Solar PV Uptake and Solar Thermal Programme

-MK Case Study-

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Overview

- The current state
- Solar energy in the INDC
- Boosting PV systems

The current state

Installed capacity

- Solar thermal
  - Year 2009: 18 MWth; 25 744 m2 [1]
  - Year 2014: 6.15% of the total number of surveyed households with solar collectors, 3809 m2 (3136 surveyed; 560 000 total number of households) [2]
- Solar PV
  - Year 2015: 102 plants, 16.71 MW, 21 411 MWh [3]

- [1] Solar Heat Worldwide, Market and Contributions to Energy Supply 2012, Solar Heating&Cooling Programme, IEA, 2014
- [2] Energy Consumption in Households, 2014, Statistical Review: Industry and Energy, State Statistical Office
- [3] Register of plants for production of electricity from RES, Energy Agency

Support schemes

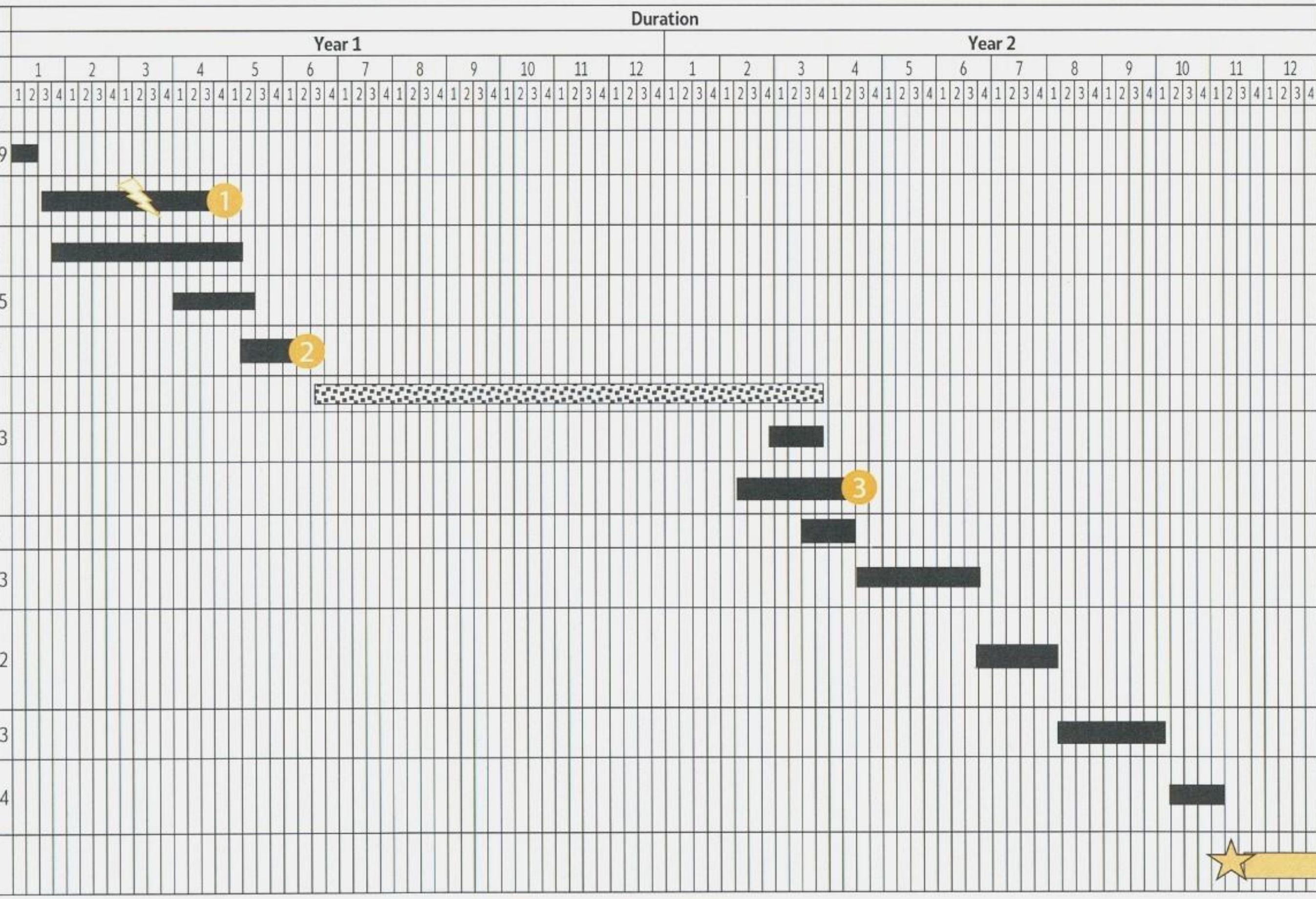
- Solar thermal
  - Program for partial subsidizing of purchased and installed solar thermal collectors in households (2007, 2009 – 2015) - subsidies of 30% from the total investment, up to 300 EUR per household.

    Subsidized households: 3611; Total budget: 800 000 EUR
  - Reduced VAT for solar collectors (5%)
- Solar PV
  - Feed-in tariff:
    - Maximum Plant Size: 1MW
    - Less than 0.05 MW: 16 €¢/kWh
    - More than 0.05 MW: 12 €¢/kWh
    - Fixed tariff period: 15 years
    - Cap:18 MW

Regulation and procedures: PV plants guidelines (2015)

3. STEP-BY-STEP DIAGRAM OF THE DEVELOPMENT PROCEDURES AND DOCUMENTS

	Procedure	Competent institution
4.1	Establishing a company	6.9
4.2	Use of the land	6.7, 6.8 or municipality
4.3	Environmental Impact Elaborate Study	6.6 or municipality
4.4	Approval for connection to the distribution system	6.5
4.5	Construction permit	6.7 or municipality
	CONSTRUCTION PROCESS	
4.6	Award of temporary status of preferential producer	6.3
4.7	Design and construction of the connection	6.5 or authorised company
4.8	Use permit	6.7 or municipality
4.9	Energy generation license	6.3
4.10	Registration of the facility in the Register of electricity generation facilities from renewable energy sources	6.2
4.11	Award of status of preferential producer	6.3
4.12	Power purchase agreement with the electricity market operator	6.4
	Start of generation and sale of electricity	



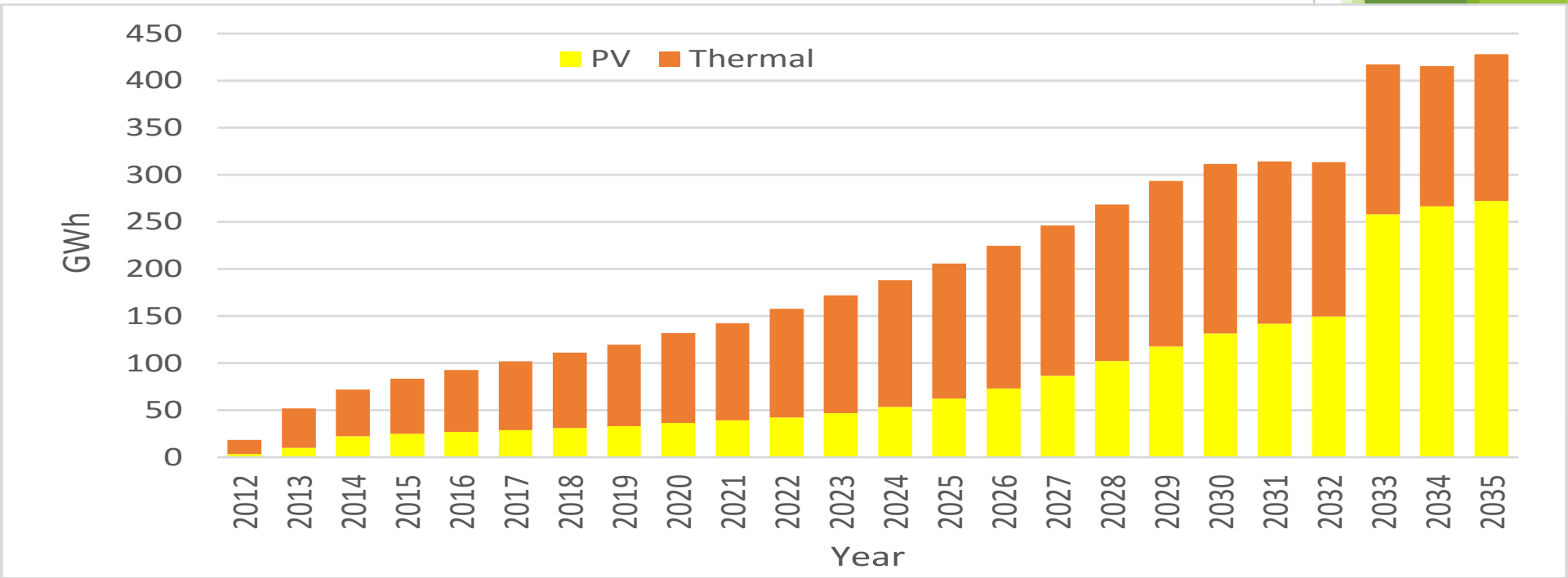
Legend:

- Duration of the procedure
- Construction works
- 1 Risk 1: Inability to obtain right of use of State-owned land; delays and uncertainty of outcome and costs

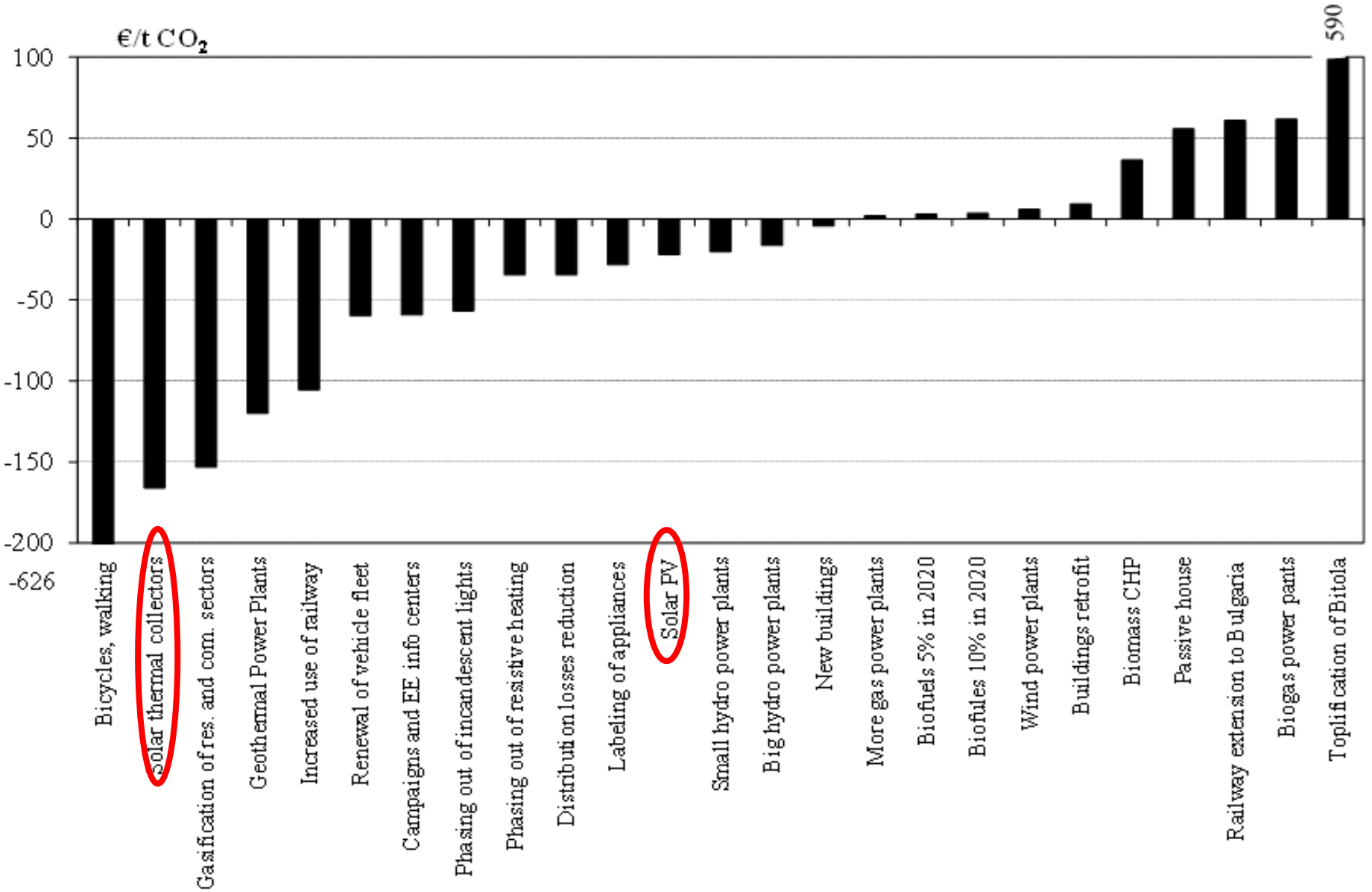
Solar energy in the INDC

Assumptions under the baseline and mitigation scenarios

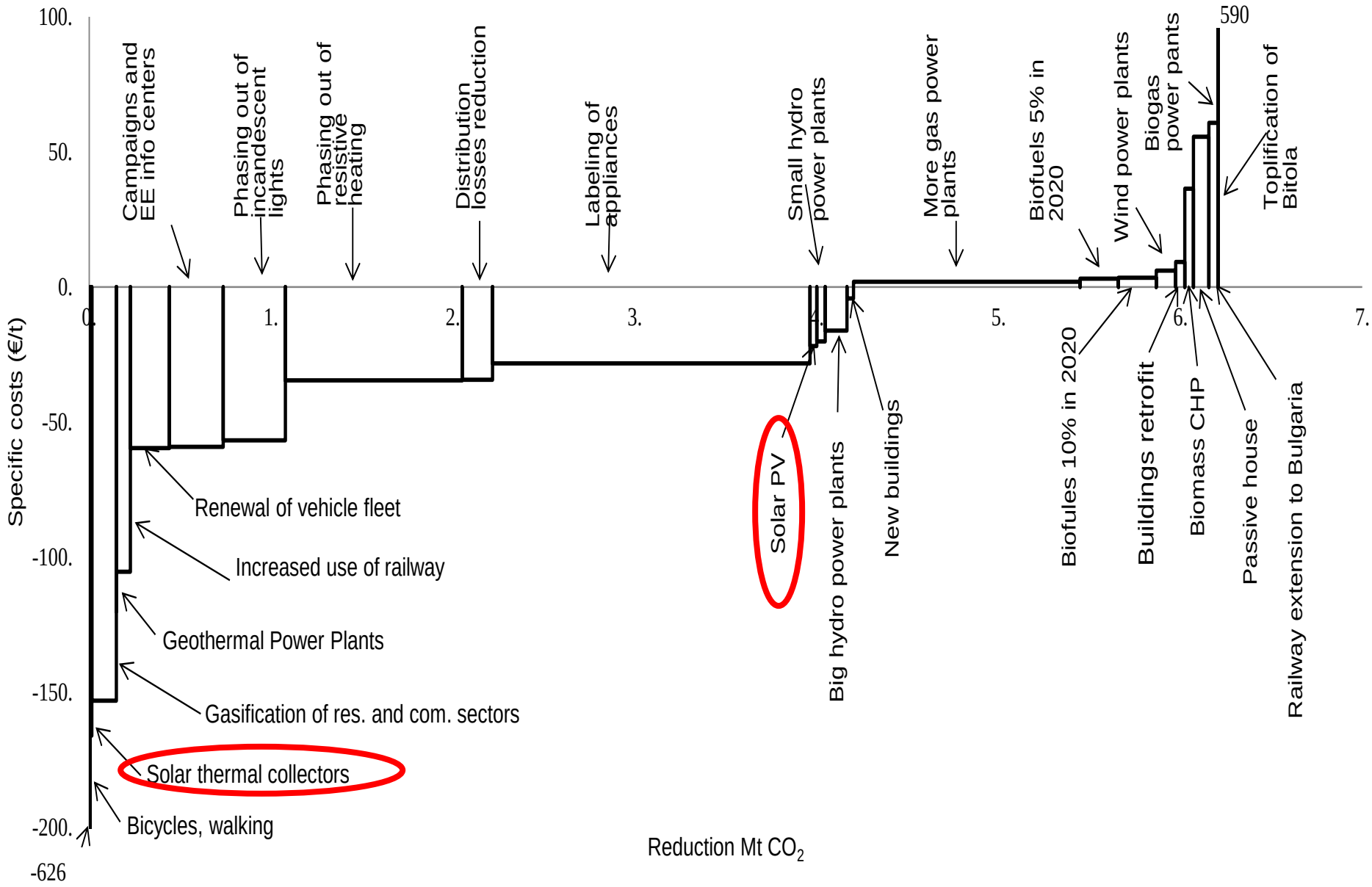
- Solar thermal
  - 60% of hot water needs in urban areas and 50% of those in rural areas by 2035 will be covered by solar collectors
- Solar PV
  - Is it assumed that 180 MW will be constructed by 2035



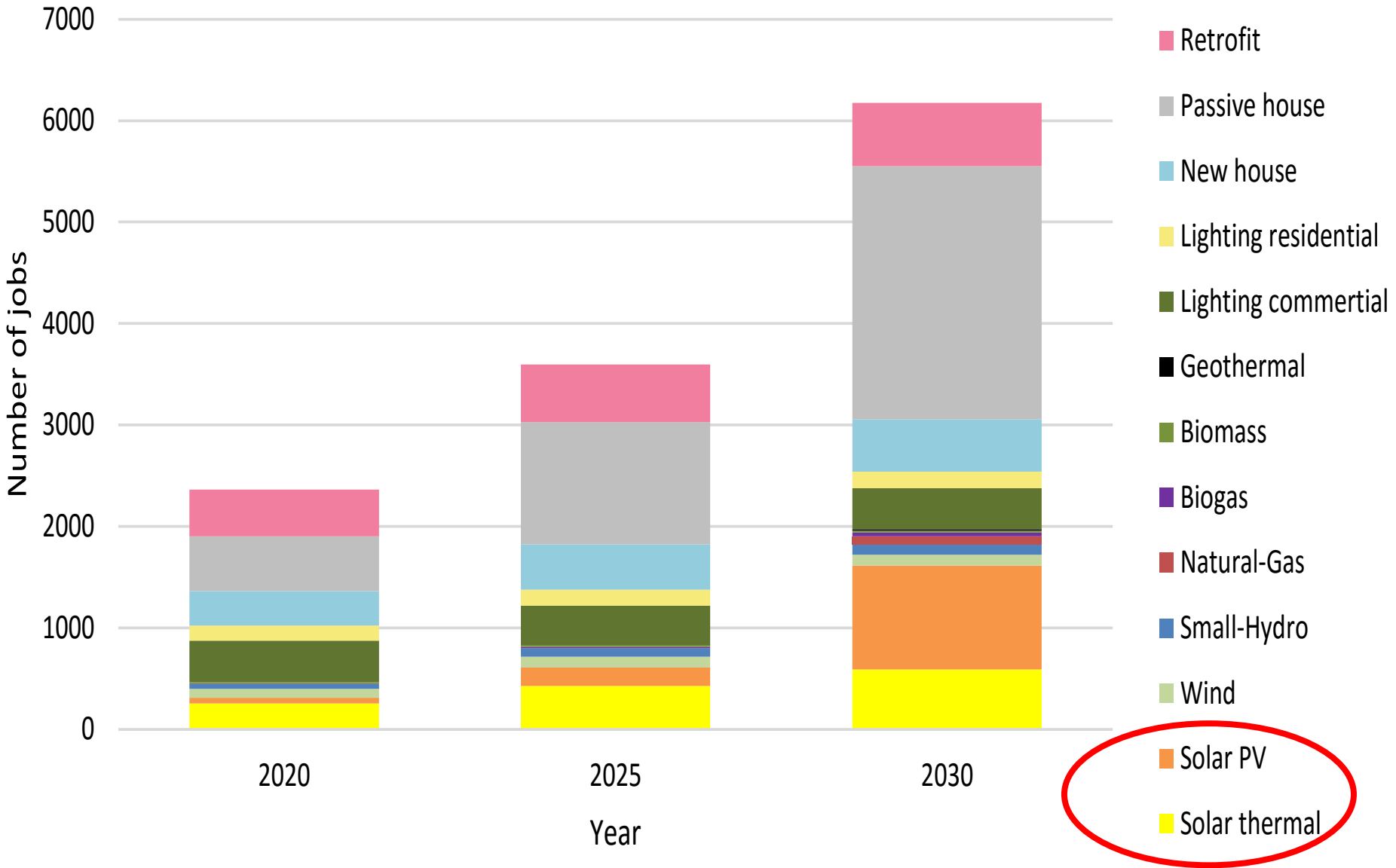
Economic evaluation



Marginal abatement cost curve (2030)



Social aspect: Domestic green jobs

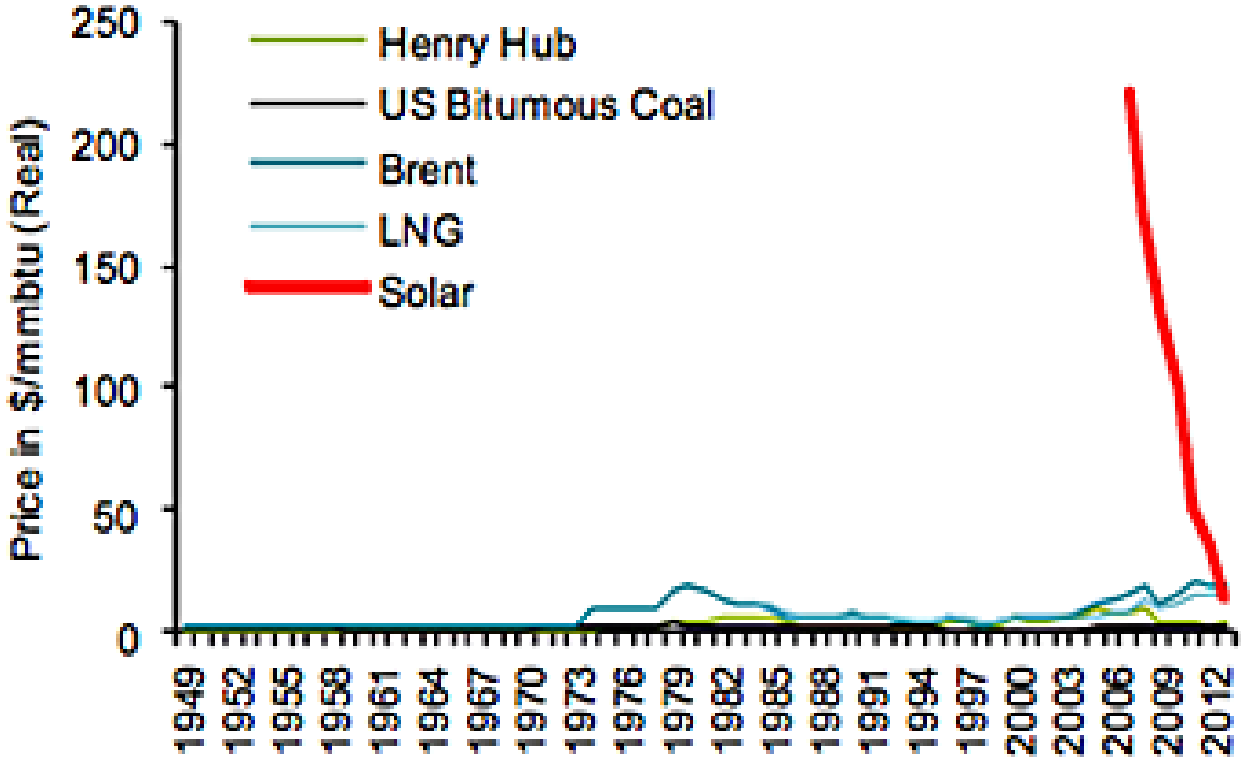


Boosting PV systems

International Context: PV Revolution

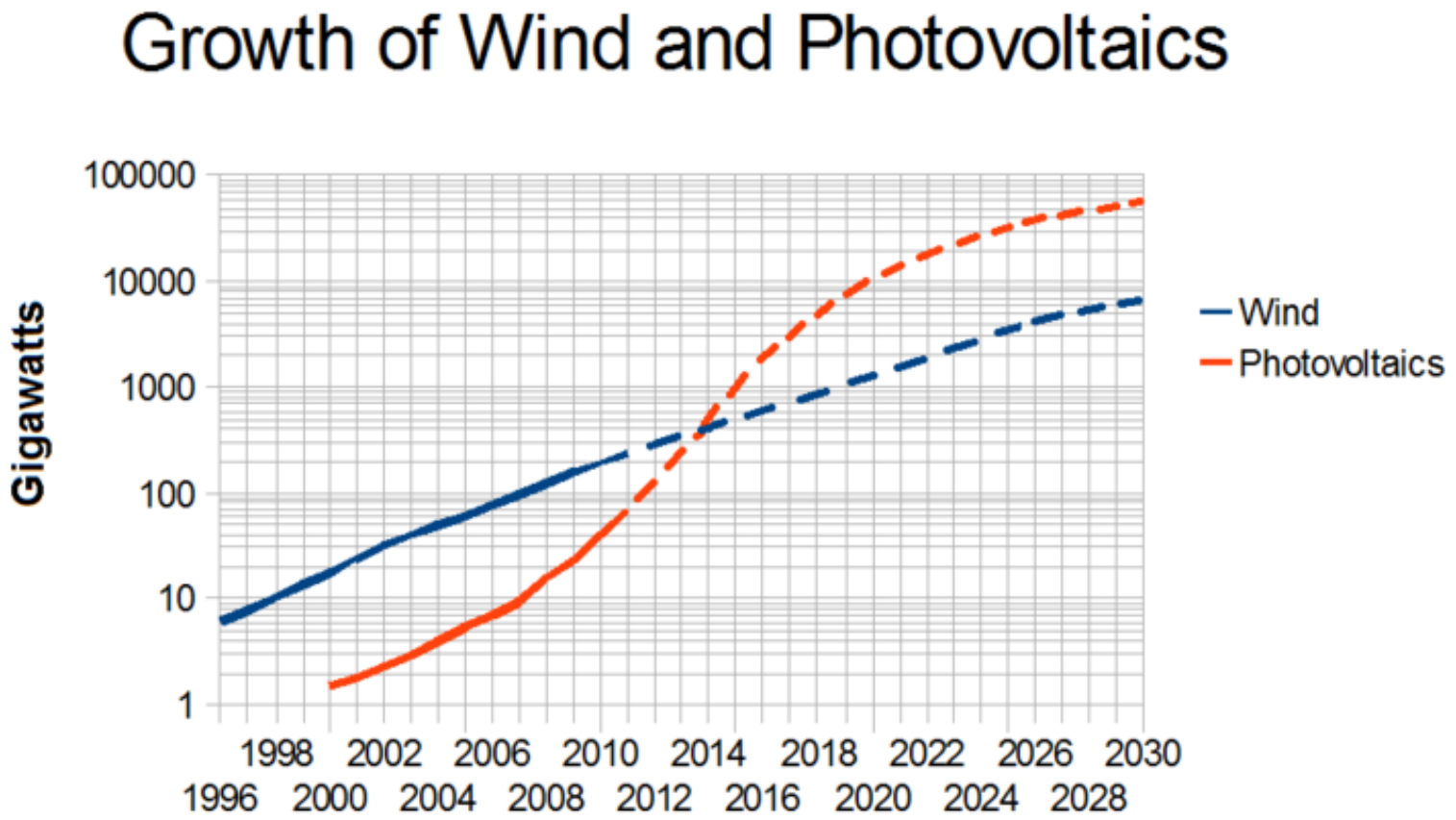
Exhibit 2

Welcome to the Terrordome… $/MMBTU by Energy Type

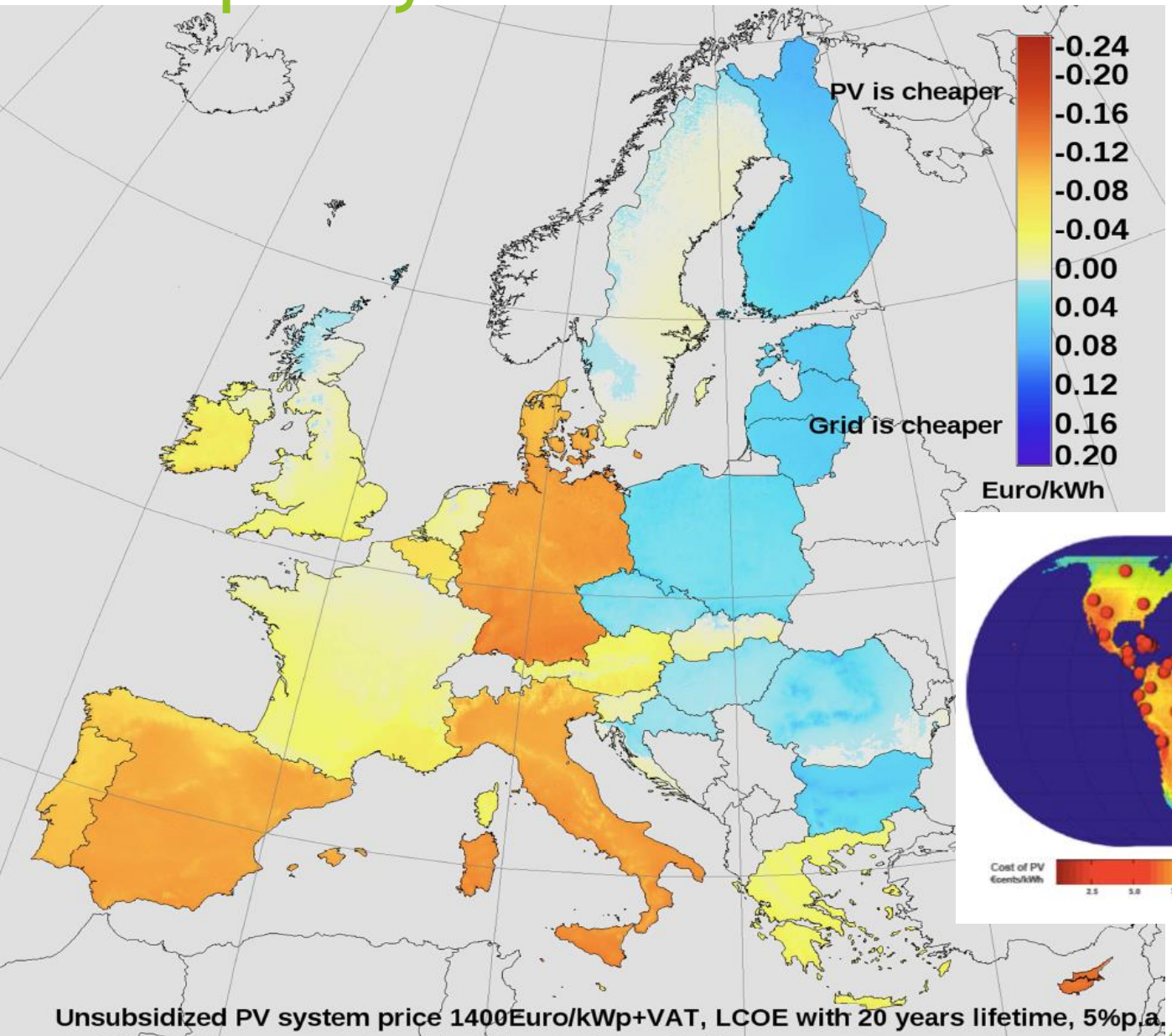


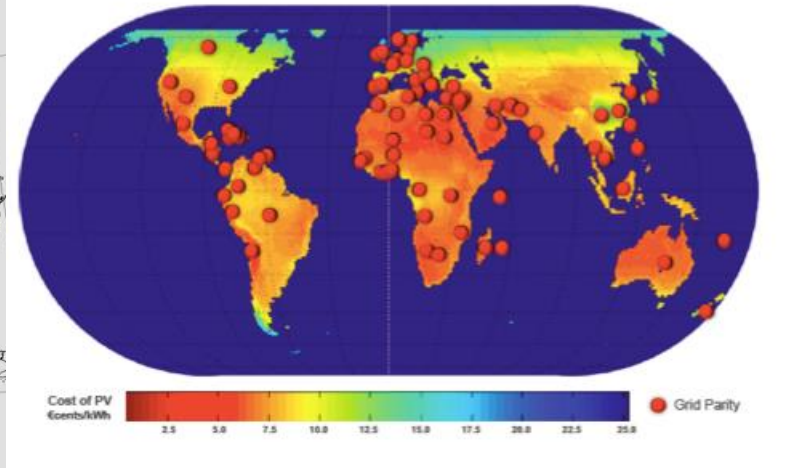
Source: EIA, CIA, World Bank, Bernstein analysis

International context: PV Revolution



International context: Grid parity in 102 countries





	Average emplyment over life of facility (Jobs per megawatt of average capacity)		
	Manufacturing, construction, instalation	Operating & maintenance/ fuel processing	Total
Solar PV	5.76-6.21	1.20-4.80	6.96-11.01
Wind power	0.43-2.51	0.27	0.70-2.78
Biomass	0.40	0.38-2.44	0.78-2.84
Coal-fired	0.27	0.74	1.01
Natural gas-fired	0.25	0.70	0.95

Note: Based on findings from a range of studies published in 2001-04. Assumed capacity factor is 21% for solar PV, 35% for wind, 80% for coal, and 85% for biomass and natural gas.

Table 8: Average employment over life of facility (Jobs per megawatt of average capacity)

Source: UNEP, ILO, IOE and ITUC (2008)

International context: The hottest scientific topics

- Better integration of solar and wind
- Integration of power, heating, cooling, water and transport systems
- Market arbitrage (time delay, power-heat, power-water, demand management, power-fuels)
- Solution for road freight, shipping, aviation and high temperature processes – biomass + synthetic fuels?
- Quantification of socioeconomic impacts of mitigation measures and policies

(N. Markovska, Climate Change Mitigation: Will we make it?, Plenary lecture, SDEWES2015, 2 Oct 2015)

National context: Resource potential

- Individual houses:320 000
- Available PV area:12.8 mil m2 (80 m2 roof area, 50% usable for PV modules)
- Installed PV capacity:1.28 GW (0.1 KW/m2)
- Electricity produced:1.64 TWh (1280 hours load factor)
- 23% of total consumption (around 7 TWh)
- Roofs of public, administrative, commercial and industrial buildings to be added on top…

(Own rough estimations)

National context: Economics

Conclusions from a recent study*:

- PV systems, particularly small ones installed at households, can be financially viable even without feed-in tariff
- Pay-back period 7-9 years (at current electricity prices and technology costs)
- The electricity distribution company will benefit from:
  - Local electricity produced in on-pick period
  - Lower distribution losses
  - New possibilities for grid regulation

(*G. Cogelja and D.Dimitrov, Feasibility of PV systems without feed-in tariffs, Forum of renewable energy stakeholders (4th meeting, 04.11.2014), USAID project for clean energy investments)

Key areas for action

Legal and regulatory framework

- The Electricity Supplier is a balance responsible entity:
  - Obligation for the Electricity Supplier to take the electricity excess which occurs when the PV system produces more electricity than is needed by the household
  - Obligation for the Electricity Supplier to supply electricity to cover the gap when the PV system does not produce electricity (during the night) or produces less electricity than is needed by the household.
- The trading ratio is 1:1 – annually, the PV system produces less or equal amount of electricity than the amount of electricity taken by the household

Key areas for action

Finance

- Establishing technology-specific consumer credit facilities, (particularly useful for technologies that require higher up-front investments).

Market development

- Indirect and/or “soft” interventions such as education, campaigns and performance rankings.
- Introduction of strict product standards and product labeling.
- Introduction of strict installation and O&M standards and certification of companies for planning, installation, and balance of system, and operation and maintenance (O&M) of PV system.

Key areas for action

Entrepreneurship and business acceleration (opportunities)

- In the latter segments of the PV system value chain: planning, installation, and balance of systems, and O&M,
- Tailor-made programs for technical assistance for the local companies.

Technology development

- R&D tax credits,
- Research grants,
- Publicly funded competitive research collaborations, competitions,
- Public investment in R&D,
- Public or private agreements on technology cooperation,
- Demonstration projects and applied research networks.