



# PV for Heating & Cooling: A PV perspective

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PVPS

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# What is IEA PVPS?

- Implementing Agreement from International Energy Agency – Energy Technology Network.
- Established in 1993
- 29 members: 24 countries, European Commission, 4 associations
- Strategy 2013-2017: *“To enhance the international collaborative efforts which facilitate the role of photovoltaic solar energy as a cornerstone in the transition to sustainable energy systems”*



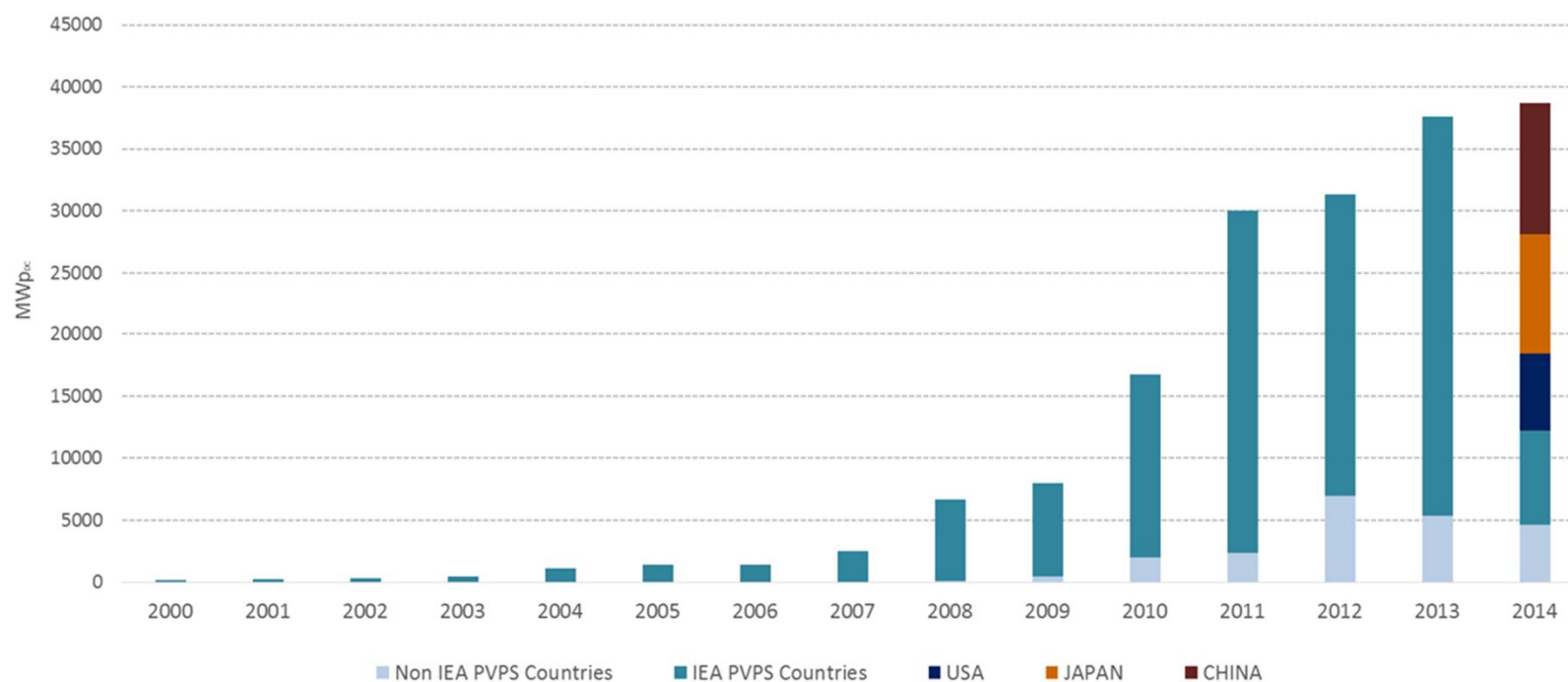
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# 40.000 MW installed in 2014

FIGURE 2: EVOLUTION OF ANNUAL PV INSTALLATIONS (MW<sub>pdc</sub>)

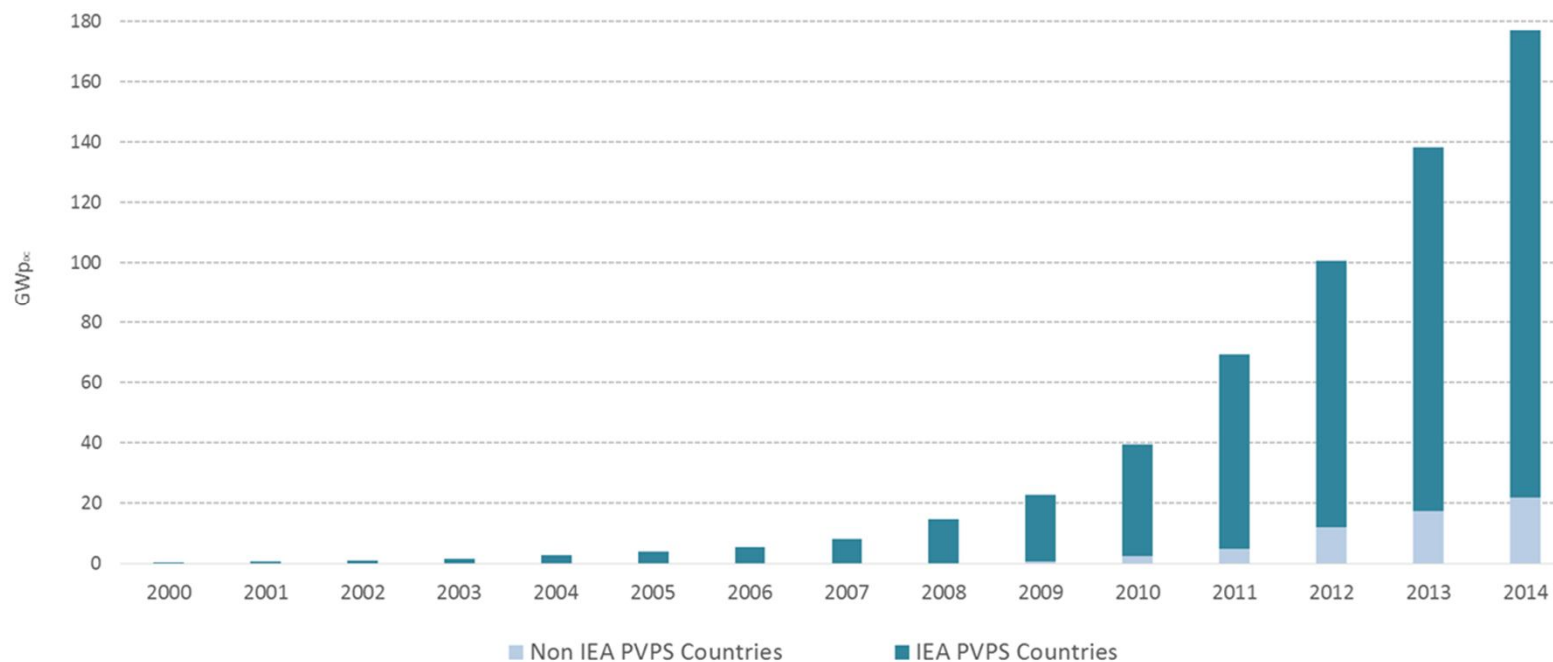


Source: IEA PVPS



# 177.000 MW end of 2014

FIGURE 1: EVOLUTION OF PV INSTALLATIONS (GW<sub>pdc</sub>)

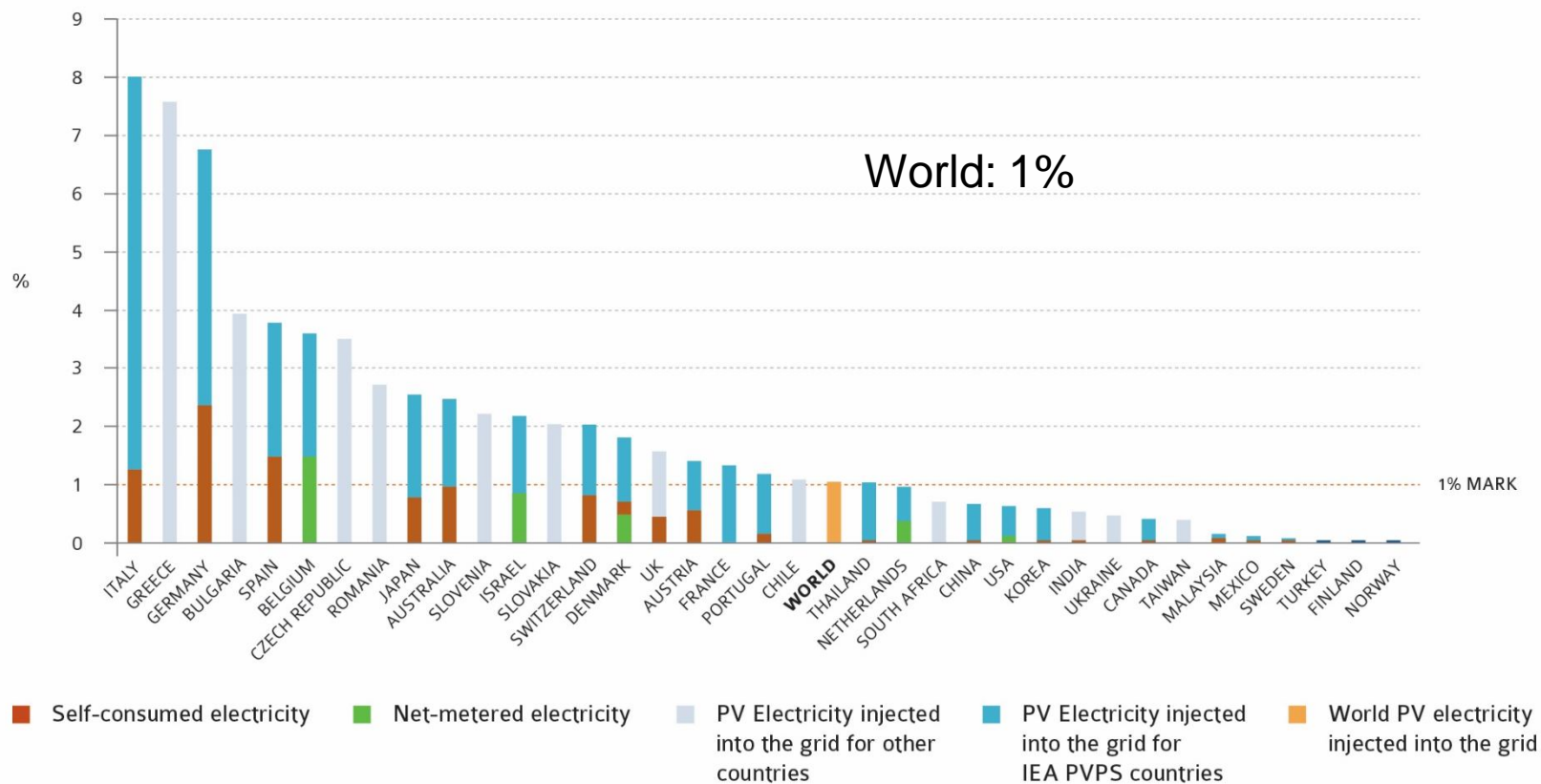


Source: IEA PVPS



# % electricity demand

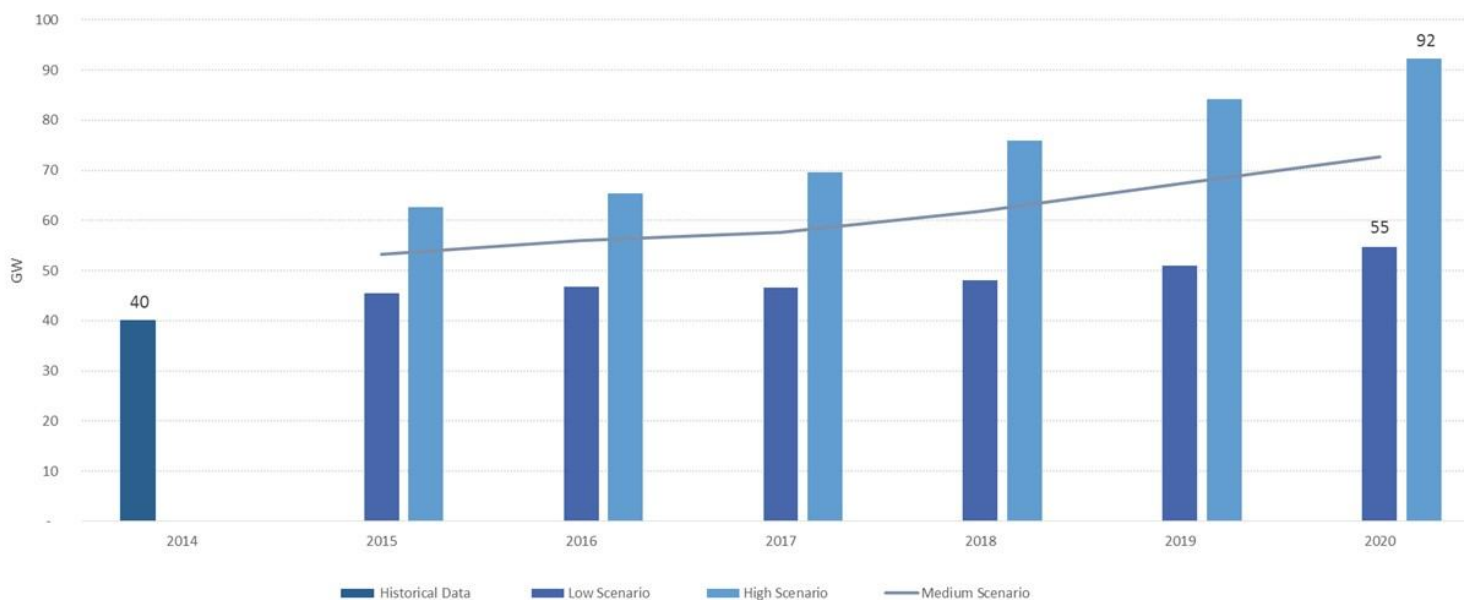
PV CONTRIBUTION TO THE ELECTRICITY DEMAND IN 2014





# Where is the market going to?

FIGURE 4.3 GLOBAL PV MARKET EVOLUTION 2014 - 2020

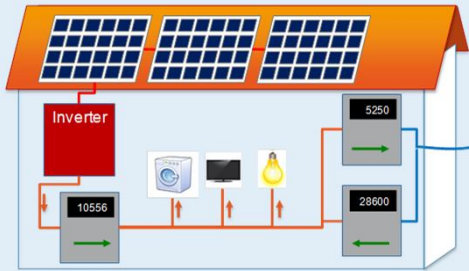


PV Market Alliance – Global PV Market Report 2015 - 2020

Global PV Market Report – *PV Market Alliance* 2015



# 2 Distinct PV Worlds



Distributed PV

Self-consumption,  
energy efficiency, grid  
parity, competition  
with utilities  
distribution business

Prosumers

One  
technology

Centralized PV

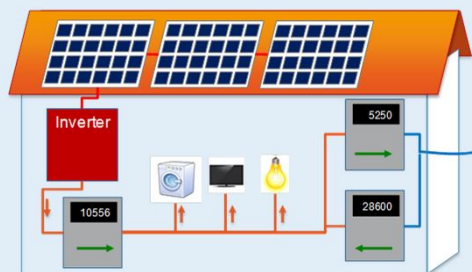
Producers

Grid injection, PPA,  
competition with  
utilities generation  
business





# Competitiveness of PV Solutions



Distributed PV

Producers

Savings on the electricity bill = Retail prices – « must Pay » (grid costs, taxes...)

One technology

Electricity sales = Wholesale market prices – forecasting premium

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Prosumers

Centralized PV





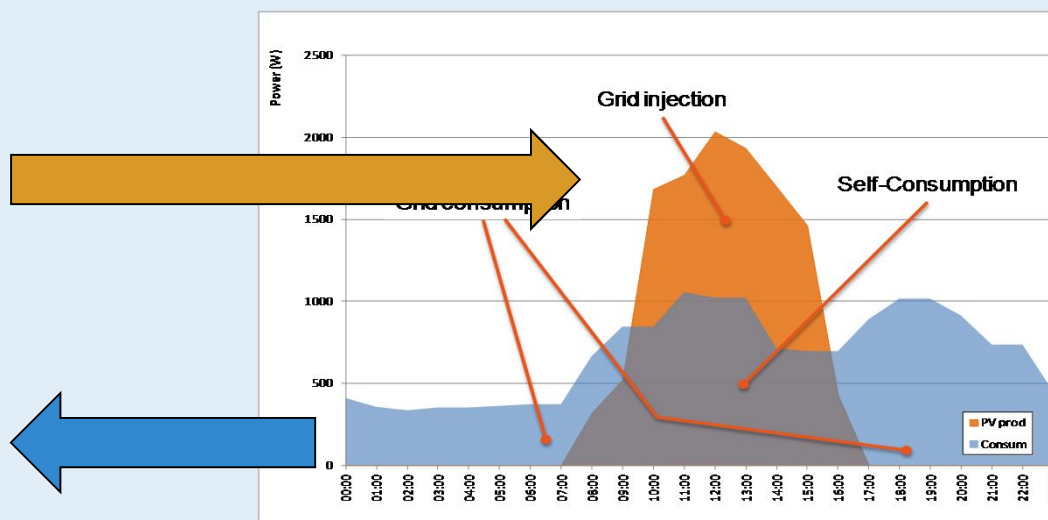
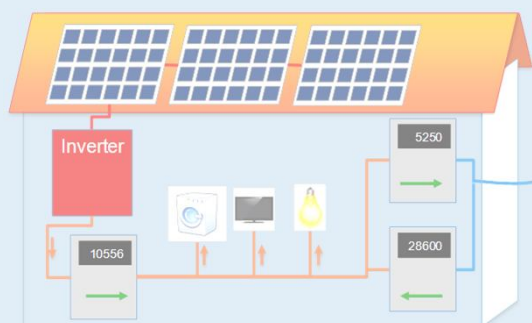


- Integration of PV into the energy system
- Diagramme de flux pour Italie
- Montrer par électricité
- Lien avec H&C



# The self-consumption challenge

- Self-consumption of PV installations
- 20 to 100%



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- Challenge: minimizing grid injection
- Solutions: decrease PV system size, DSM, Storage

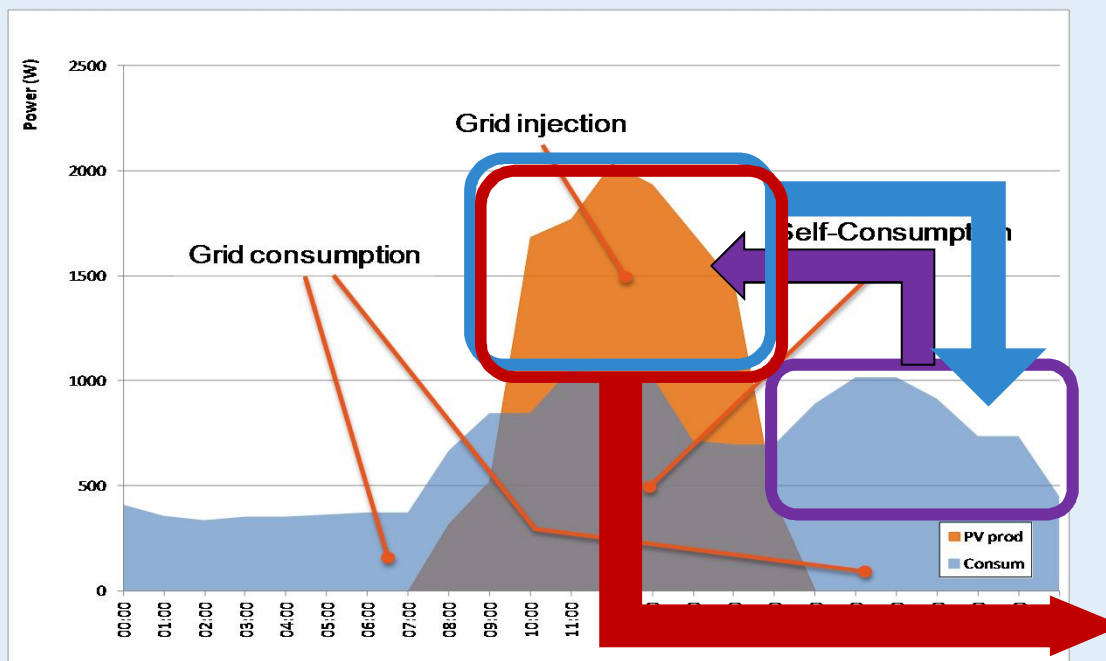


# DSM & Storage Solutions

DSM

Electricity Storage

Other uses(out of the load)



H&C, Transport

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# Research questions

- What self-consumption ratio of PV electricity can be reached ? With:
  - Direct use of PV electricity
    - Direct water heating
    - Air conditioners
  - Indirect use (Heat-Pump)
    - For hot water production
    - Heating
    - Cooling



# Competitiveness ?

- A simple business model (Ex: Spain)
  - PV electricity production cost: 0,1 EUR/kWh (1500 kWh/kWp + 1,5 EUR/WP + WACC @ 7%)
  - Residential electricity prices 0,2 EUR/kWh (assuming 100% savings on electricity bill)
  - Value of injected electricity = 0 !
  - With 30% SC: **-0,04 EUR/kWh**
  - With 70% SC: **+0,04 EUR/kWh**
    - Margin for investment in H&C
    - NPV\_20years (i=2%) for a 3kWp PV system = **3200 EUR**
- What about Italy?
  - NPV = **5700 EUR** (using Scambio Sul posto)

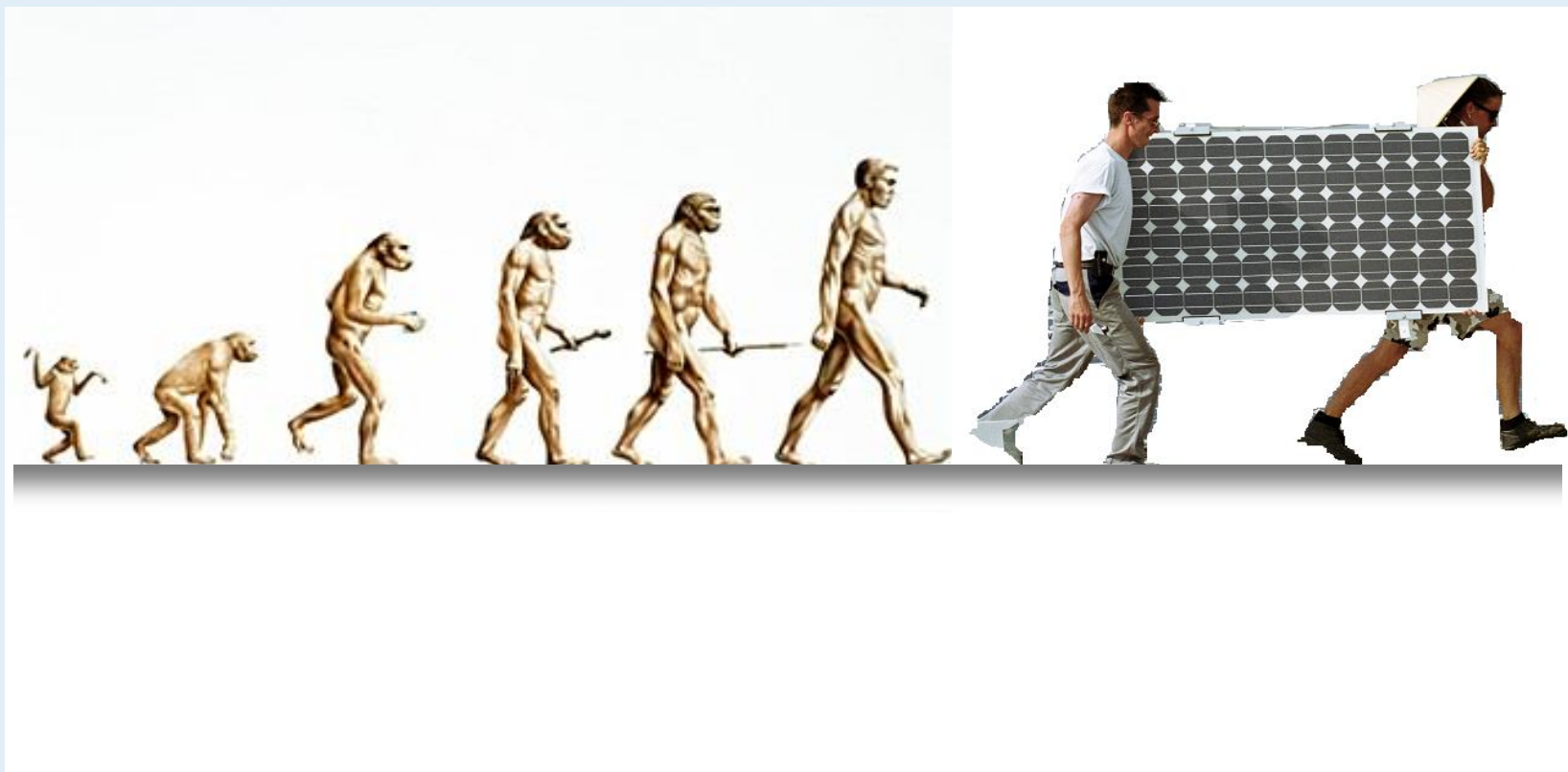


# Conclusion(?)

- PV declining costs are opening a range of new solutions
- PV and H&C offer grid integration and system integration solutions
- Solving the reluctance of regulators to allow grid injection of PV electricity at a fair value  $>$  local use
- Solutions already available?
- Need for a regulatory framework ? PEB ?
- Need for education: the electricity storage option is NOT the only one and NOT the cheapest one.
- Collaboration ?



# The Next Step in Evolution



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Thank you for your attention