Deutsches Biomasseforschungszentrum
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Status of bioenergy hybrids in Germany

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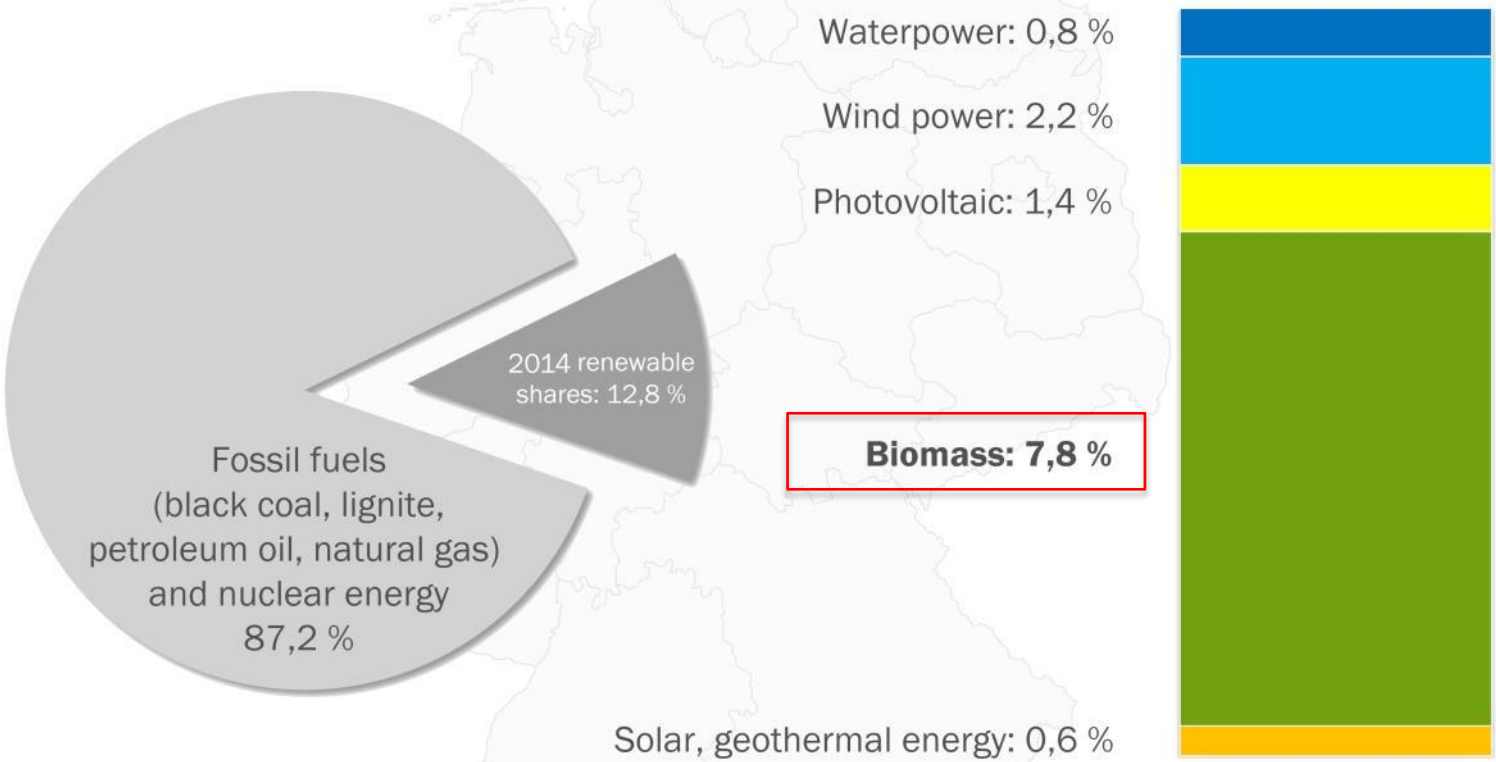
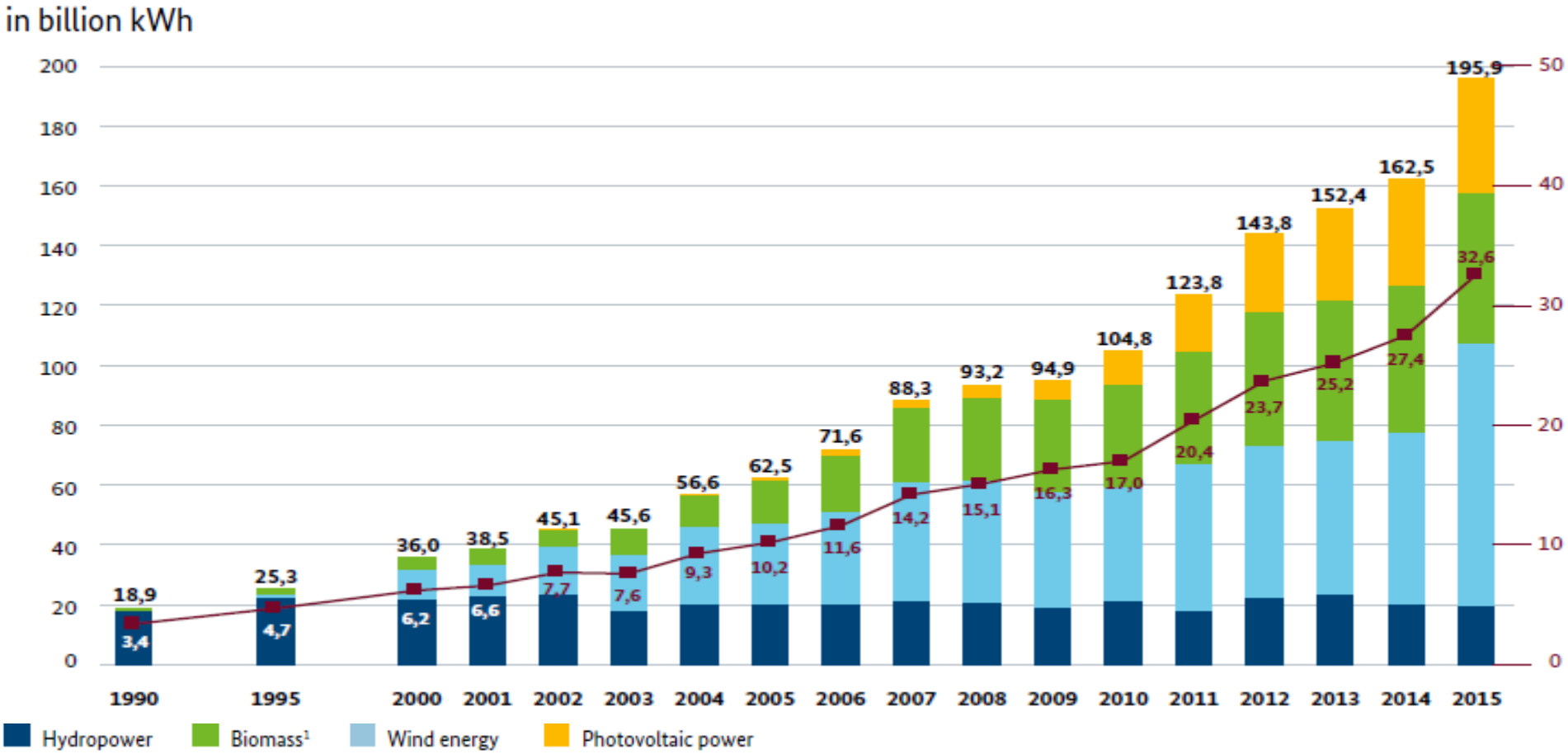
Biomass in the German energy system

Share of renewable energies in final energy consumption in 2014



Source: Erneuerbare Energie in Zahlen, BMWi/AGEEStat 2014 (own presentation)

Development of the renewable electricity generation in Germany in 2014



Geothermal electricity generation is not shown due to the small quantities involved.

1 including solid and liquid biomass, biogas including biomethane, sewage gas, landfill gas and the biogenic fraction of waste; also including sewage sludge as of 2013

Sources: BMWi on the basis of AGEE-Stat and other sources; see figure 8

Sources for renewable heat in Germany

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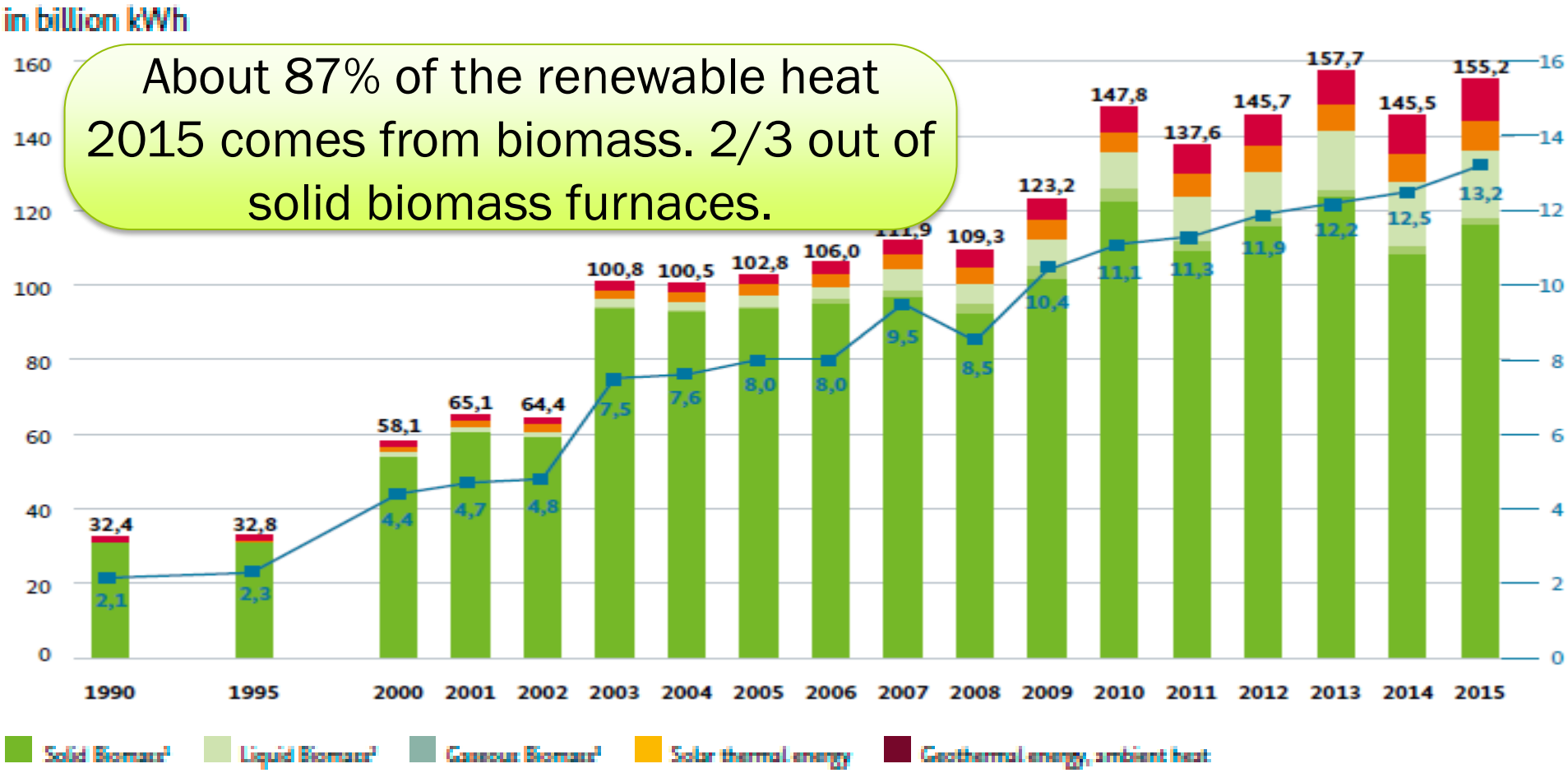
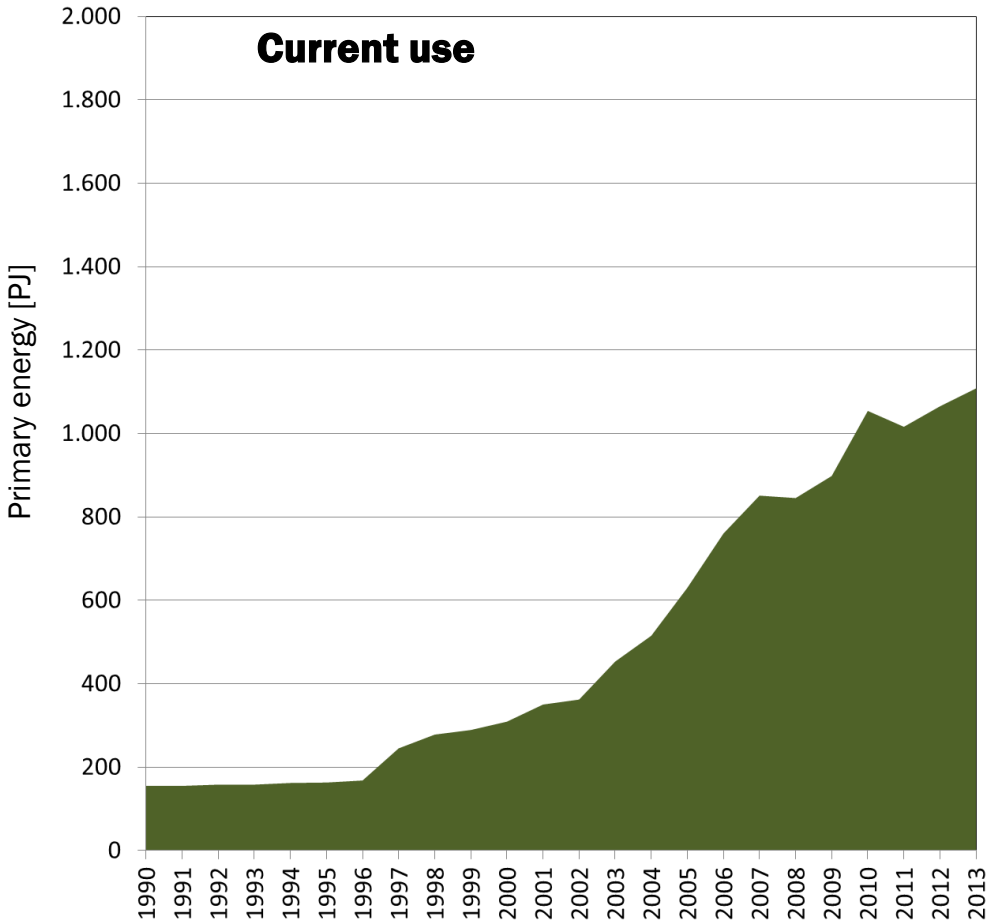
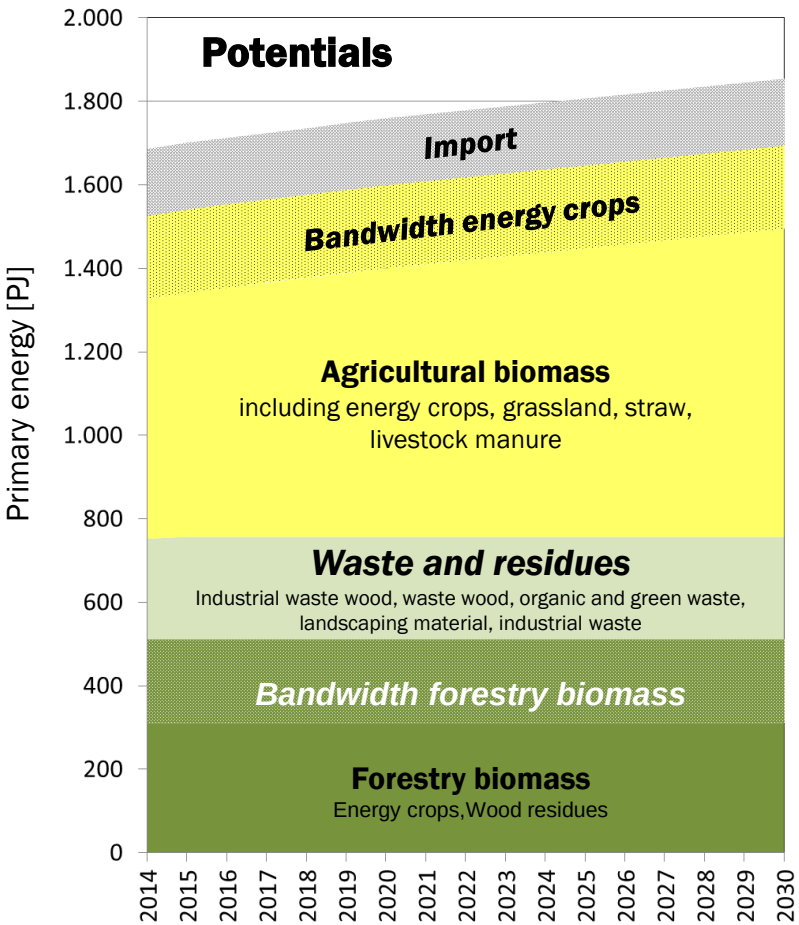


1 Including biogenic fraction of waste; including sewage sludge as of 2012; as of 2015 information available for TCS-sector (trade, commerce and service sector) for the years 2003 to 2014
2 Including agricultural consumption of biodiesel
3 Biogas including biomethane, sewage gas and landfill gas

Sources: BMWi on the basis of AGEE-Stat and other sources, see figure 16

Current use and biomass potential in Germany





Sources:
Usage: *according to AGEE-Stat 2013 (PEV calculated by method of efficiency),* ***Potentials:*** *BMVBS 2010 (*Energy crops, manure*), Zeller et al. 2011 (Straw), Destatis (*External trade statistics *2011), DBFZ 2013 (Organic and green waste, industrial waste, unpublished)*
*(Notice:*Missing years were determined by updating the results)

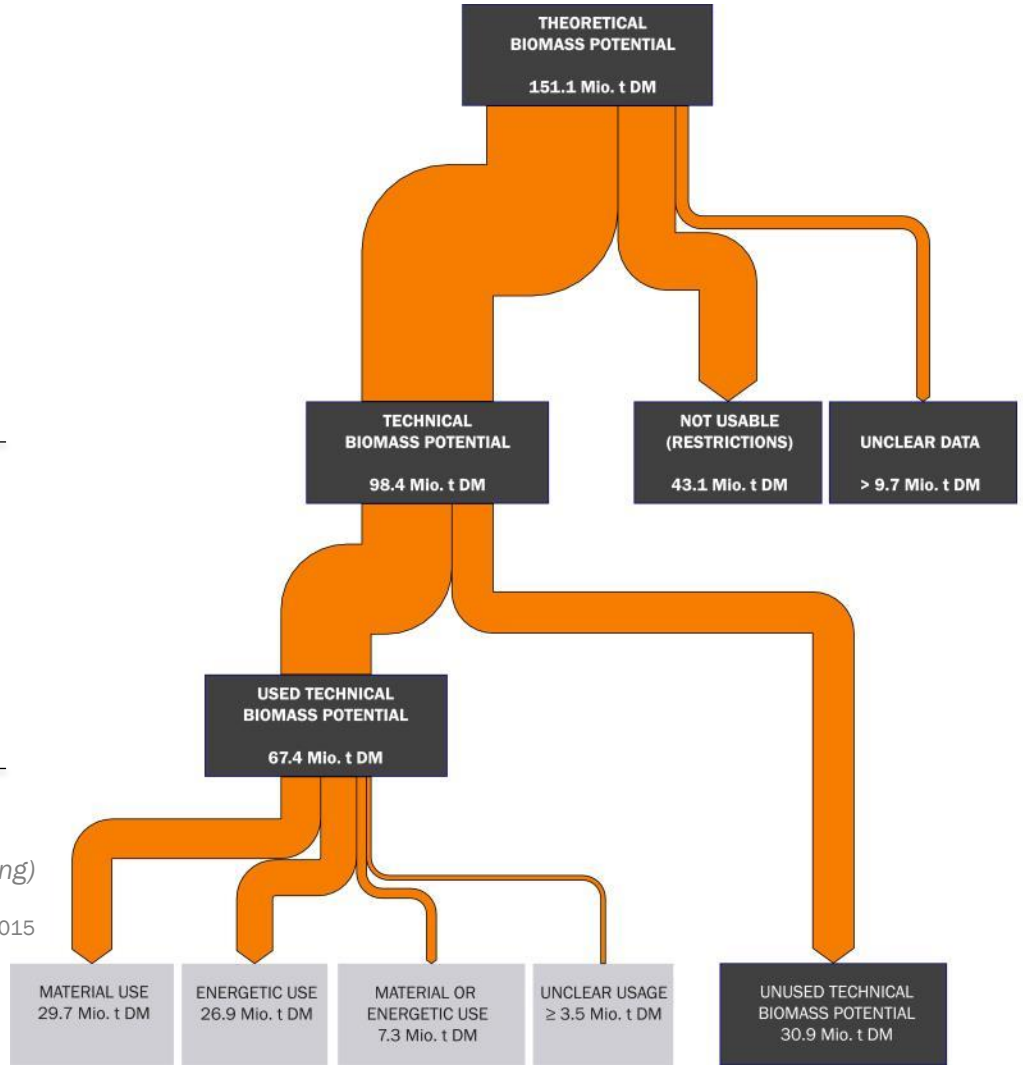
Biomass in the German energy system
Focus: waste and residues

Biomass potentials from waste and residues and their actual use – status quo in Germany
77 Single biomasses have been considered
Time references are not uniform

151.1 Mio. t DM	Theoretical potential
- 43.1 Mio. t DM	Not usable (Restriction)
- 9.7 Mio. t DM	Unclear data
= 98.4 Mio. t DM	Technical potential
- 29.7 Mio. t DM	Material use
- 26.9 Mio. t DM	Energetic use
- 7.3 Mio. t DM	Material or energetic use
- 3.5 Mio. t DM	Unclear usage
= 30.9 Mio. t TS	Unused potential

(Discrepancies due to rounding)

Source: Brosowski et al. 2015



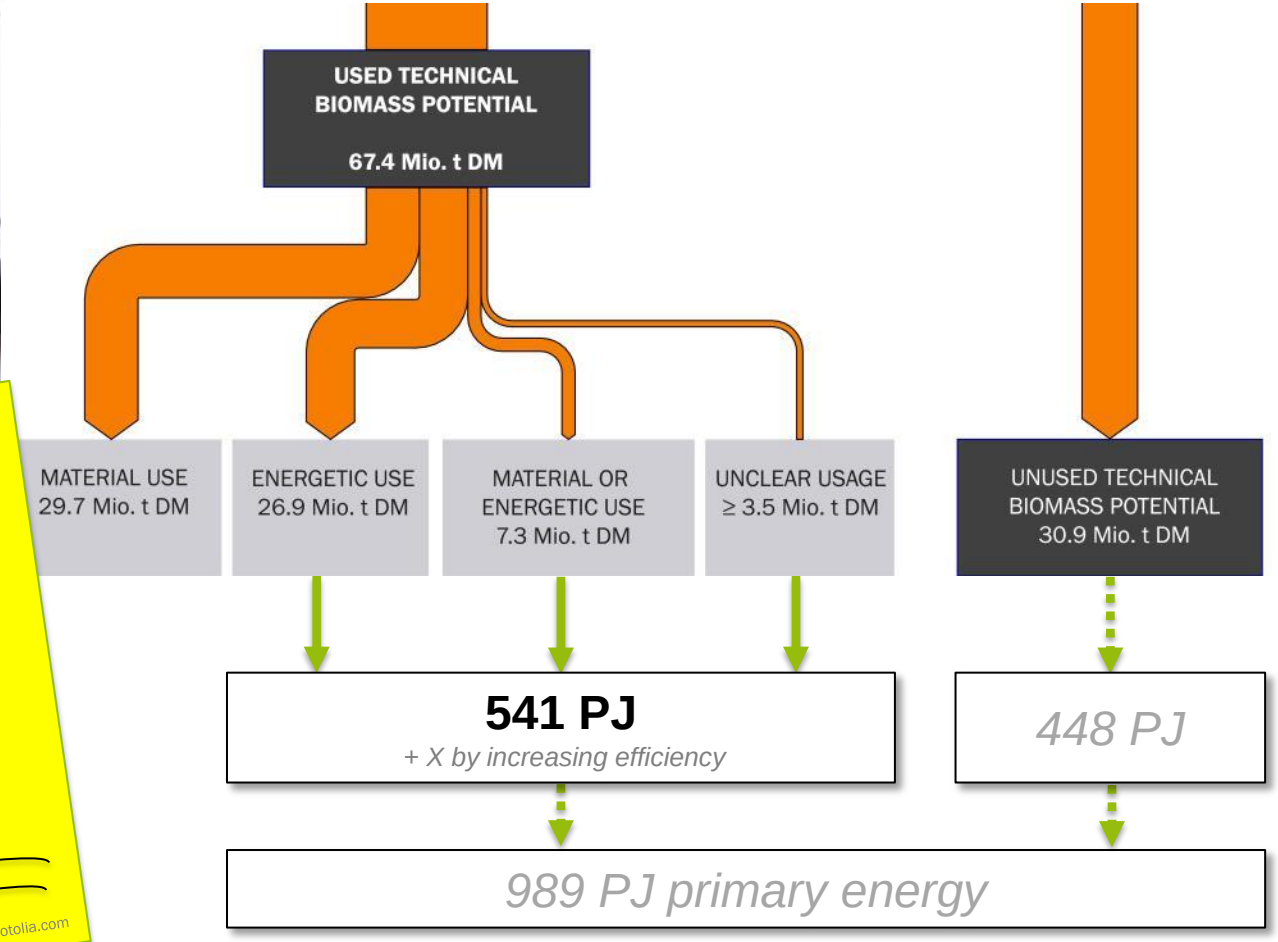
What do these results mean?

Calculation of primary energy consumption

13.566 PJ Demand 2014
989 PJ from residues

= 7,3 %

Picture: morchella / Fotolia.com



Source: Brosowski et al. 2015

Sectors to be considered

„Bioenergy should be consistently geared to areas of use in which it can demonstrate its advantages." (German Bioeconomy Council)

Renewable heating & cooling

Renewable electricity generation

Renewable fuels & chemicals production

Cross-sectoral issues

Domestic/Residential heating and cooling

Current bioenergy hybrid systems in Germany are usually custom solutions and operate as combination of

- pellet, woodchip or firewood boiler (mainly pellet boilers in domestic, woodchip in residential applications)

with

- thermal solar system
- heat pump and
- always buffer tank(s)
- intelligent control concepts (system integration)

Research usually takes place in

- the development of control strategies for the combined operation of renewables

→ applications use the **constant availability** and **storage capacity** of biomass
→ decoupling demand and availability of (volatile) heat generation through thermal buffers

Virtual power plants

Current bioenergy hybrid systems in Germany are usually based on research projects and operate as combination of

- biomass and biogas plants

with

- wind
- photovoltaics
- fuel cell
- hydro power facilities
- buffers/pumped hydro facility
- intelligent control concepts for optimized system integration

→ applications use primarily the **ability** of biomass to **partially compensate for the high volatility** of wind and solar power in the generation of electricity and heat and additionally its constant availability and storage capacity

Power to gas

Current bioenergy hybrid systems in Germany are usually pilote and demonstration plants in utility-scale and industrial applications and operate as combination of

- biogas plants (as source for the required CO_2 for the conversion process)

with

- wind
- electrolyzer (for the conversion process)
- buffer tanks (for hydrogen, methane)
- intelligent control concepts for optimized system integration

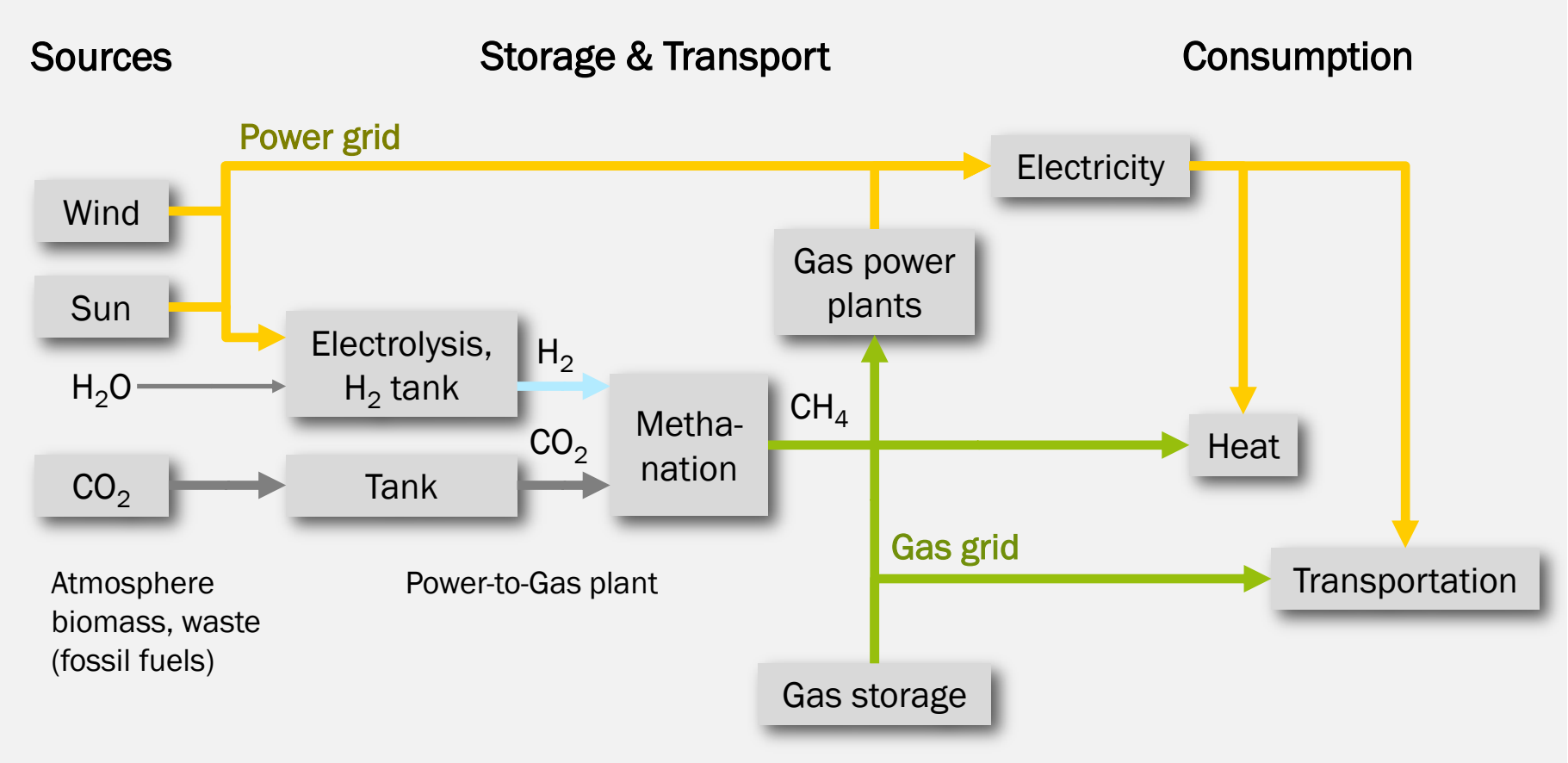
Research usually takes place in

- the methanation process (use of catalysts, tank material)

→ applications use the **constant availability**, **storage capacity** and the **ability** of biomass to **partially compensate for the high volatility** of wind and solar power

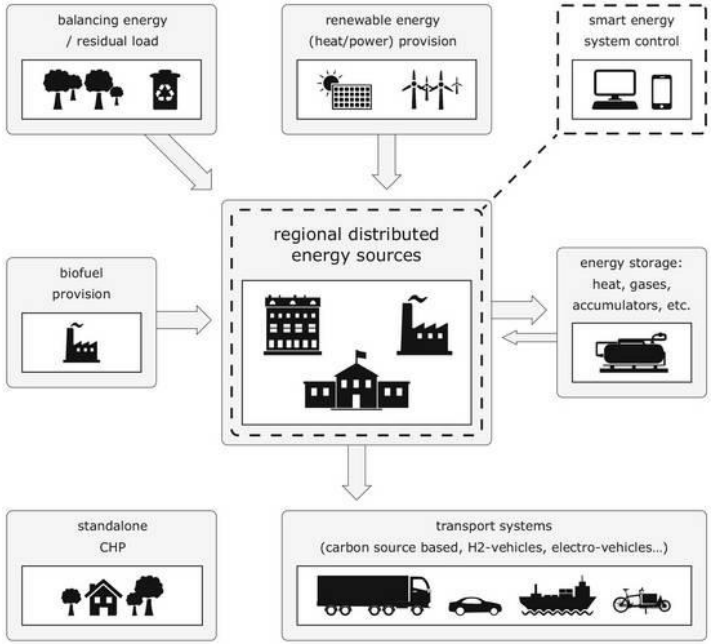
→ decoupling the process of electricity and heat generation through material conversion

Integrated electricity and gas grid with a storage capacity



Source: based on IWES, ZSW/Schmid, J. & Günther M.: Methanisierung: CO_2 nutzen statt endlagern. In: energie|wasser-praxis, issue 3/2013, p. 15.

Research for the Smart Bioenergy concept



Source: Thrän, D. (Hrsg.) (2015): Smart Bioenergy. Technologies and concepts for a more flexible bioenergy provision in future energy systems. Heidelberg: Springer, p. 176.

- Food security
- Security of supply
- Innovative products and markets within the bioeconomy
- Climate and environmental protection
- Rural development

→ Directing the focus of the individual investment on their **systemic embedding**

Summary:
Bioenergy Hybrids in Germany 2016

→ In **domestic and residential applications** there are mainly biomass boilers used in combination with thermal solar systems and/or heat pumps for **heating purposes**

→ **Utility-scale and industrial applications** turn to power to gas applications and virtual power plants and have an impact on the **electricity and transport sectors** in Germany

→ in the **long run** a **transformation of bioenergy** use is necessary – integration into a renewable energy system – **almost all bioenergy use will become a part of multibrid solutions.**

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