Power Sector Costing Study Update

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Paris 27 March 2012

IRENA
International Renewable Energy Agency

Rationale

- Assist government decision making
- Economics are a key decision factor
- The cost of renewables have declined rapidly in recent years
- Decision making is often based on outdated numbers
- Cost figures are often not fact based and therefore coloured by opinion of the author
- Cost data vary by project, country and over time

- IRENA strives to become a source of objective cost data that enable cost comparisons
- This will be complemented with an assessment of benefits for cost/benefit analysis
- Business perspective will be complemented with macro-economic perspective (PACB)

- 2011 focus power sector data, followed by transportation sector (2012) and stationary applications
- For the time being no cost competitiveness analysis

Cost indicators

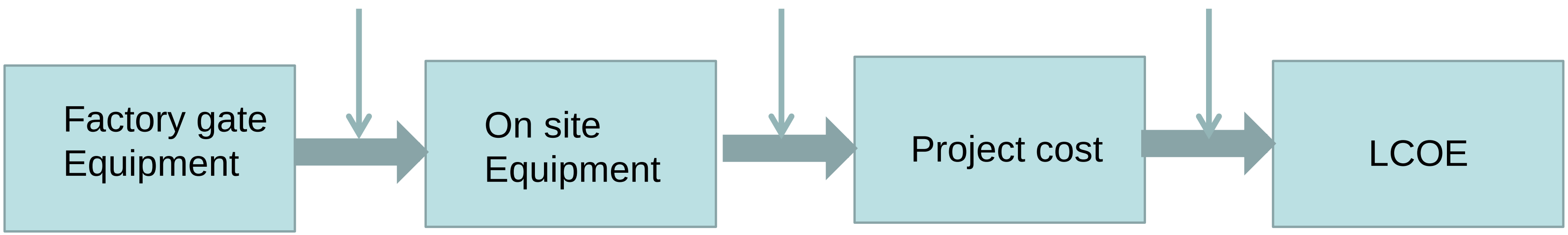
- Cost can be measured in many ways
- A simple method is preferable
- Three indicators have been selected:
  - Equipment cost (factory gate FOB and delivered at site CIF)
  - Project cost
  - Levelized cost of electricity LCOE (ONE possible measure of attractiveness)
- Trends, most recent year and 5-year outlook (learning curves and market outlook)
- Available information is usually limited to prices
  - Strictly speaking *price* indicators
  - Long term, prices are a function of production cost
  - Short term, profit margins can vary and prices and cost may diverge

Two step approach:
Literature/BNEF/tender etc data
Own project data collection with focus Africa and Asia
(in-kind contribution Germany)

Transport cost
Import levies

Project development
Site preparation
Grid connection
Working capital
Auxiliary equipment
Non-commercial cost

Operation & Maintenance
Cost of finance
Resource quality
Capacity factor
Life span



LCOE:
Levelized cost of Electricity
(Discounted cost equal discounted revenues)

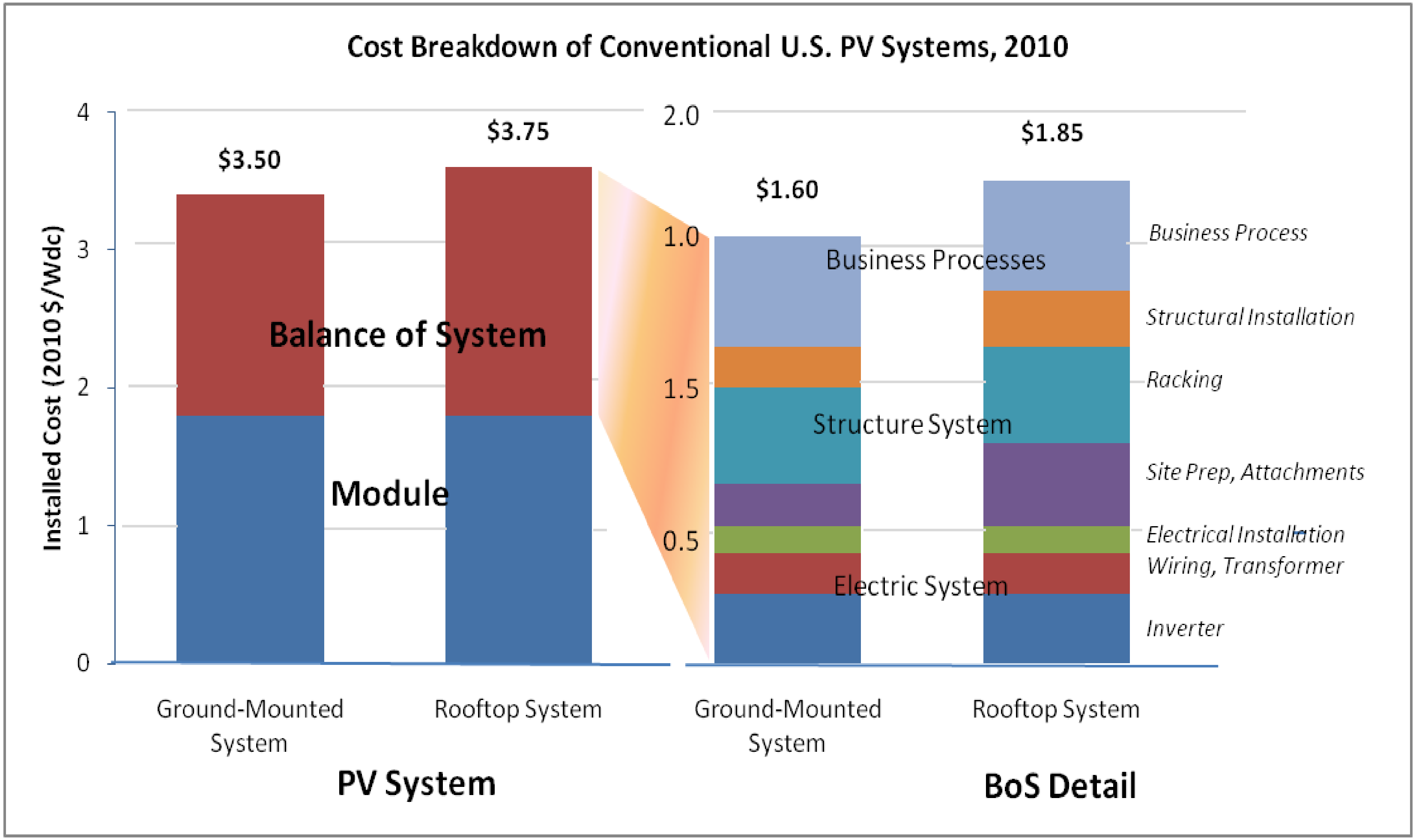
10 power technologies
IEA data review
Working papers launched April 2012

Overall insights

- Price data are readily available, cost data less so: often mixed up while trends may differ
- Equipment cost account for half to three quarters of project cost
- Typical project cost in many cases higher than data from literature
  - Important economies of scale. Especially very small projects tend to show a wide cost spread.
  - Infrastructure needs vary
  - Split commercial and development/state projects
- Major differences in financing conditions can make a factor two difference for LCOE
  - Equity:debt ratio between 80:20 to 20:80
  - Typical average cost of capital in Africa more than 20%

SOLAR - PV

Module 60% of system cost, BOS other 40%



Source: Lionel Bony etc., Achieving Low Cost, Solar PV, 2010

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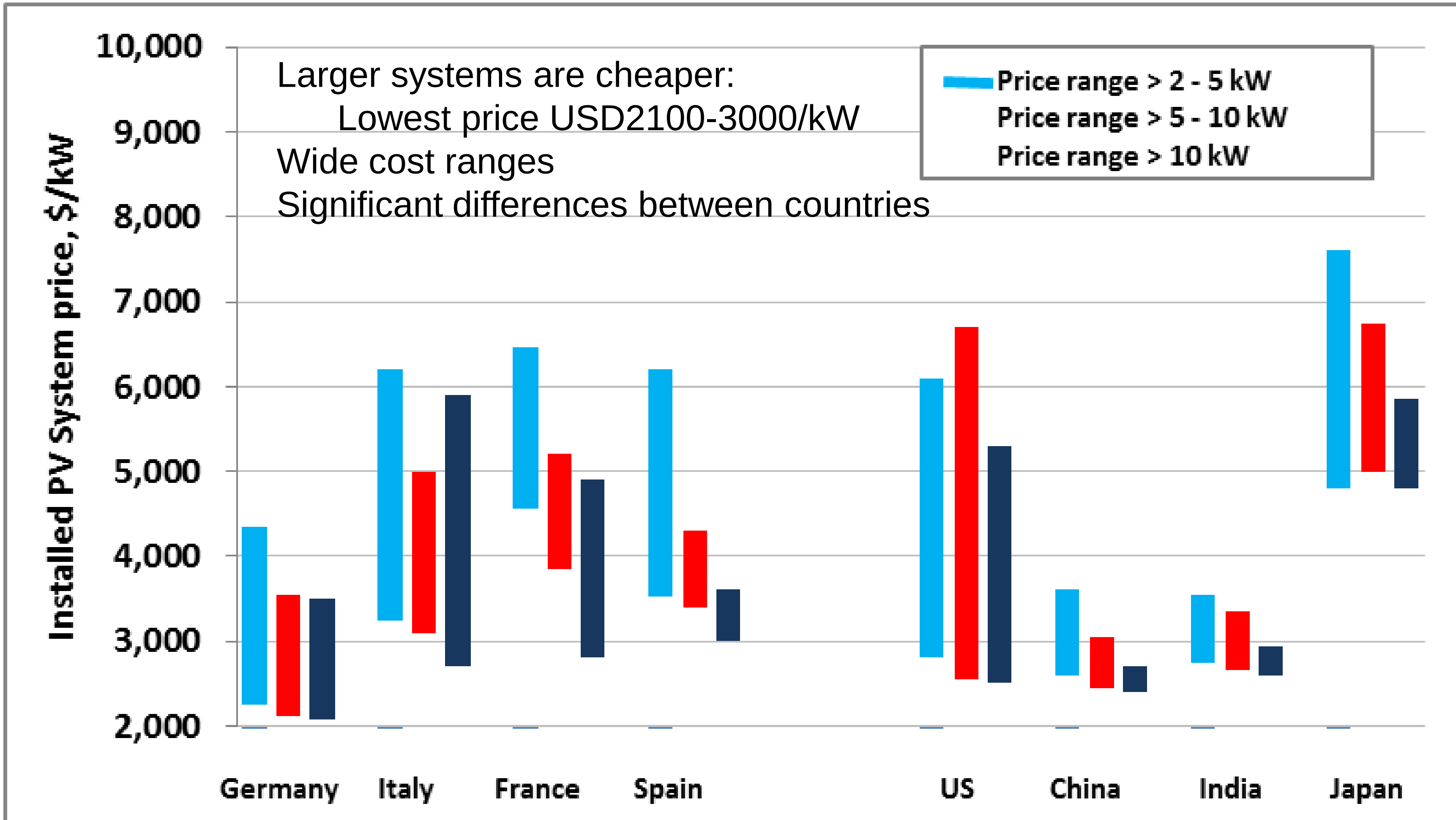
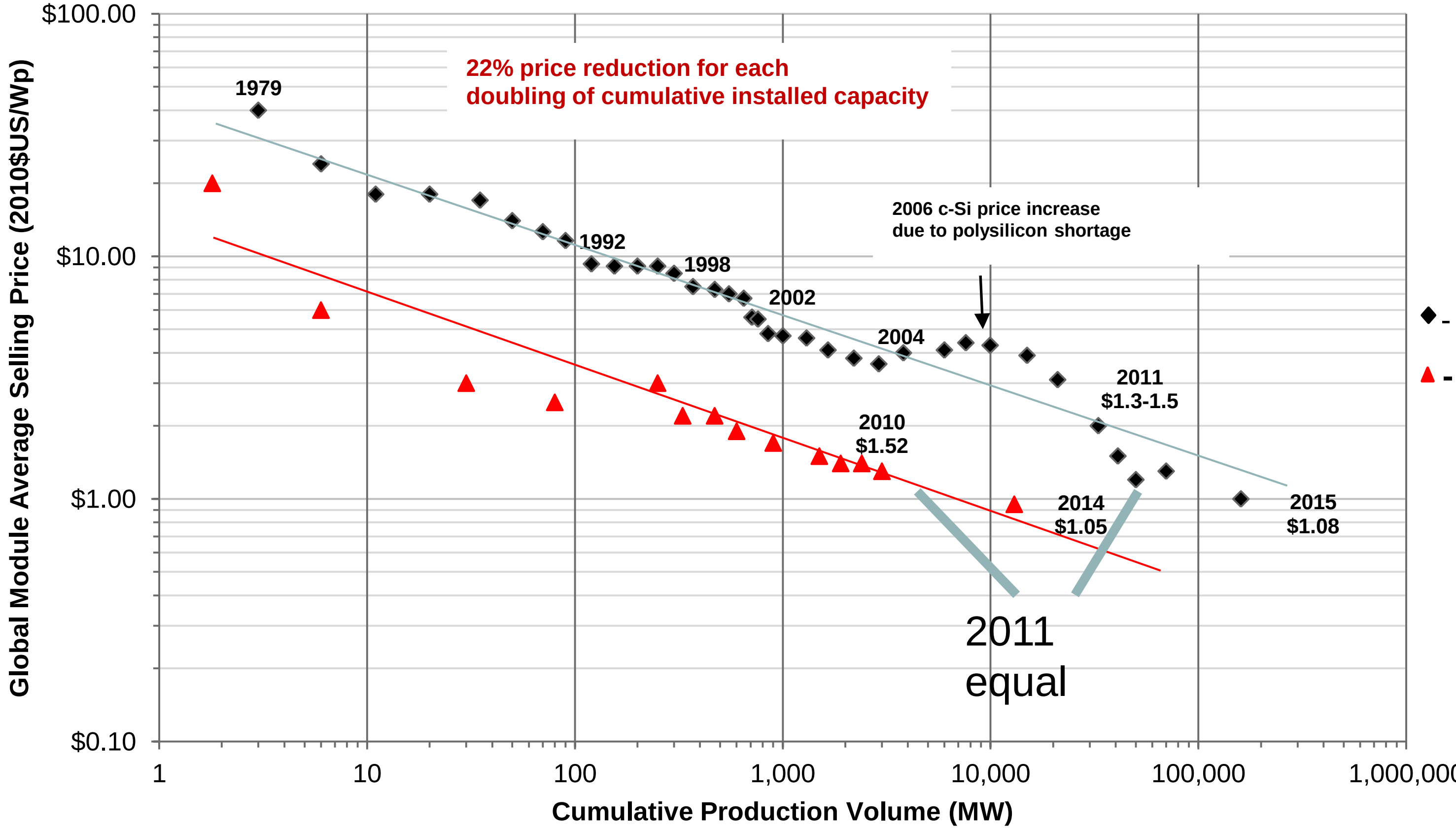
Residential installed PV system prices, first half 2011



Source: IRENA Study, 2011

Rapid and predictable cost reductions for PV modules

Learning curve: constant % cost reduction per doubling installed capacity



Next doubling
70 GW
2-3 years
(22% cost
reduction)

Source: Mints, Navigant, Bloomberg NEF, First Solar, NREL PV cost Model

Module efficiency projections

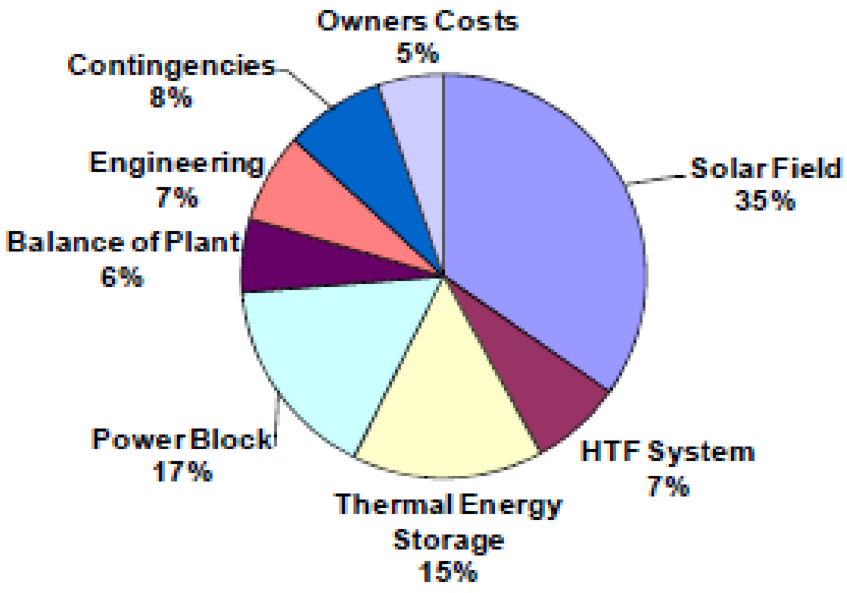
	2010	2015	2015 cost reduction impact
c-Si	14%	16%	-12%
Thin film si	9%	11%	-18%
CdTe	11-12%	13%	-9% to -15%
CIGS rigid	11-12%	14%	-14% to -20%
CIGS flex	10-11%	13-14%	-15% to -30%

Sources: Lux Research, 2010

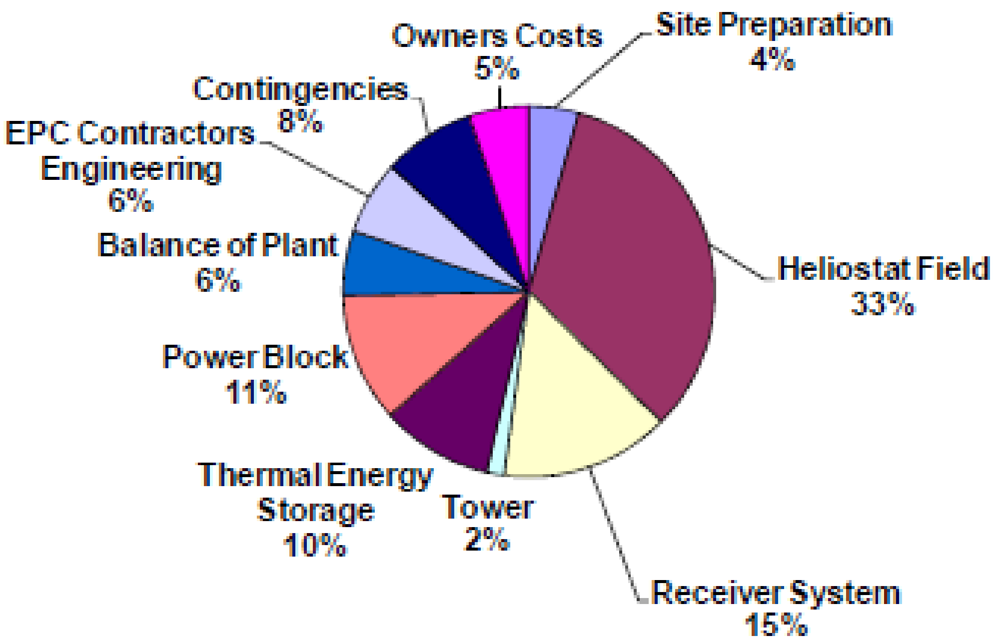
SOLAR CSP

CSP Project cost breakdown

Parabolic trough

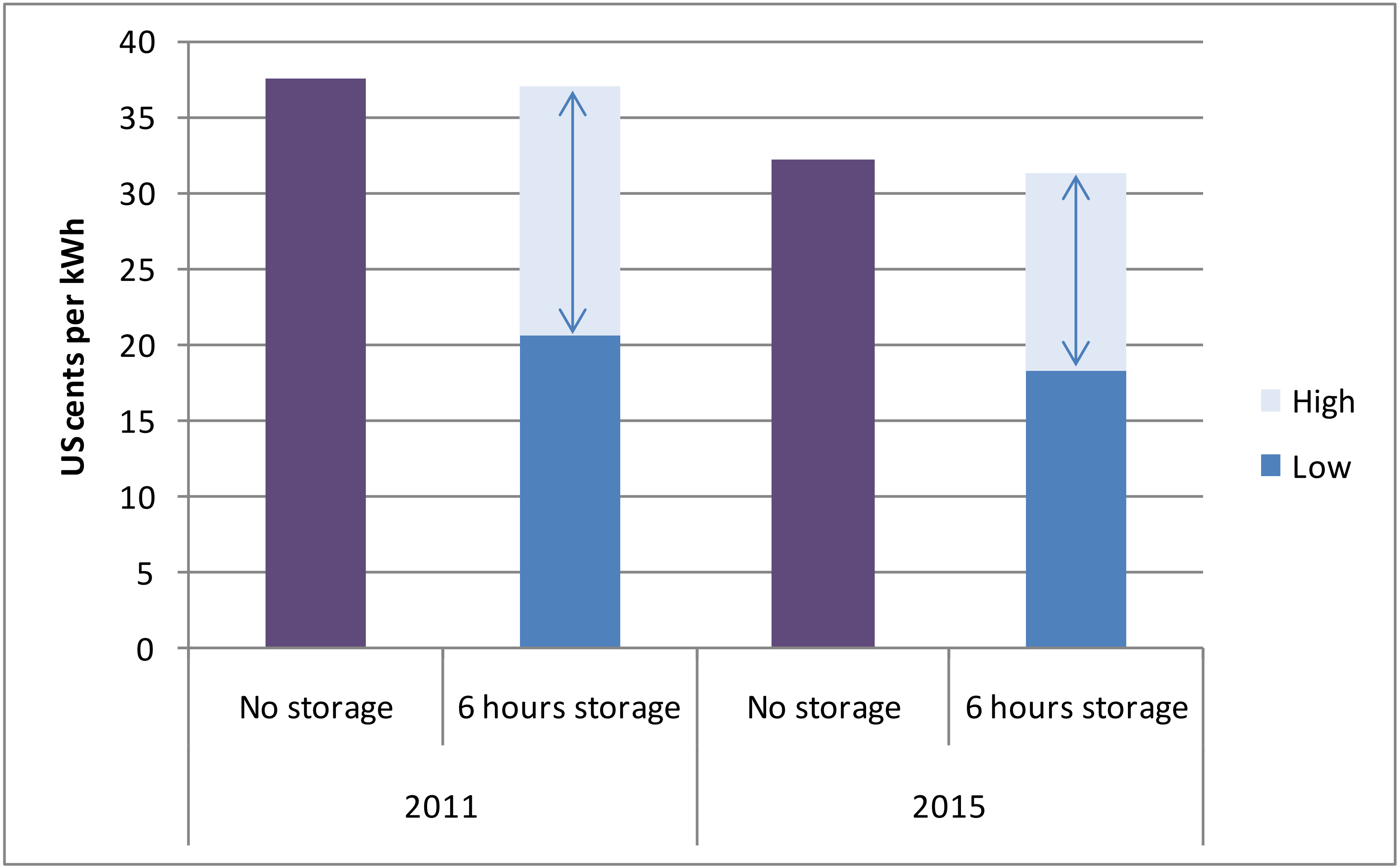


Solar tower



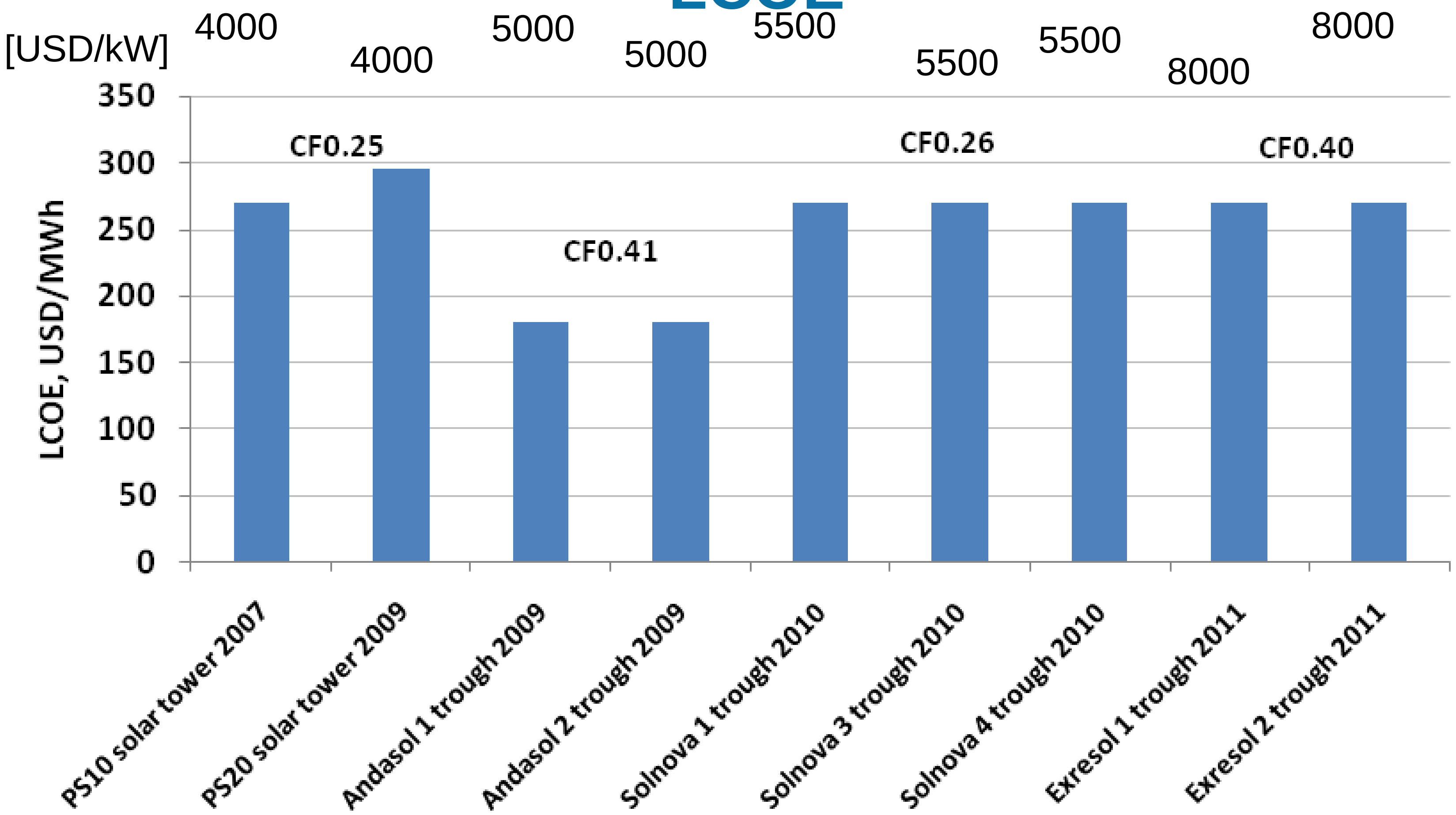
Source: Fichtner, 2010

LCOE of parabolic trough



10% discount rate, SW US insolation conditions

LCOE

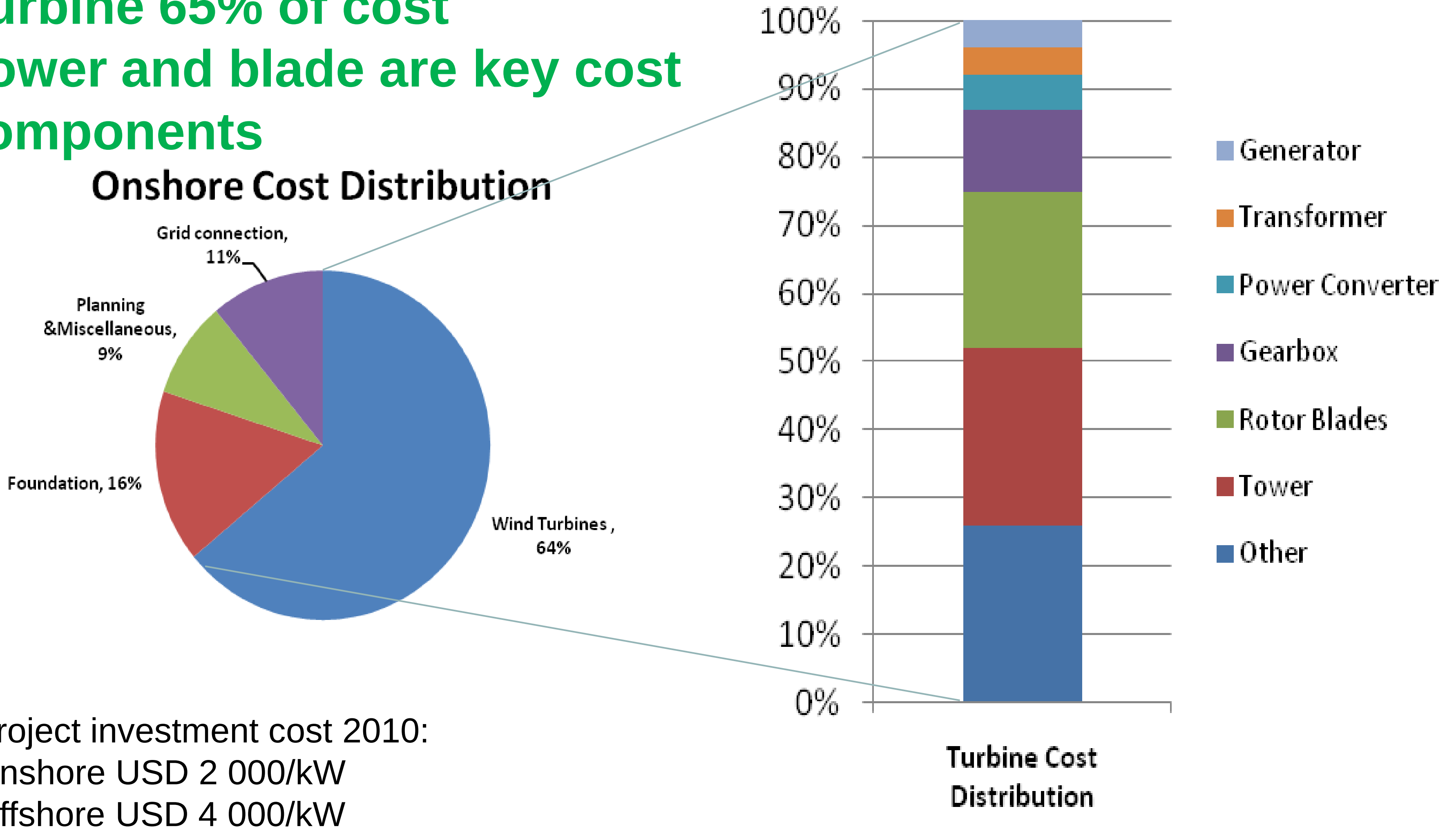


Source: IRENA Analysis

WIND ONSHORE

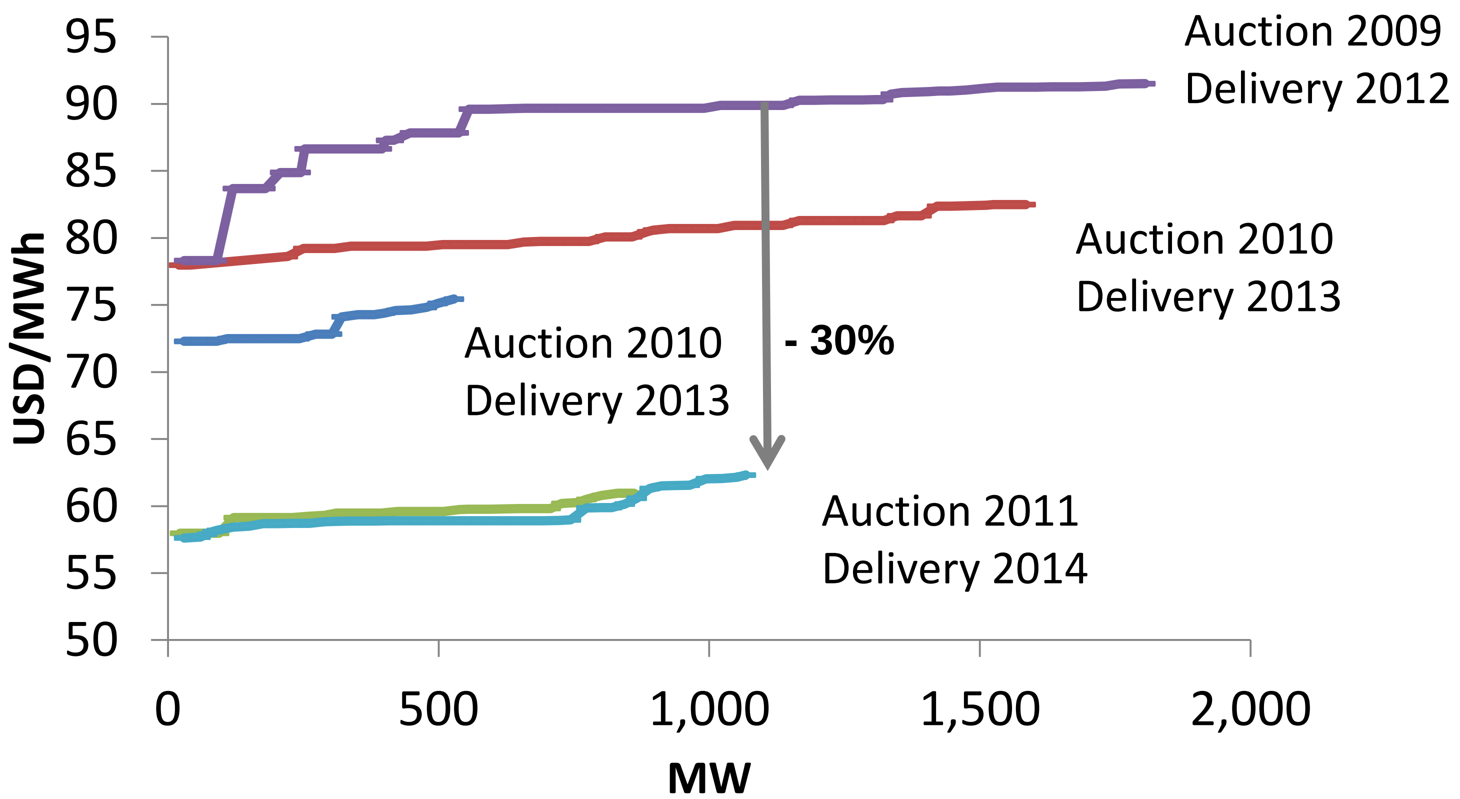
Typical wind project cost structure

Turbine 65% of cost
Tower and blade are key cost components



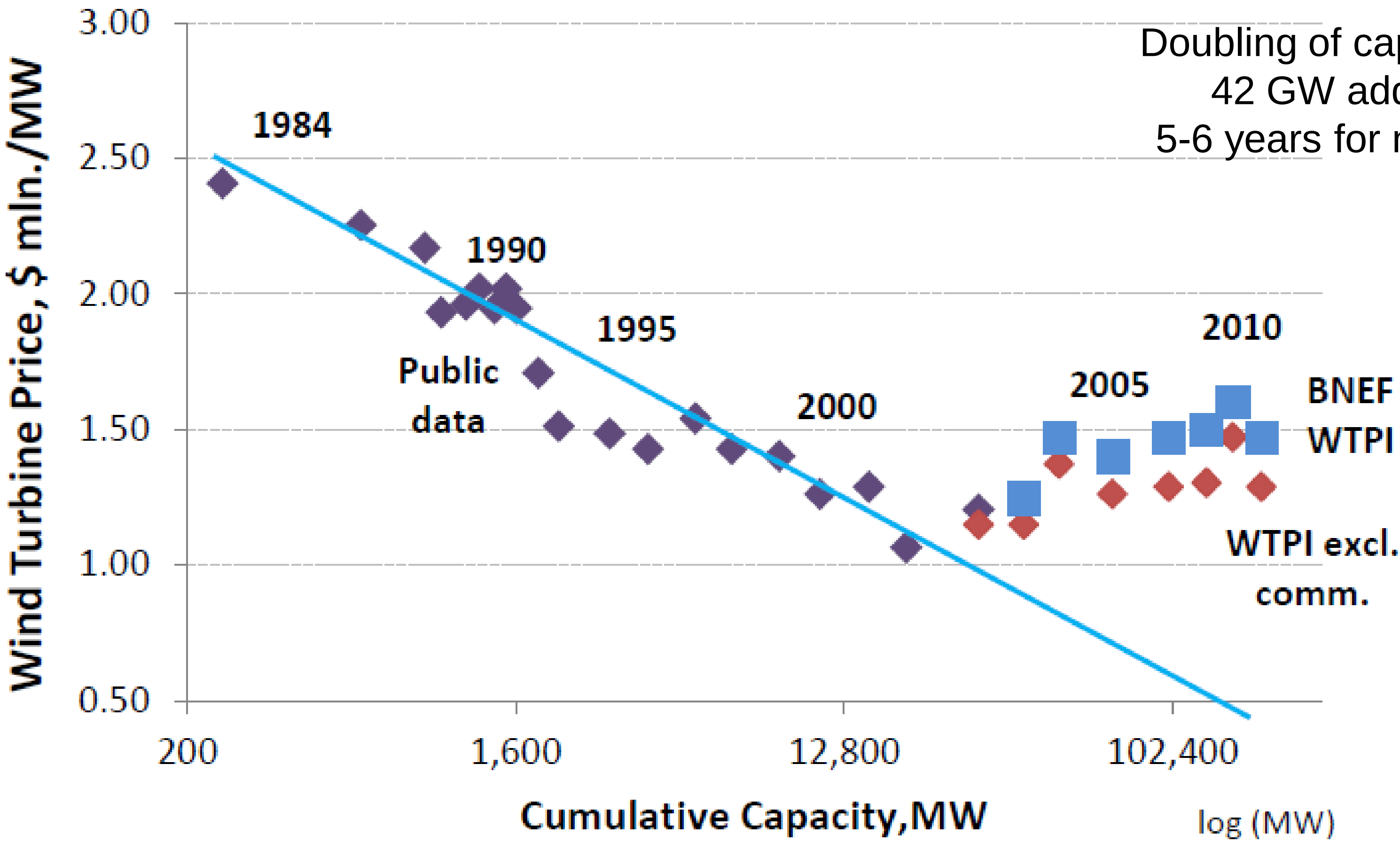
Project investment cost 2010:
Onshore USD 2 000/kW
Offshore USD 4 000/kW

Wind Auctions Brazil



Learning curve for turbines

Strong anomalies in recent years; further analysis needed



Doubling of capacity 240 GW
42 GW added in 2011
5-6 years for next doubling?

Commodity prices only part of the Explanation

Higher turbines yield higher CF

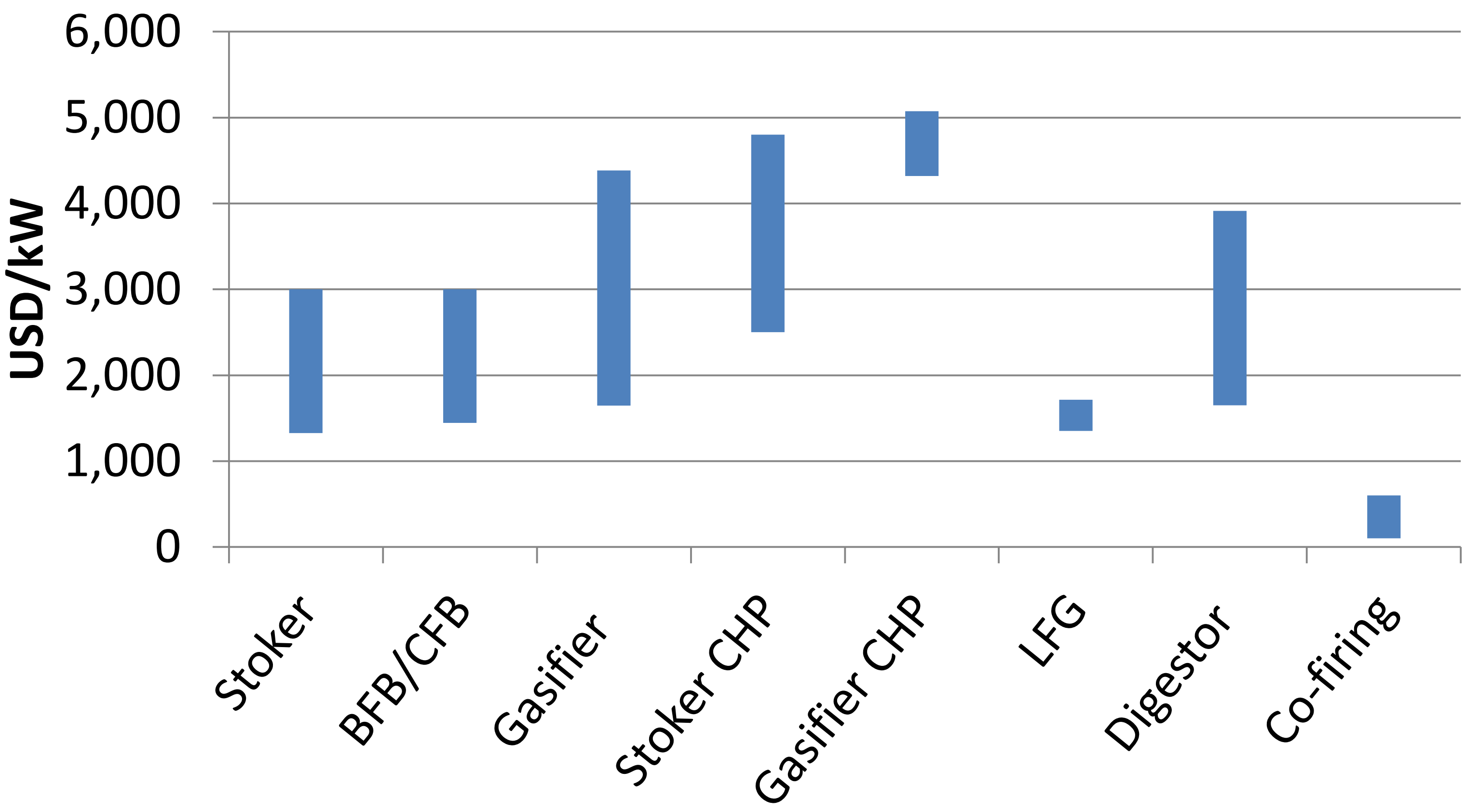
Source: Bloomberg New Energy Finance, February, 2011

BIOMASS POWER

Set of Technologies:

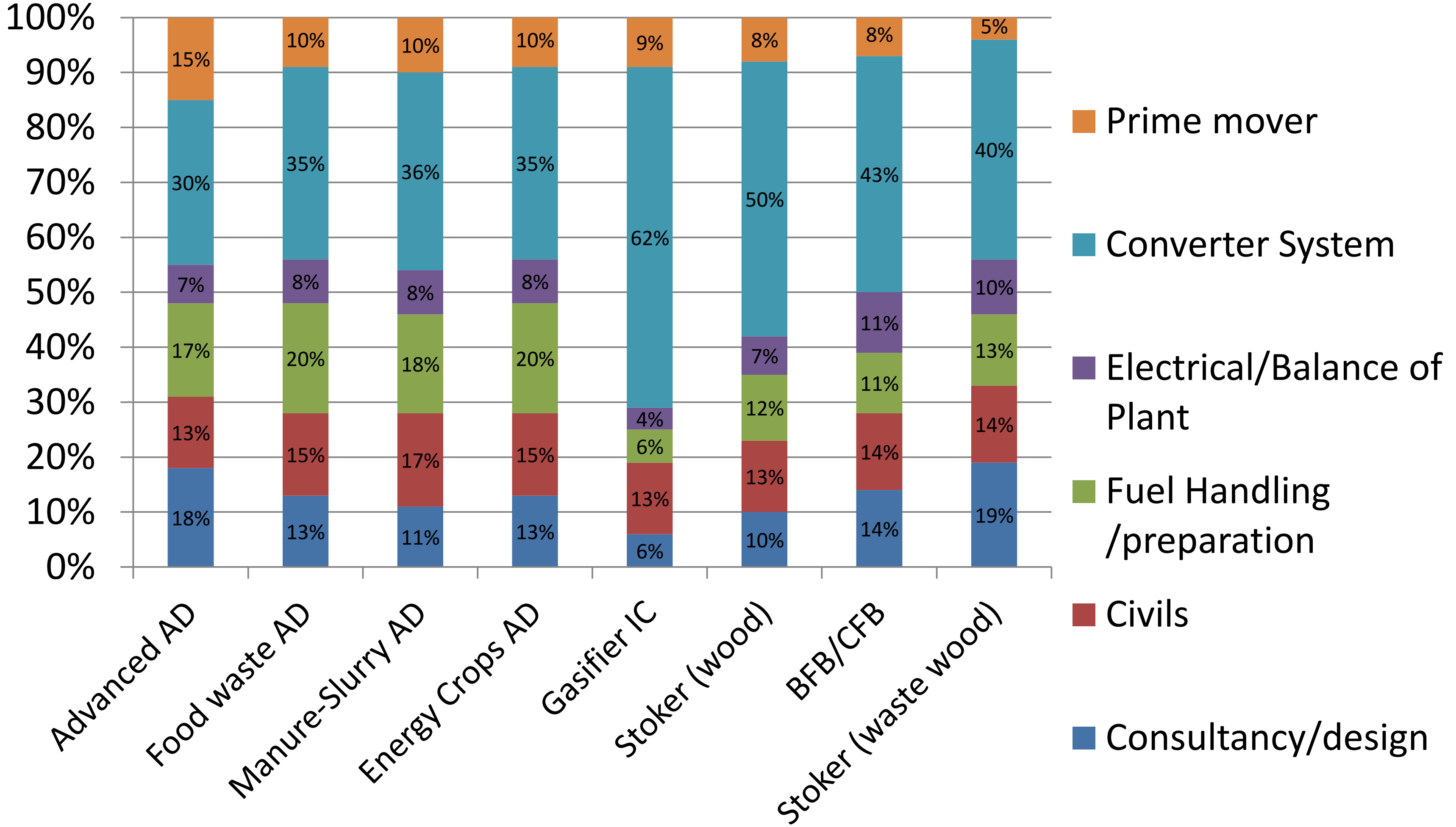
- Stoker boiler, Gasification, Digester, Biogas (Landfill Gas, Anaerobic digestion)
- Feedstock cost account for a large share of the total cost
  - Biomass feedstock prices depend on quality, quantity, availability, moisture content
  - Biomass handling cost can have a high impact on final cost
- A market for pellets and woodchips has emerged in recent years
- Biopower plants require long term contracts for agricultural and forest residue supply
- Biomass co-generation systems are usually linked to industrial, agricultural and crop processing plant where the waste heat can be used in the process

Typical range of equipment costs



Typical Project Cost Structure

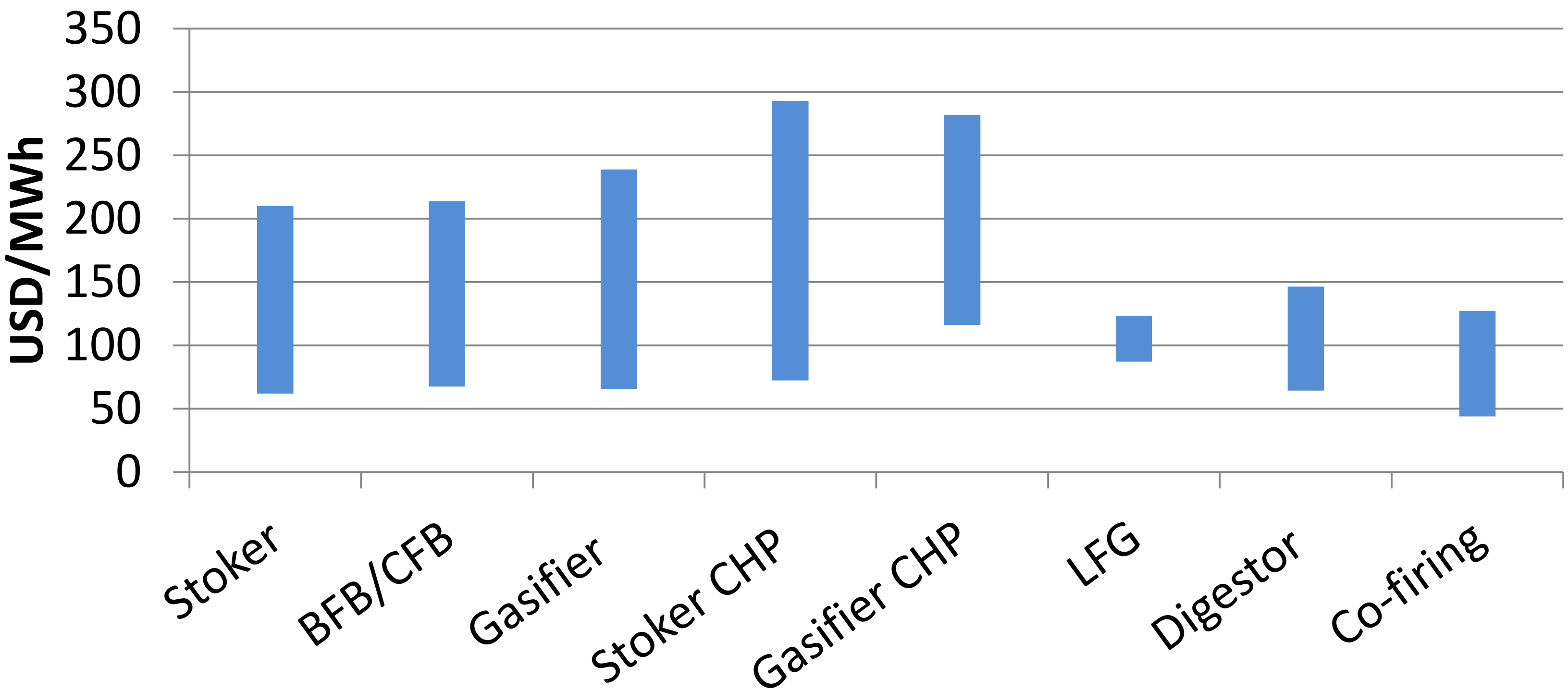
Equipment cost account for 45%- 70% of total cost



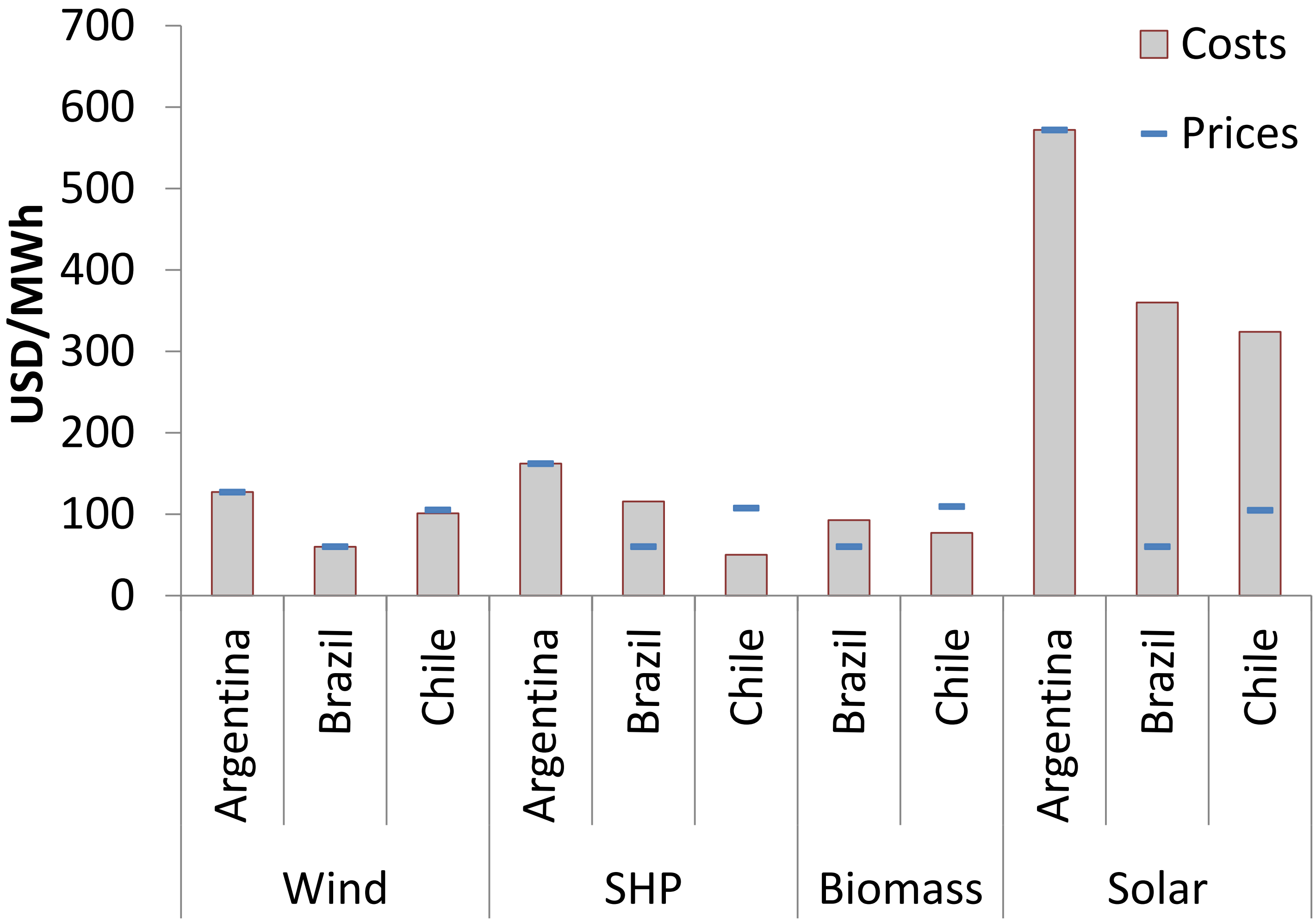
Source: CCC, 2011

Typical LCOE ranges

Feedstock from 10$/ton (9 GJ/ton) to 160 $/ton (17 GJ/ton)



Renewable Project Cost and Prices Latin America



Next steps in cost analysis 2012

- Issue working papers
- Prepare a report with summary of working paper findings and questionnaire
  - Explain regional/country differences
- Make a start with cost data collection for transportation fuels
- Develop a software based system to facilitate data roundup with the help of member countries

Thank you !

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