The road to PV and beyond - from Technology to the Energy System

Becquerel Prize Acceptance - Stefan Nowak
33rd EU PVSEC Amsterdam, 25 September 2017
after a journey through different fields...
the choice for photovoltaics ...
and
... my first lesson in energy matters:
working on “alternative energy”
Photovoltaics today: The state of play

45 years after “The limits to growth”

Some facts...
Technology
Technology: Great achievements!
Products: Maybe some way to go!
Applications
Applications: Great variety!
Market: Extraordinary growth!

2015: 50 GW, +25%
2016: 75 GW, +50%
2017: ?
Cost
Cost: Enormous reduction!

-75% over 10 years,
< 30 USD/MWh in best cases
“Can we predict the future?”

“No”, says the chaos theorist

“Yes”, responds the astrophysicist

“To an extent”, says the economist

“Usually”, says the meteorologist

U. Pillkahn 2008
Renewables to remain fastest growing source of electricity generation

Indexed electricity generation by fuel (2001-21)
A new ‘fuel’ in pole position

Low-carbon fuels & technologies, mostly renewables, supply nearly half of the increase in energy demand to 2040
PV’s Integration Challenges

- PV & electrical grid integration
  high penetration PV, grid management issues, flexibility

- PV & storage
  storage technologies, P2X, short term storage, seasonal storage

- PV & buildings
  BIPV, BAPV, PVT, technologies, aesthetics, design, standards

- PV & mobility
  plug-in hybrids, onboard PV, charging infrastructure

- PV & energy system
  power, heat, fuels

- PV & energy market
  market design, business models, regulatory framework
And then...
Chris Luebkeman, Arup
“The future, always oversold and under-imagined”

The difference between
Forecast, scenarios and foresight
2007
imagine

Steve Jobs: iPV
The challenges of becoming mainstream

- Sustainability dimensions
- Integration in the society
- Taking responsibility
- Sharing the future
Arrogance

Jakob Kellenberger, Ex-president International Red Cross:

“Arrogance as a superlative of stupidity is globally well distributed, better than food or other daily needed goods....
Thanks
To conclude: 3 take aways

- Alternative:
  There’s presently not many other than PV

- Imagination:
  Many things could happen over the next 45 years

- Arrogance:
  Minds are like parachutes, they only function when they are open*

*Thomas Dewar
Thank you