Shale Gas and Photovoltaics
– Game Changers at Regional or Global Scale?
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Game changing in Photovoltaics
Cost of rooftop-installations in Germany in EUR/kWp

Source: http://www.photovoltaik-guide.de/pv-preisindex
Survey among new installations of PV systems
Game changing by shale gas
Natural gas spot prices in major global markets in $/MMBtu

Source: EIA
http://www.eia.gov/todayinenergy/detail.cfm?id=3310
Sustainable Game Changing by Shale Gas?

• Henry Hub prices further down in 2012 to 2$/MMBTu but up again now

• Further considerable production expected to come online

• Infrastructure for exportation not coming up very rapidly
  – Exportation subject to licensing
  – Construction lead times
  – Uncertainty in price spreads

→ Medium term price expectation moderately upwards sloping
  From 3.6 $/MMBTu to 6.0 $/MMBTu in 2020

→ Game changing to North American market persistent
  – Certainly in terms of production
  – In terms of prices at least in the medium term
**Expected future price**

*Future market quotes in $/MMBTu*

![Graph showing expected future price of gas markets.](chart.png)
Sustainable Game Changing by Photovoltaics?

→ Technological progress considered to be irreversible
  - Partly also a result of economies of scale

→ But prices might be currently under long-term marginal costs
  - Overcapacities in production
  - Market consolidation on-going
  - Part of price decrease also due to cyclical low silicone prices

→ Price decrease might not continue at similar pace
  - Depending on how long overcapacities will persist
Alternative Analysis of PV Cost Development
Similarities

- Both technologies with long lead times
- Both potentially available at a global scale
- Both offer potential for emission reduction

Differences

- Shale gas enters through market forces, PV through government intervention
- Shale gas controllable generation, PV not
- Shale gas exhaustible resource, PV not
Game changing at global scale with Shale Gas?

- Prospects for shale gas outside North America much more uncertain
- Europe is divided on the issue
- China may embrace shale gas
Game changing at global scale with Photovoltaics? (I)

• If Germany can produce solar electricity at less then 20 ct/kWh sunny countries can do it at 7 to 10 ct/kWh

• This still sounds expensive at American scale

• But for European and other, coal-importing countries this is not far from a competitive edge

• And at the time horizon 2020 further cost reductions likely
Game changing at global scale with Photovoltaics? (II)

- **Game changer in particular for developing countries with**
  - weak electricity grids
  - few domestic energy resources

- **Cost melt down in battery technology would be welcome complement**
  - unlikely in the coming decade

- **Grid parity possible game changer in industrialized countries and emerging economies**
  - Misnomer from a general economic perspective
  - Yet relevant for individual decision making
  - Impact strongly dependent on details of electricity grid tariff regulation, e.g. net metering & energy based grid charges
  - Under German rules Photovoltaics-battery systems competitive without subsidies around 2017
Game changing for global challenges? (I)

• Even before shale gas we were not running out of energy
  – Coal resources abundant and rather cheap
  – If at all, oil resources have seemed limited

➔ Shale gas changes prices but not the (energy) economy
  – U.S. had cheaper energy prices than Europe and Japan already before shale gas
  – For the majority of economic sectors, labour costs & innovation strength much more crucial than energy costs

• Puts pressure on competing energy resources
  – But coal will remain in general cheaper
  – Puts pressure on gas oligopolists
  – But 3 – 6 $/MMBTu costs to deliver U.S. shale gas to other continents
  – Makes life harder for nuclear and renewables (?)
Game changing for global challenges? (II)

• Global Warming remains on the agenda - disputed
  – Shale gas & photovoltaics can make contributions
  – But cheap gas may also crowd out carbon-free electricity

• Global first-best solutions remain out of reach in the decade to come

• The cheapest takes it all – not likely to work in energy policy
  – Fuel dependency and diversification concerns
  – China: conventional pollution
  – Domestic and international environmental pressure

→ The law of one price unlikely to be applied in energy, particularly in electricity
Game changing for global challenges? (III)

• Electricity is electricity – at least if delivered at the same place, the same time
  → unique price regardless of production technology

But:

• Numerous jurisdictions around the world (including in the U.S.) do not apply market-based pricing to electricity

• Even with markets, preferential treatment for green electricity often in place
  – Feed-in-tariffs, renewable performance standards etc.

→ One hidden rationale: price discrimination between price sensitive consumers exposed to international competition and others

→ A place for PV (and other renewables) even in a world with cheap shale gas
Thank you for your attention