Which Factors Determine the "Right" New Power Generation Mix?

A Webinar Presented for:

green power ACADEMY

by

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The Electricity System…

… exists to

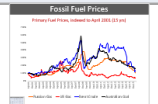
supply and deliver

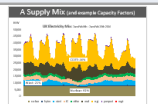
the right amount of **power**

at exactly the time

it is **demanded**.

Source	Renewable	Thermal	CO_2	Fuel	"Flexibility"	C. Factor
Oil		●	●	●	✓✓✓	£
Coal		●	●	●	✓✓	£
Gas		●	●	●	✓✓✓	£
Nuclear		●		●	× (✓)	£ (>90%)
Hydro	(●)				✓✓✓	*varies*
Biomass	(●)	●	(●)	●	✓✓(✓)	£
Geothermal	(●)	●			(✓)	>90%
Tidal	●				(✓)	20-30%
Wave	●				×	20-40%?
Wind	●				×	25-50%
Solar (pv, csp)	●	(csp)			×	<25-30%
Storage	(●)			●	✓✓✓✓	£





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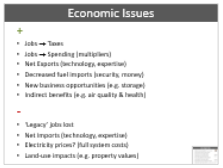
Gas		●	●	●	✓✓✓	£
Nuclear		●		●	×(✓)	£ (>90%)
Hydro						*varies*
Biomass						£
Geothermal						>90%
Tidal						20-30%
Wave	●				×	20-40%?
Wind	●				×	25-50%
Solar (pv, csp)	●	(csp)			×	<25-30%
Storage	(●)			●	✓✓✓✓	£

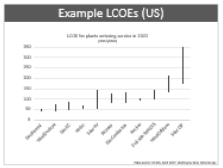
***Demand** is also part of the mix!*

- Efficiency
- Demand-side Response (DSR)
- Storage

The “Right” Mix

- Where are you starting from? (e.g. mix, demand…)
- Which natural resources do you have?
- How secure is your energy supply?
- What does you economy look like?
- How much (usable) space do you have?
- How flexible is your power system?
- How sensitive are your consumers to costs?
- What other issues impact them? (e.g. climate, health, control…)





Judging Success…?

- Effectiveness in **deployment?**
- **Efficiency** in deployment?
- **Climate** impact?
- Public **acceptance?**
- **Cost** of delivered energy?
- **Investment** attractiveness (low risk, high reward)?
- **Conformity** with electricity market?
- **Diversity** of technologies supported?
- **Socio-economic** benefits?

Other…?

Thanks for Listening!

Dr John Massey

Managing Director, Grey Cells Energy Ltd.

greycellsenergy.com

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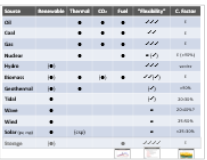
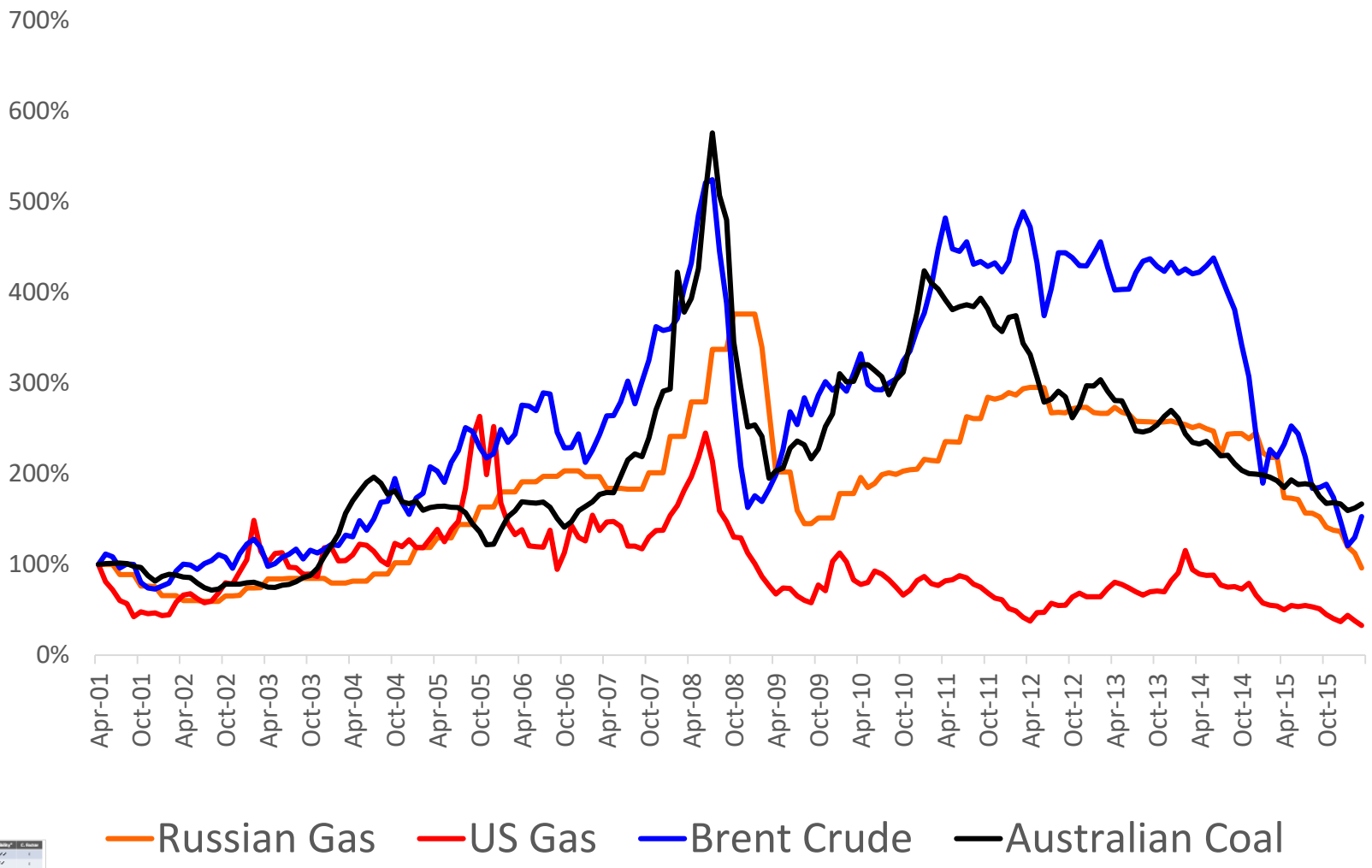
REFERENCE SLIDES

Fossil Fuel Prices

Primary Fuel Prices, indexed to April 2001 (15 yrs)



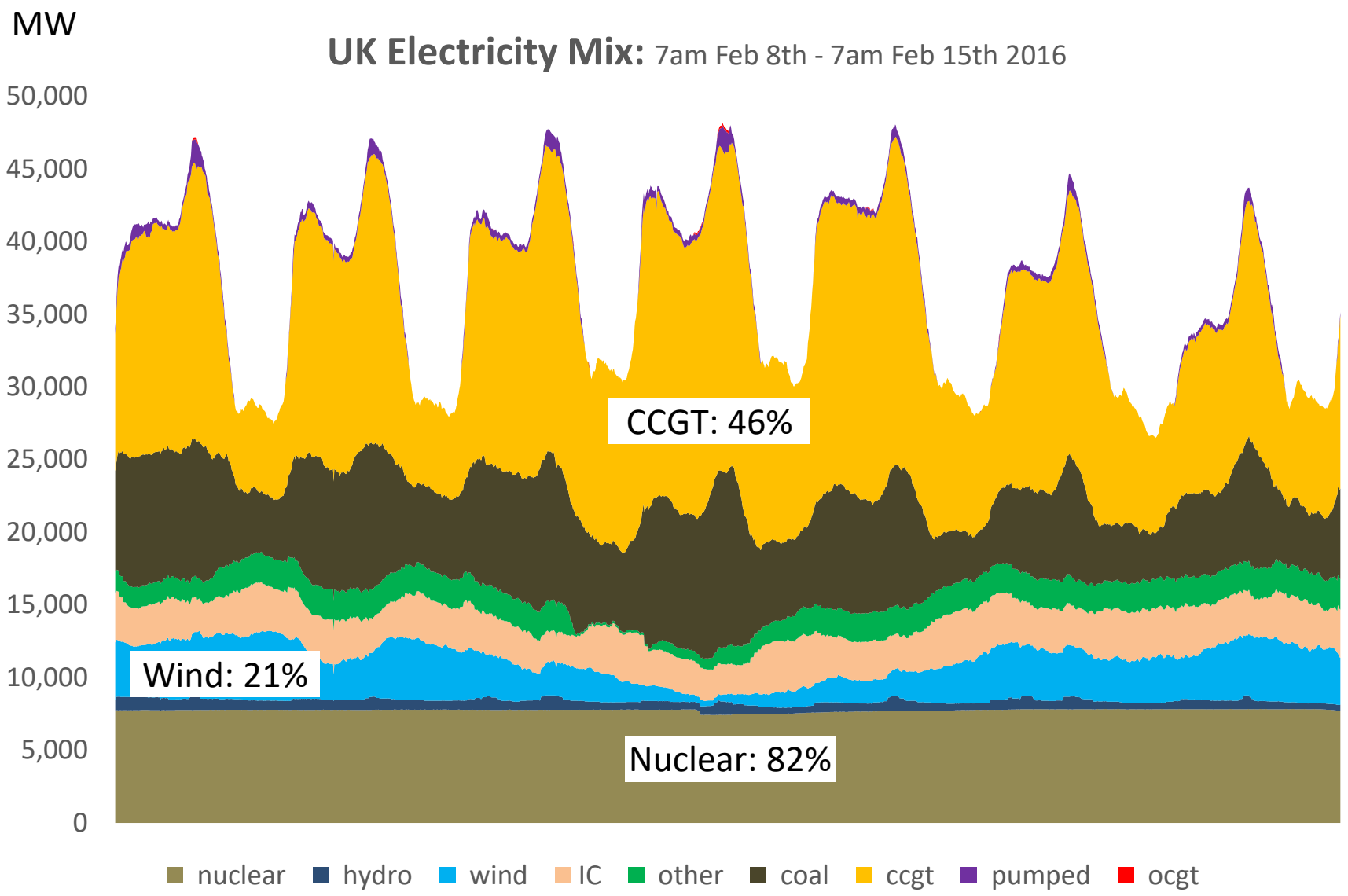


Analysis: Grey Cells Energy / Data: indexmundi

Power System Planning

- The flexibility of a power system includes:
  - System size ("Balancing Area"):
    - & Distance from supply to demand centres!
  - Interconnection with adjacent power systems
  - Quickly dispatchable power plants
  - Energy storage
  - Demand Management:
    - *Variability isn't new!*
    - Changing the "shape" of demand to suit fluctuations in supply.

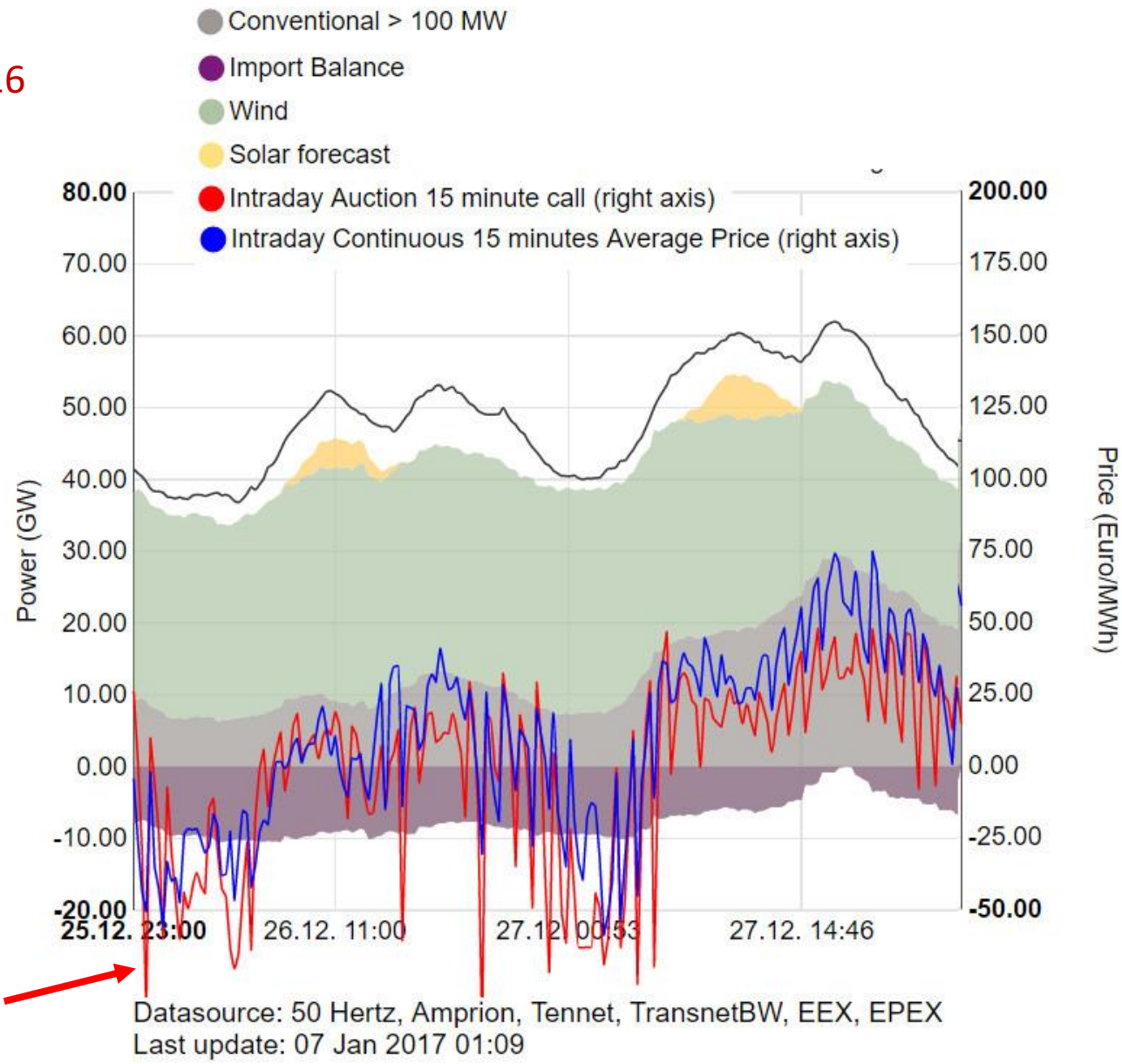
A Supply Mix (and example Capacity Factors)



UK data source: www.gridwatch.templar.co.uk

Too much …

Germany,
Dec 25th – 27th 2016

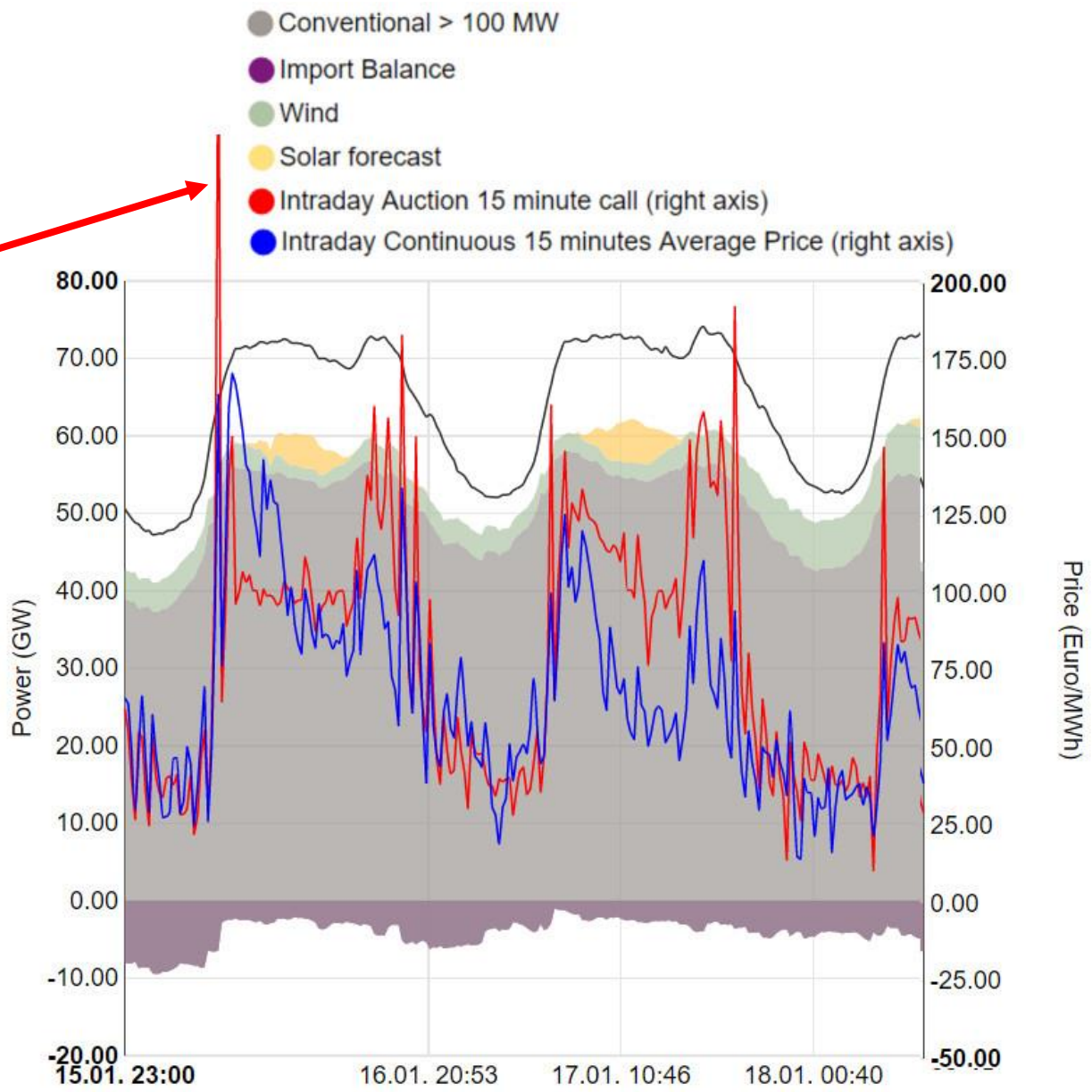


Good for filling storage!

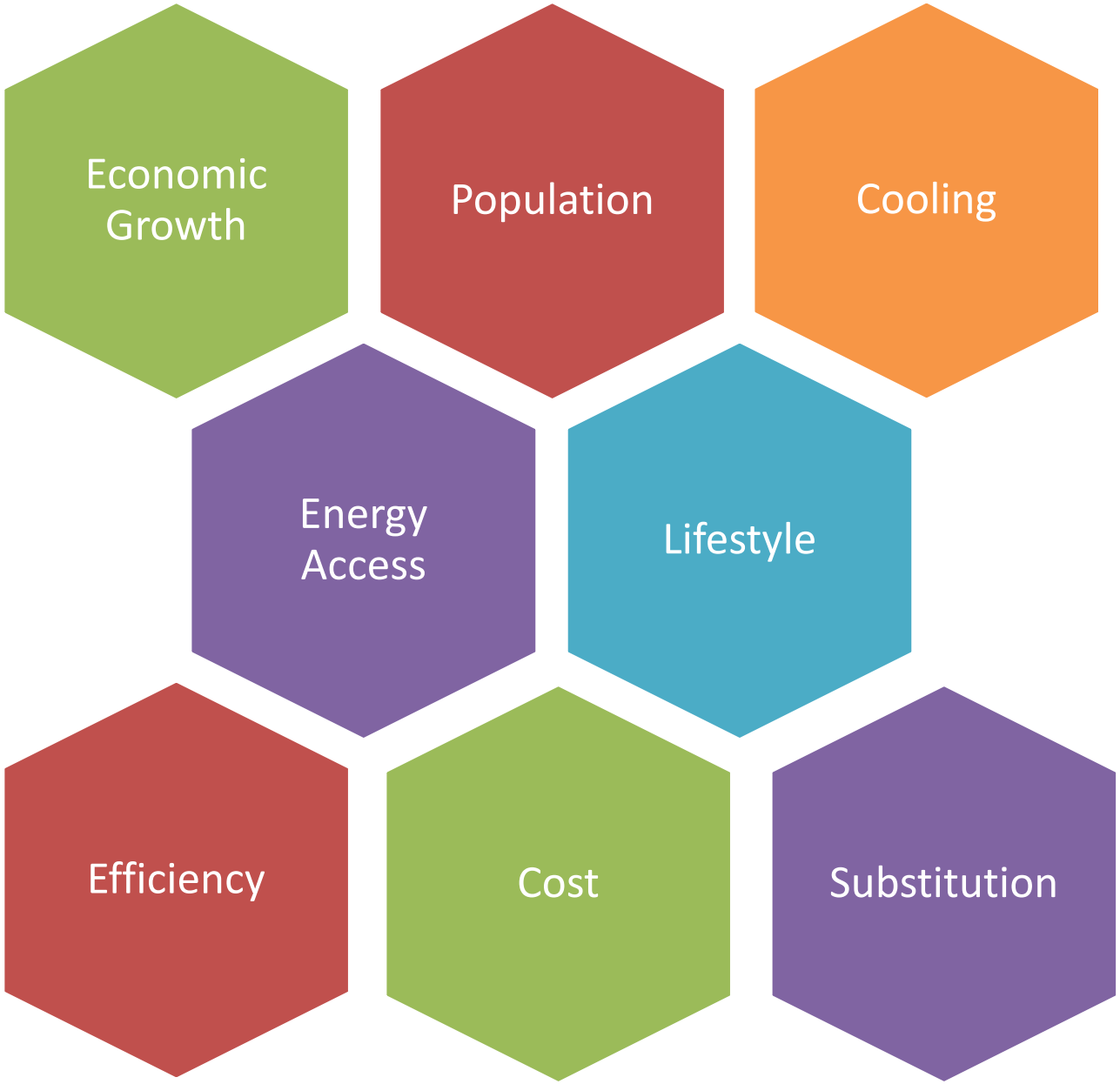
Too little …

Germany,
Jan 15th – 18th 2017

Good for emptying storage!



Energy Demand Drivers

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Economic Issues

+

- Jobs → Taxes
- Jobs → Spending (multipliers)
- Net Exports (technology, expertise)
- Decreased fuel imports (security, money)
- New business opportunities (e.g. storage)
- Indirect benefits (e.g. air quality & health)

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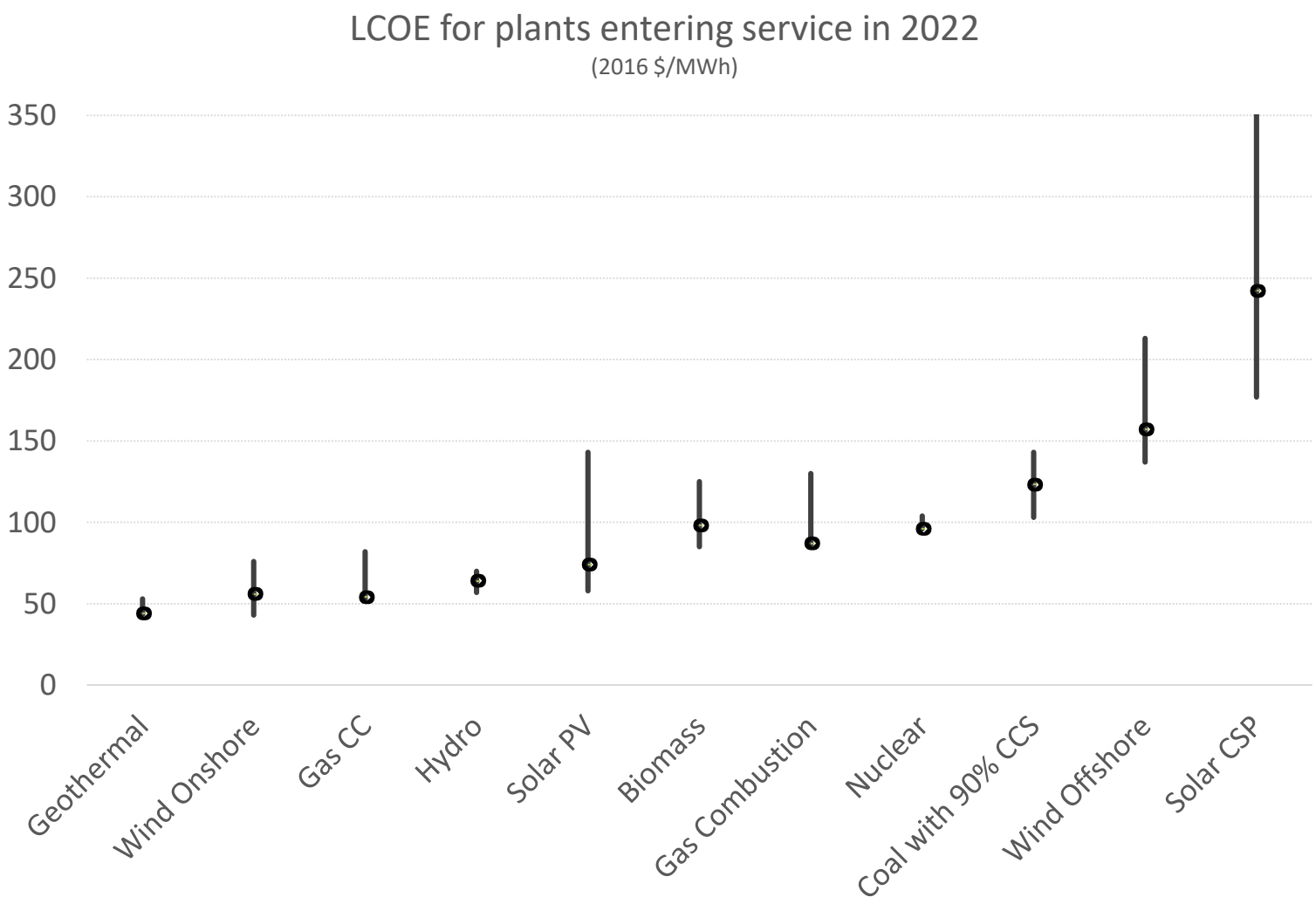
- ‘Legacy’ jobs lost
- Net Imports (technology, expertise)
- Electricity prices? (full system costs)
- Land-use impacts (e.g. property values)

Example LCOEs (US)



Data source: US EIA, April 2017; charting by Grey Cells Energy

Cautions with Simple Metrics

- Assumptions?
  - Behind any single metric
  - Differences: same metric, different studies
- Mixing up “Cost” with “Price”?
- Current or Projected?
- Independent or proving a point?
- Relevance?

“LCOE is **not** used by EIA to project new capacity builds, dispatch, or electricity prices” (EIA 2013)

Other Metrics…?

- “Societal Cost of Energy” (Siemens)
- “Levelized Avoided Cost of Energy” (US EIA)