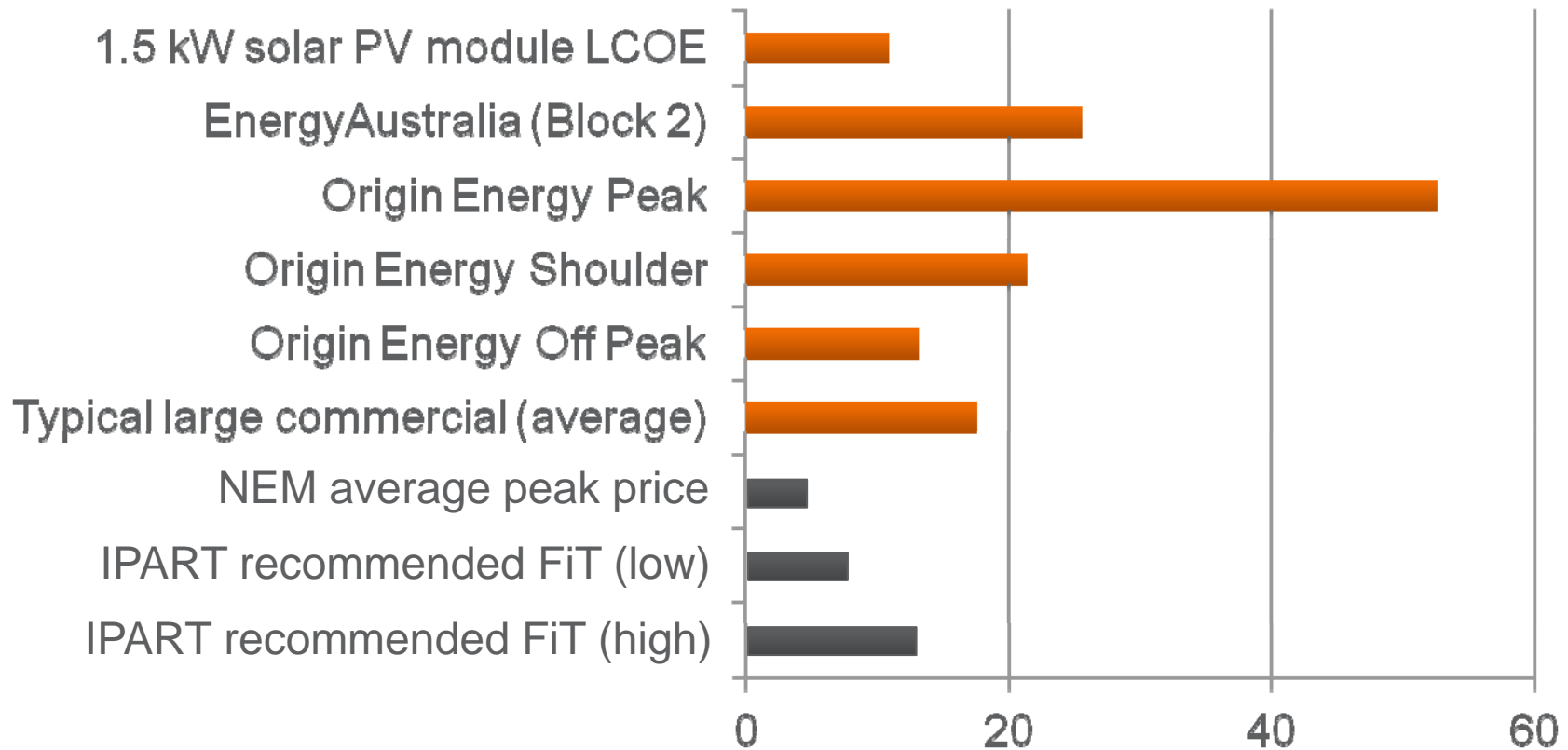
Maintenance cost of \$25/year/kW

## Sources:

BREE, IPART, NREL

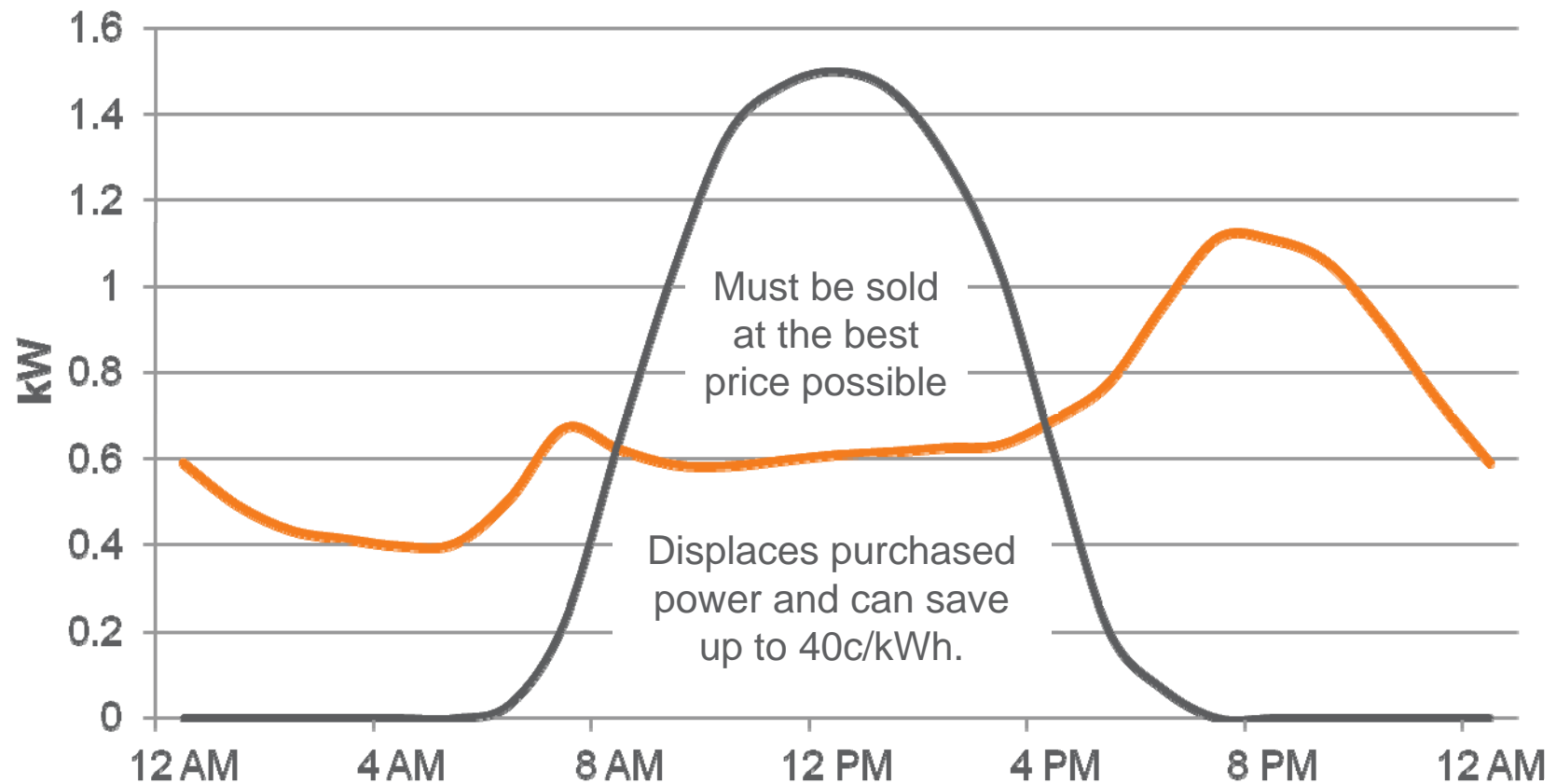
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# Price comparisons



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# Generation and consumption profiles



Must be sold  
at the best  
price possible

Displaces purchased  
power and can save  
up to 40c/kWh.

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- Load profile for a typical residence
- Maximum power from a 1.5 kW solar PV unit

## What it means

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If electricity from solar PV displaces purchased electricity, then its value is the same as the price of the purchased electricity.

If it must be sold then its value is the price a retailer is willing to pay.

The value of solar PV depends upon the demand profile, the size of the system, the actual price for displaced power and the potential power sale price.

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# Making the numbers work

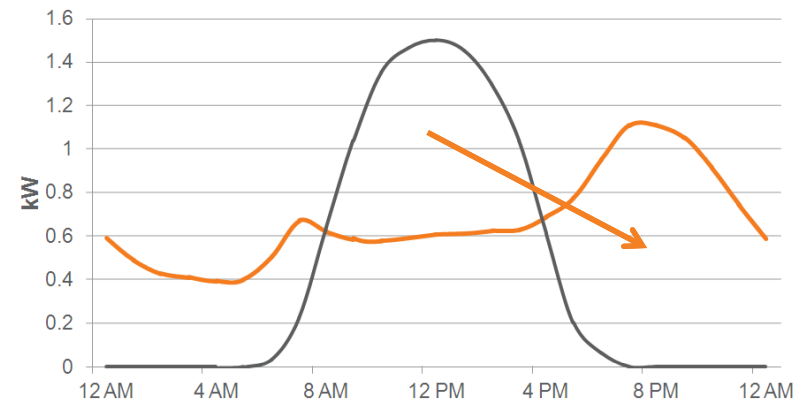
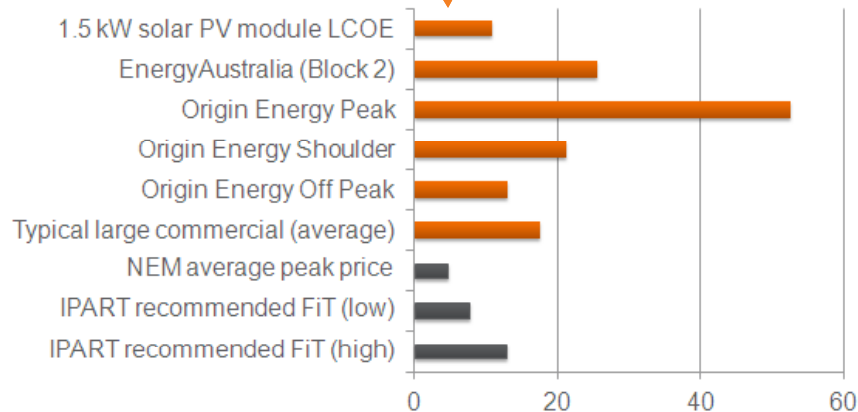
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# Making the numbers work



Make this smaller



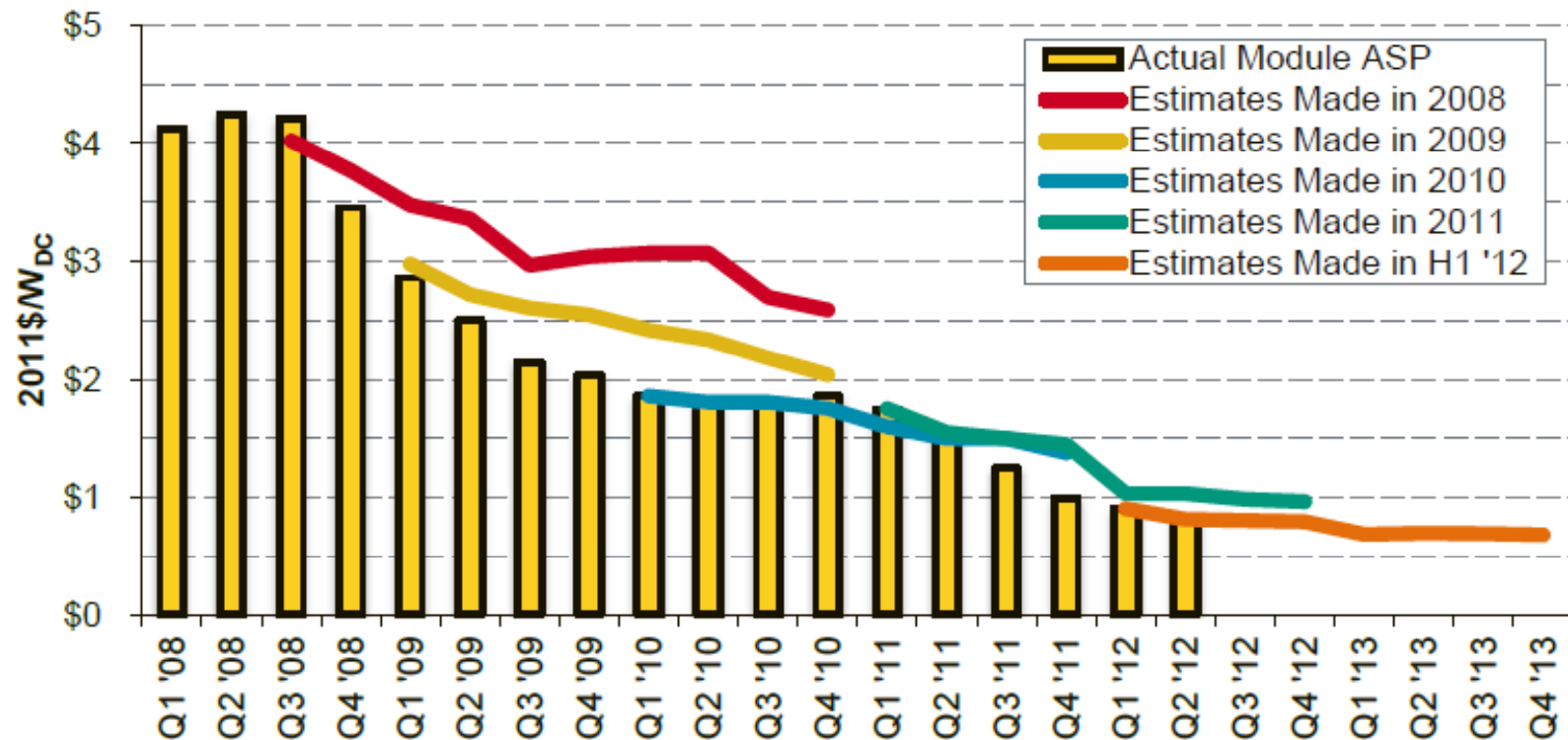
or export less and  
displace more

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# Reduce the capital cost per kW



Everyone is aware of:



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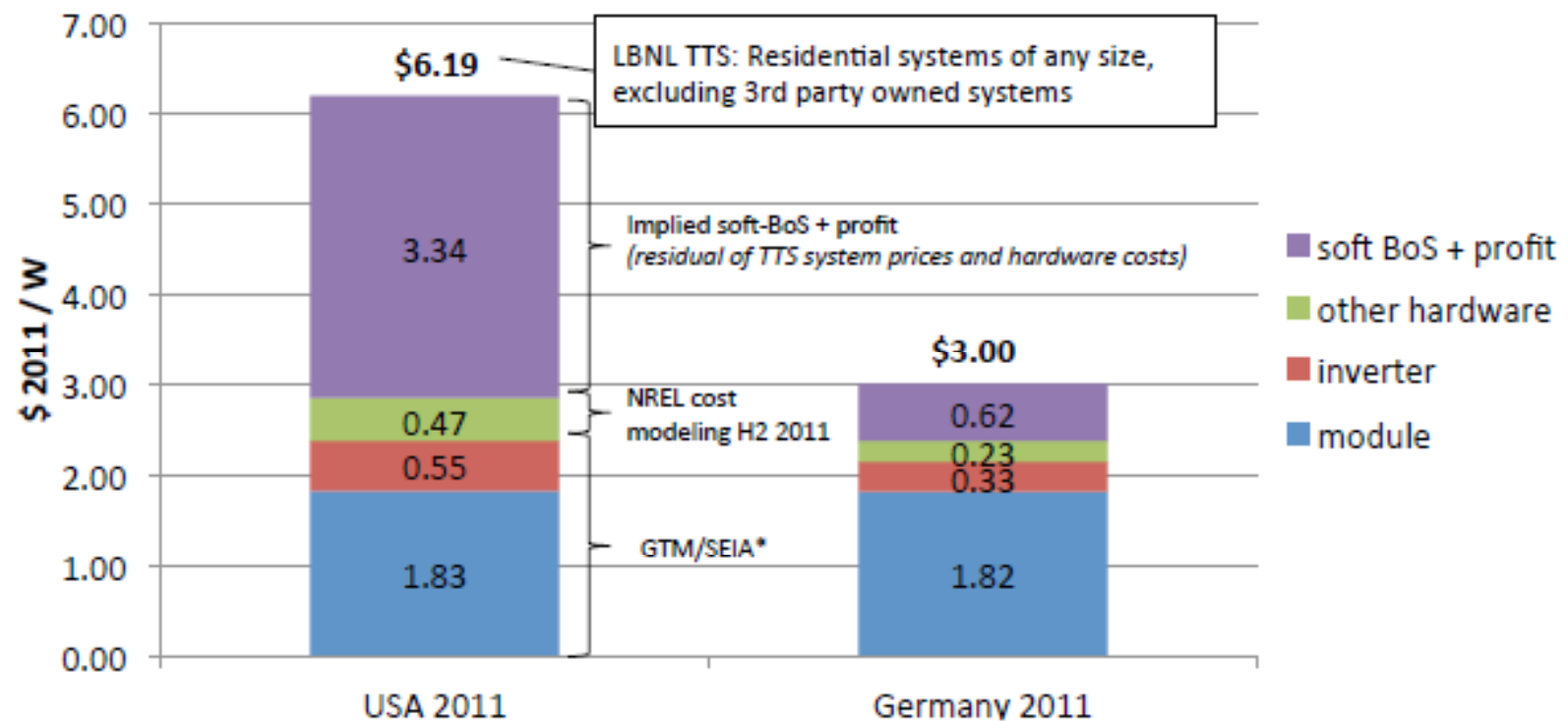
Source: National Renewable Energy Laboratory ,  
Lawrence Berkeley National Laboratory



# Reduce the capital cost per kW



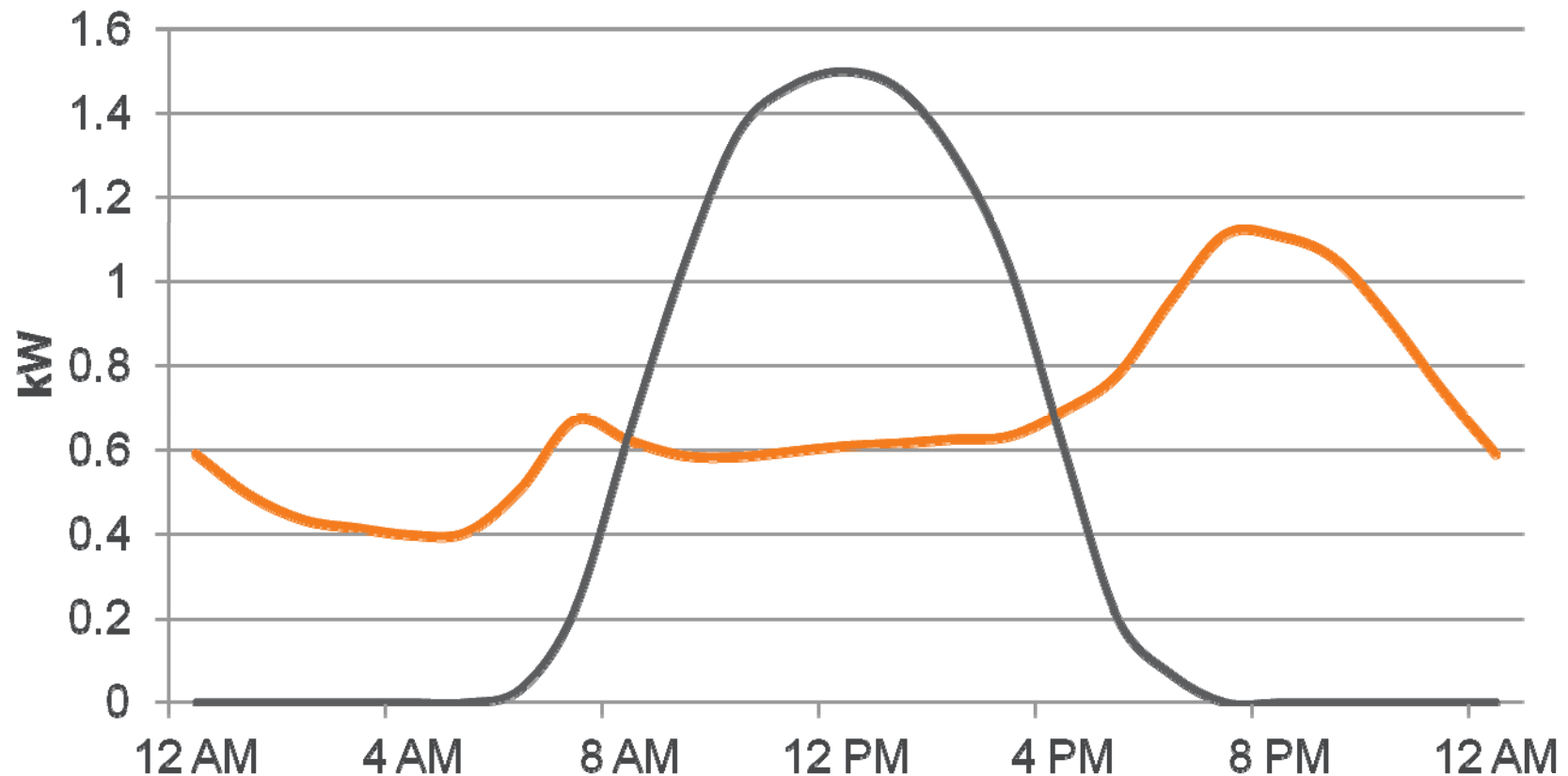
Fewer may know of:



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Source: Lawrence Berkeley National Laboratory

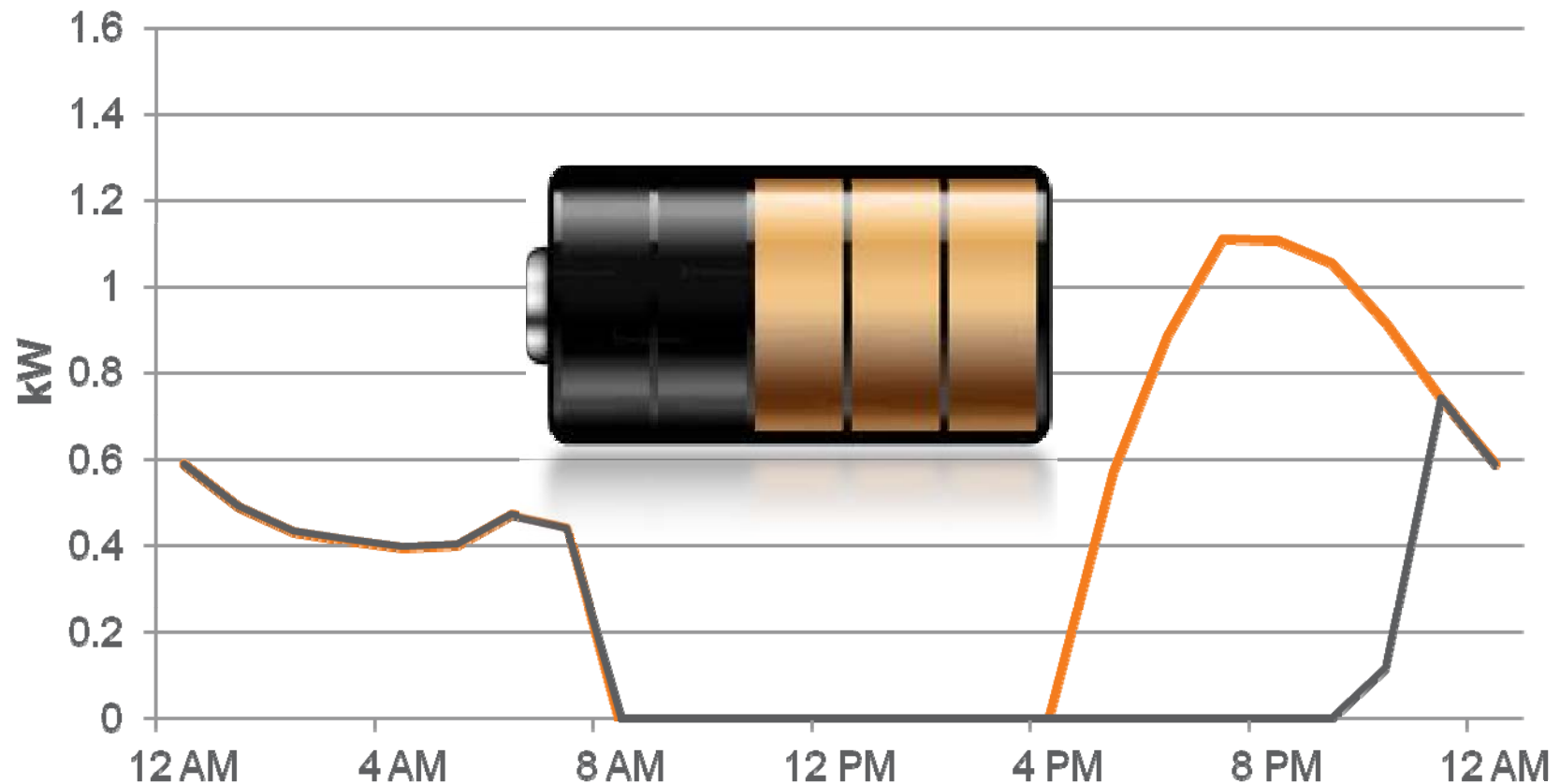
# Displace more purchased power



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- Load profile for a typical residence
- Maximum power from a 1.5 kW solar PV unit

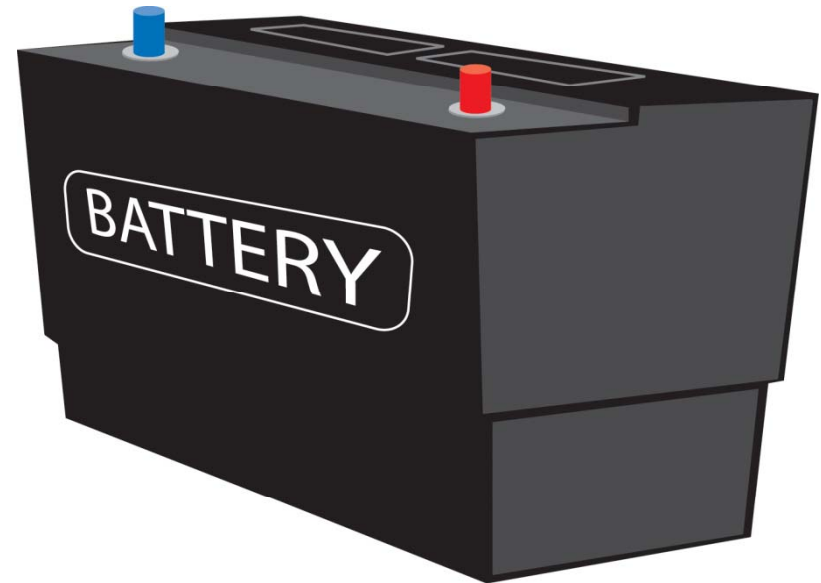
# Displace more purchased power



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— Imported power  
— Imported power if all solar power used

# Is storage worthwhile?



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# Is storage worth it?

## The house

Average daily electricity use of 16.1 kWh  
Daytime electricity use of 6.0 kWh

## The PV system

Installed cost of \$2900/kW  
Maintenance is \$25 per year per kW  
Solar PV capacity factor of 14%  
Lifetime of 25 years

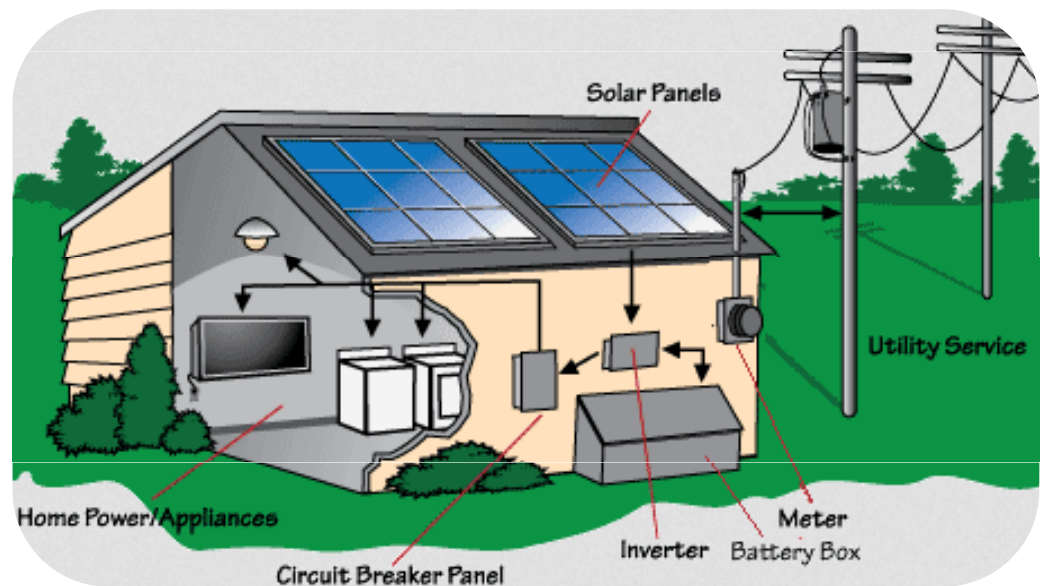
## The battery

Lifetime of 7 years  
Levelised cost of \$400.00 per kWh  
Battery cost falls by 5% per year

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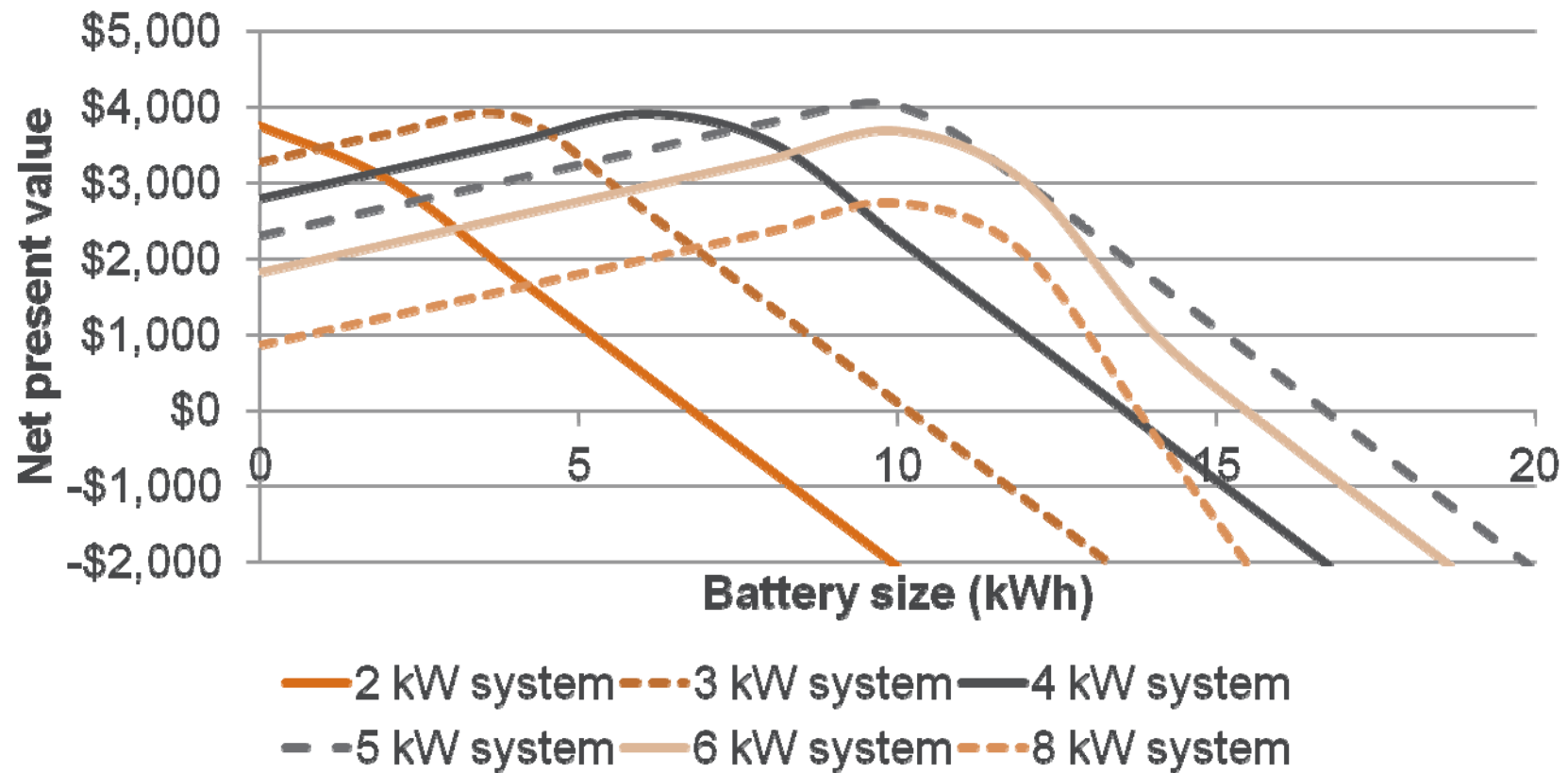
## The financials

Electricity price \$255/MWh  
Electricity FiT \$100/MWh  
Discount rate of 7%  
Inflation rate of 3%



Courtesy of National Renewable Energy Laboratory

# Value of storage



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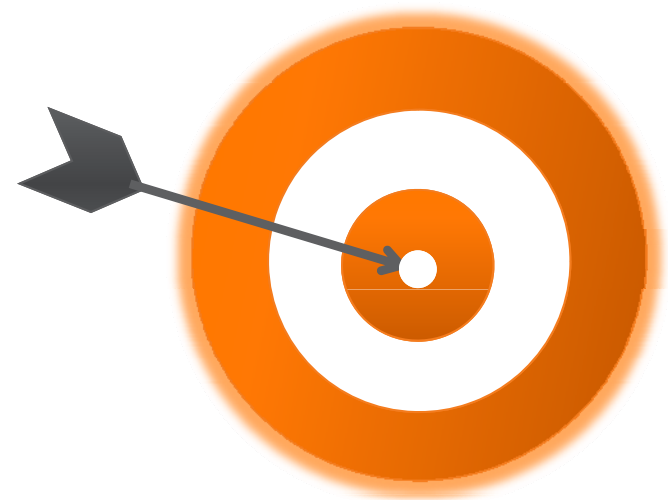
# The sweet spot

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**5.35 kW solar PV module, that provides enough power for 24 hours of demand.**

**10.6 kWh battery capacity which stores surplus power to be used at night.**

**It means no import and no export.**



# Sensitivity

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**So long as the LCOE is greater than the FiT, the best size for the solar module is the one that just supplies the house.**

**If the LCOE is less than the FiT then the sky is the limit.**

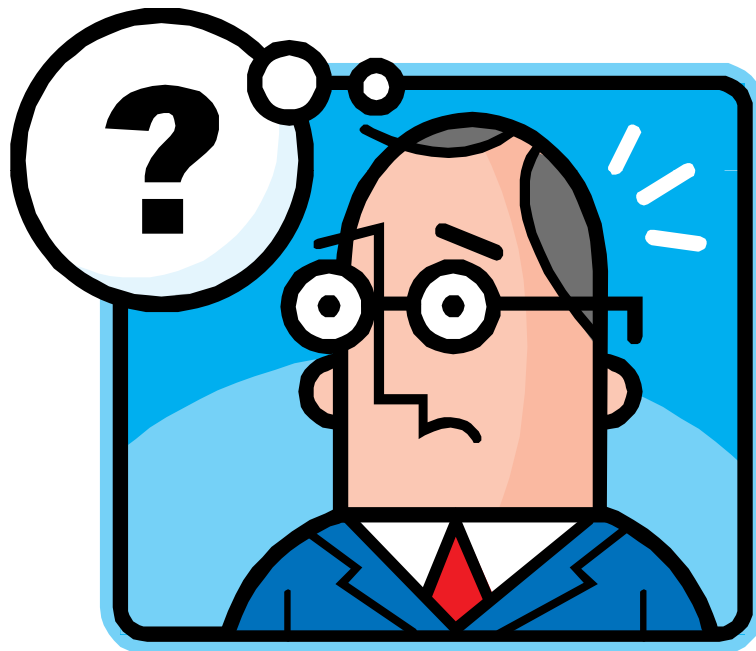
**The battery only works if the LCOE for the battery plus solar module is below the power cost.**

**And nothing works if the LCOE for the solar PV module is greater than the cost of grid power.**



# The key questions

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**Isn't the LCOE for the solar PV module without storage already below the cost of grid power?**

**What is the value of cheaper storage?**

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# The challenges



Sunday

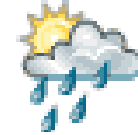
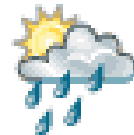
Monday

Tuesday

Wednesday

Thursday

Friday



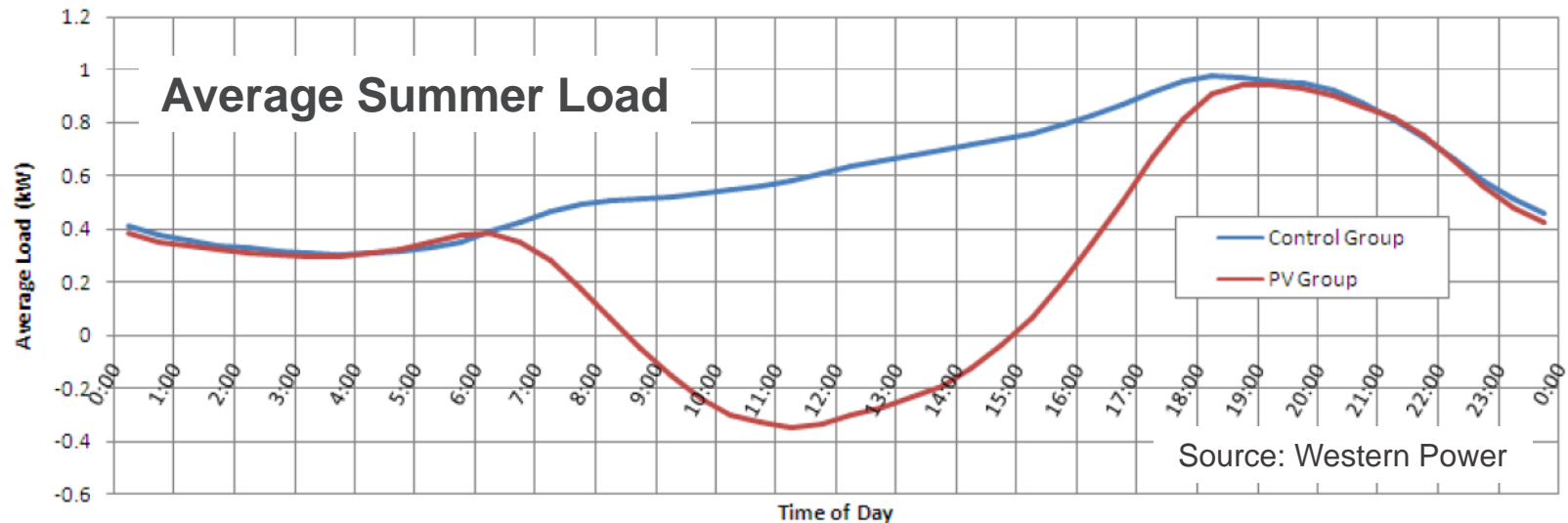
Perhaps you need more than one day's storage.

And maybe a backup generator.

Or can you just rely on the grid connection?

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# The view of the other power users



**Other network users may see no value in solar PV as it uses capacity, does not reduce peak demand and is not billed for consumption.**

**Capacity based charging for network connections will address this concern.**

**And may kill the economics of solar PV along the way.**

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# The value of storage

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- ✗ **Storage linked to residential solar PV makes it harder to recover network investment through consumption based tariffs.**
- ✓ **But it can greatly reduce peak demand, and so benefit all electricity consumers.**
- ? **The value of this trade-off needs to be debated.**



# We live in interesting times

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**Distributed renewable energy is about to be very big because it is now cost effective in terms of generated power.**

**Coupling distributed renewable generation with storage may introduce options for peak load management and improve its attractiveness from the perspective of other electricity users.**

**But it affects the cost recovery of existing network assets.**

**Distributed renewable energy may not be as cost effective if it needs to contribute to the cost of the network assets.**

# Finally

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**Renewable energy is now 'affordable'.**

**But who pays to make it dispatchable?**

**And perhaps we should start a conversation about this.**

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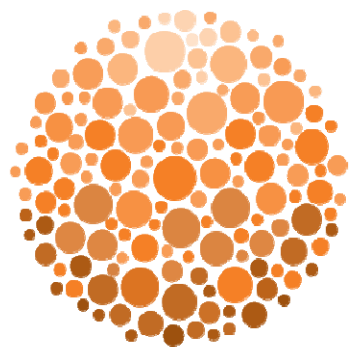
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