8. November 2016 | Berlin

The „Energiewende“ in Germany – Does Decarbonisation lead to Dematerialisation?

Interim results from the ongoing project “Analysis of the Raw Material Demand of the Energy Infrastructure in Germany”

Conference “Decarbonisation and Resource Efficiency ”

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Aim of the analysis

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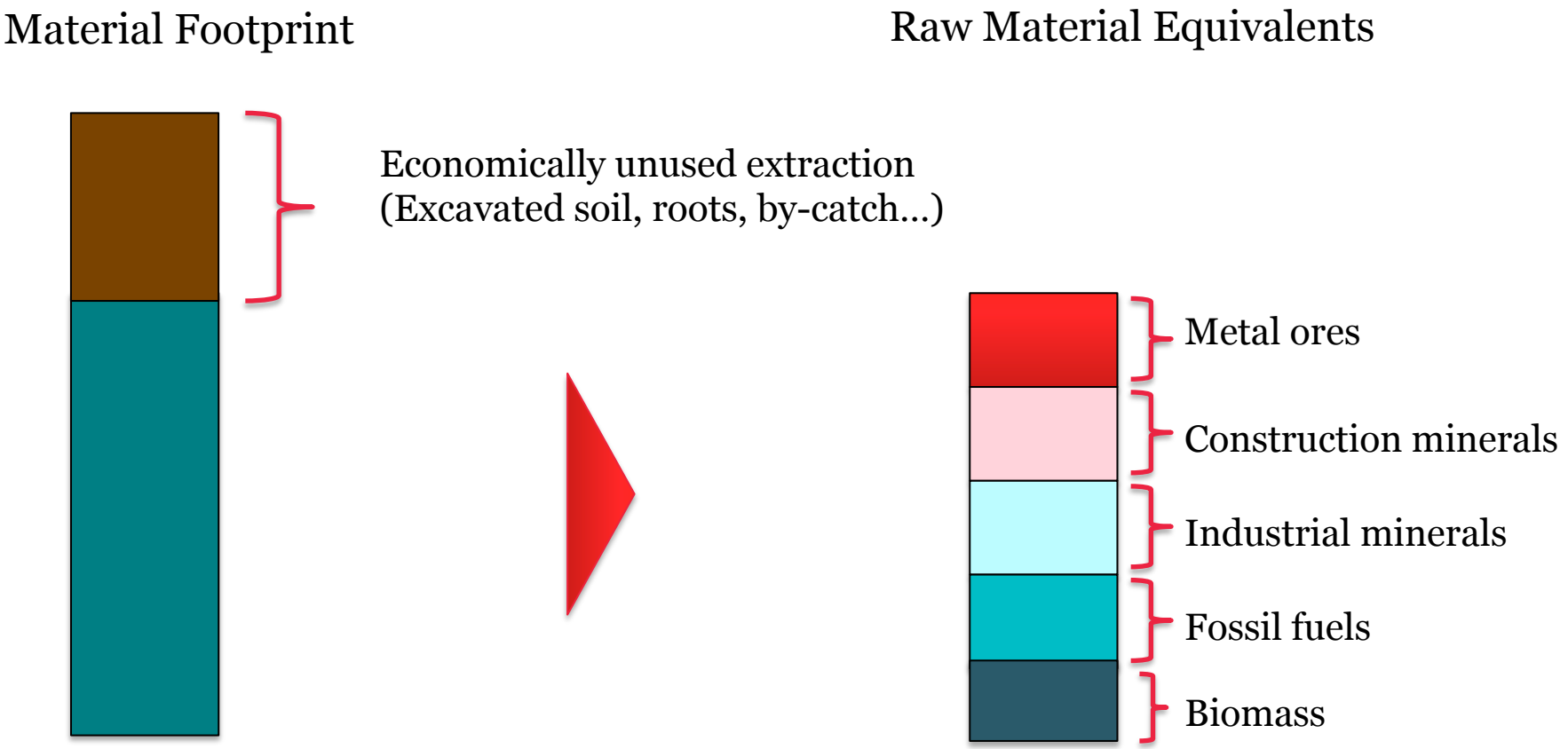
Comparing the material demand of the current German electricity mix with a projection for 2050:

- Simple but robust model of the electricity production (without im-/exports)
- Considering material demand of power plants, grid & storage systems
- Projection based on existing scenarios from literature

Definition of material demand

- We consider all raw materials from nature over the life cycle of a product
- Materials are quantified by the indicator „Material Footprint“



Based on Liedkte et al. 2013

Analysing the status quo

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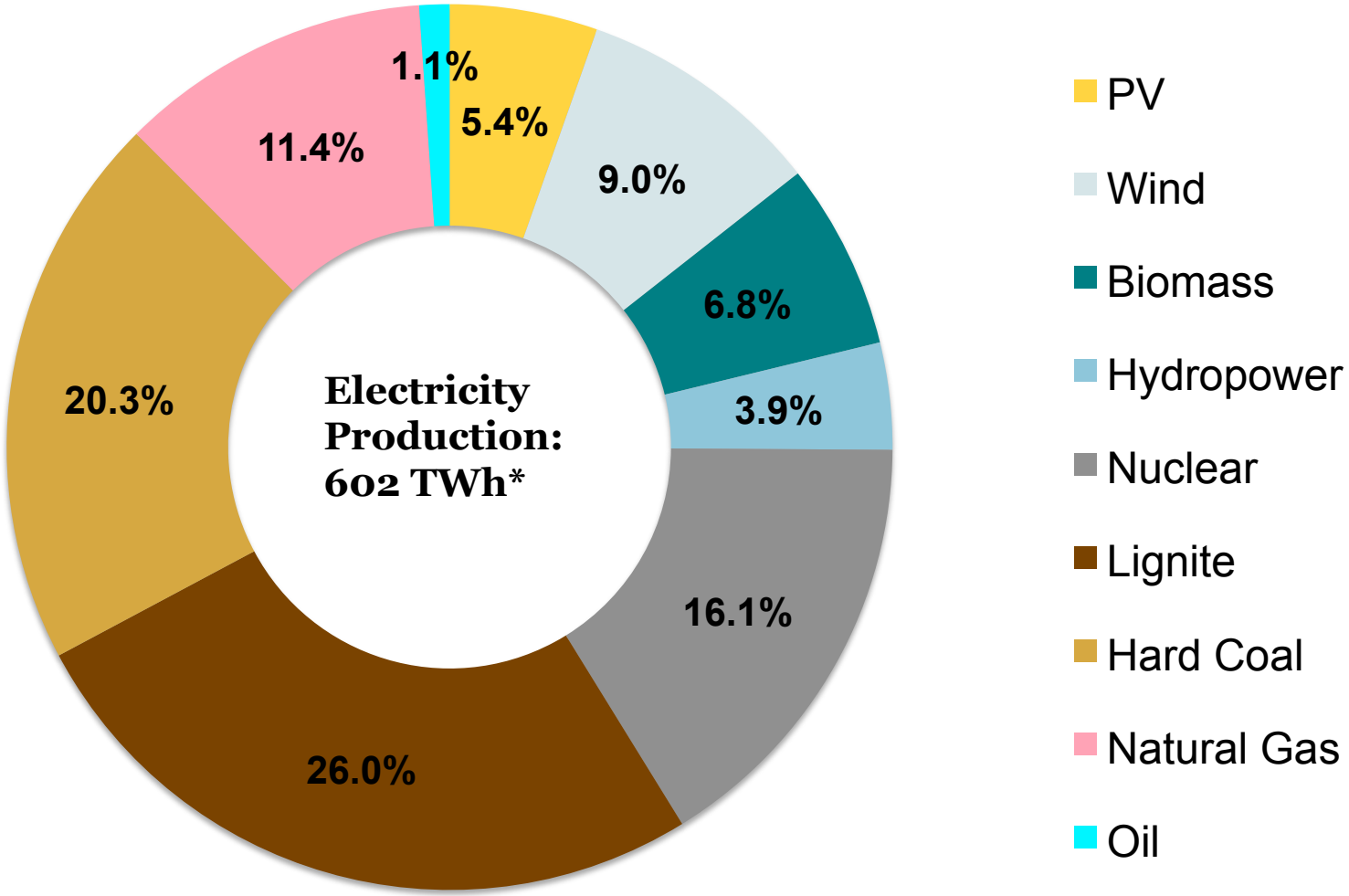
The German electricity mix in 2013



*Including electricity consumption from power plants, without im- / export

Based on BDEW (2015)

Classification of energy technologies

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- Wind turbine
- PV
- Biomass
- Hydropower
- Lignite
- Hard coal
- Geothermal
- Gas
- Oil
- Nuclear

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→

- Wind: onshore, direct drive, Enercon (58%)
- wind: onshore, gear drive, synchronous (21%)
- wind: onshore, gear drive, asynchronous (19 %)
- wind: offshore, gear drive, asynchronous (2 %)

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→

- PV multi-c silcon, roof installation (97 %)
- PV a-silicon, roof installation (1.5 %)
- PV CIGS, roof installation (1.5 %)

Classification of energy technologies

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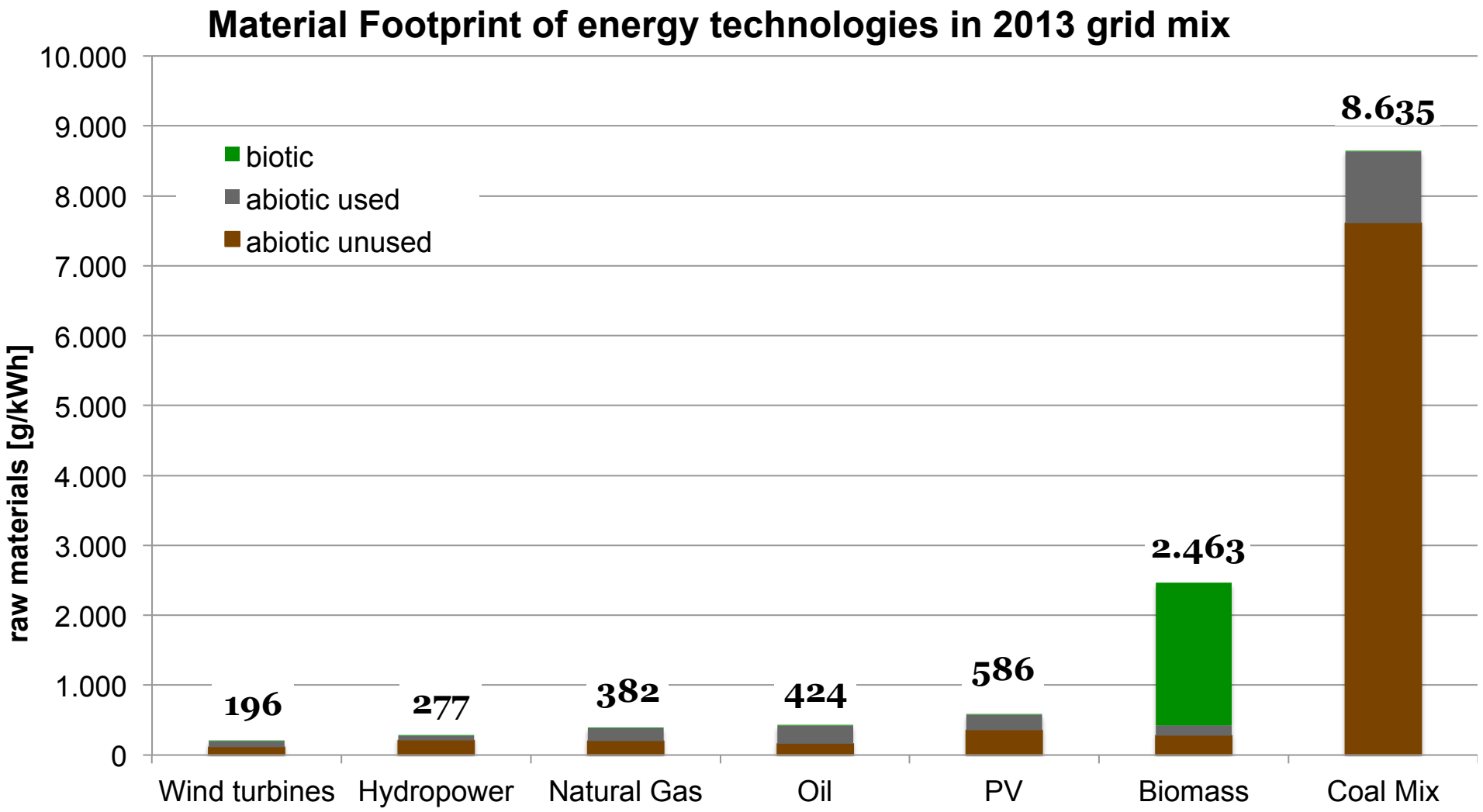
Overall 26 power plant types are considered in the model

Efficiency rate / full load hours are based on statistical data of 2013

Results for selected technologies



Basierend auf Wiesen et al. 2016a

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Projection: Electricity mix for 2050

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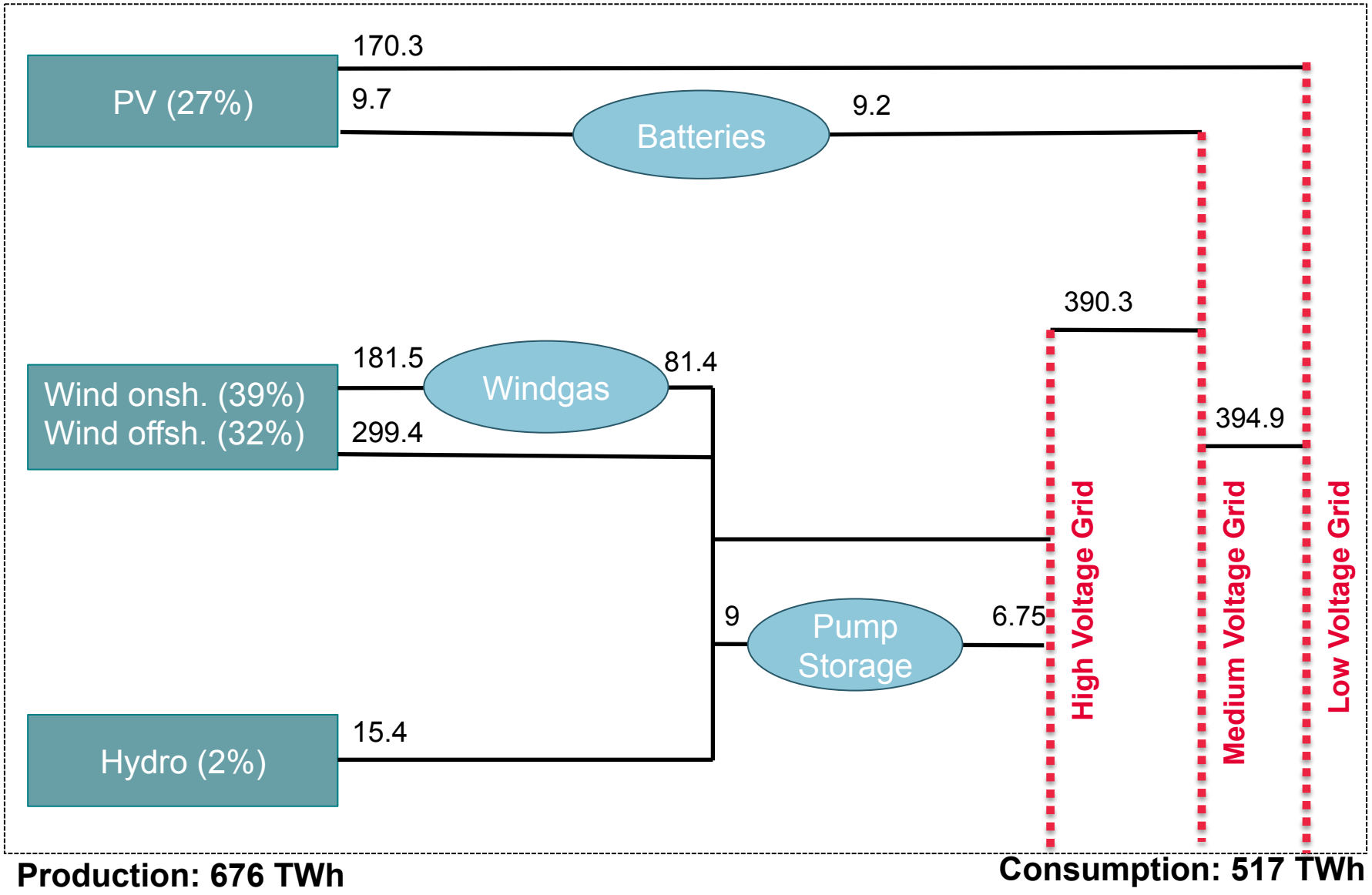
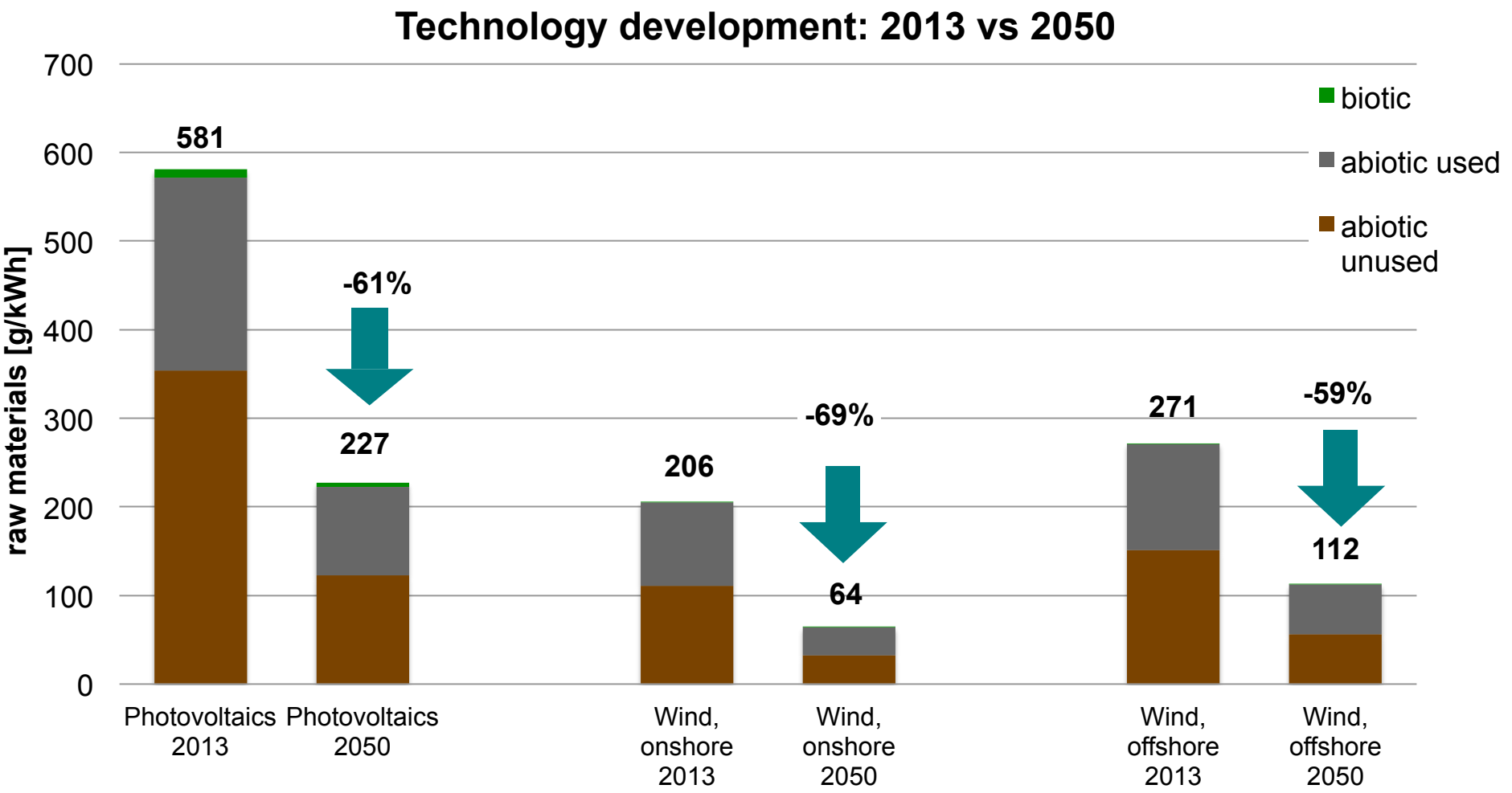
Simplified model of electricity production



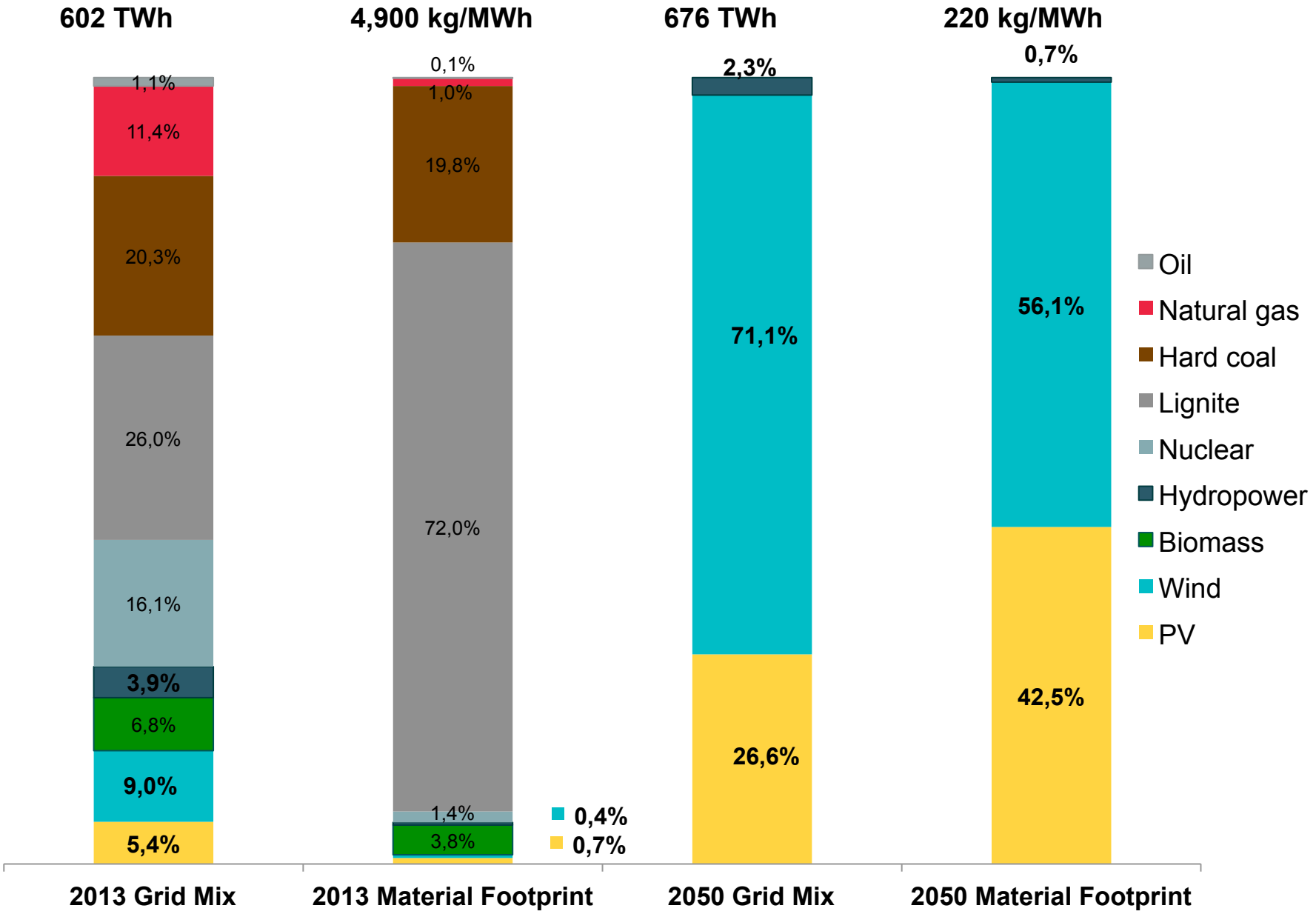
Based on Wiesen et al. 2016b, Henning and Pfalzer 2023

Results for selected power plants



Wiesen et al. 2016a

Comparision of grid mixes



Wiesen et al. 2016b

Conclusions

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Results for 2050:

- The further installation of PV and Wind energy towards a fully renewable electricity generation reduces the material demand by factor 20
- Material demand of grid components moves into focus (17% of overall footprint)
- Wind energy, specifically onshore, has the lowest material demand– even if a share of up to 30% of the electricity is stored as wind gas before being supplied to the grid

Recommendation for future analysis:

- Dynamic model reflecting
  - Demand side
  - Replacement rate of power plants
  - Decreasing ore grades and increasing recycled content

Thank you for the attention!

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Literature

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