Deutsches Biomasseforschungszentrum
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DBFZ

Smart Bioenergy – Changing biomass utilisation for decabonized economy

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22nd May 2017, Tokyo

The bioenergy journey until today

DBFZ

„Zero Hour“

Oldest tandoor

In Japan they found the first fired ceremonial vessels from the Jōmon period at nearly 75,000 places.


Quelle: http://www.badv.bund.de

12.350 ± 700 B.C..

Oldest iron stove

Use of nickel-free, i.e. terrestrial iron in Mesopotamia, proven by a nickel-free iron-dagger with bronze handle, who was found in the area of todays Iraq.


Quelle: www.pinterest.com

3.000 and 2.700 B.C.

Oldest (bio-)gas utilization

For the first time in China.


Quelle: http://www.glogster.com/ lilycake/mesopotamia

500 B.C.


Quelle: oilandgasprocessing.blogspot.com

1860s

Oldest motor fuel

Nikolaus Otto already used "alcohol" (potato fuel, agricultural alcohol, today reffered as Bio-Ethanol)


Quelle: www.focus.de

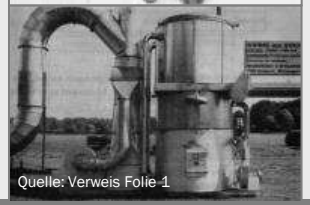

Quelle: www.deutsches-museum.de

1950-80

Modern bioenergy

First results of the bioenergy research in the EU (biogas plants in Europe)


Quelle: Biogasanlagen im Allerhop, 1951 Palz,W. (Hrsg) : Neue Energien et. al.


Quelle: Verweis Folie 1

2010

Efficient technologies

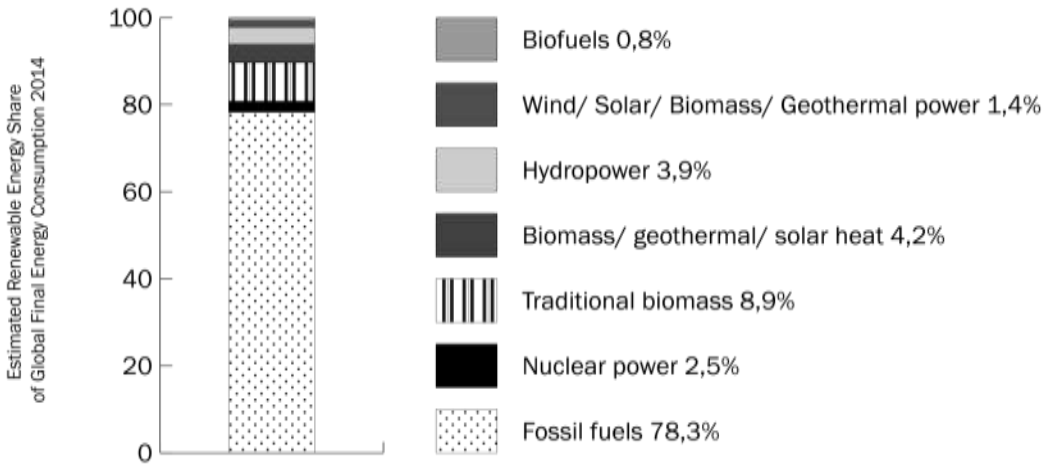
First Downburn-Oven


Quelle: Universität Leipzig, Xeoos

INNOVATION | PROGRESS

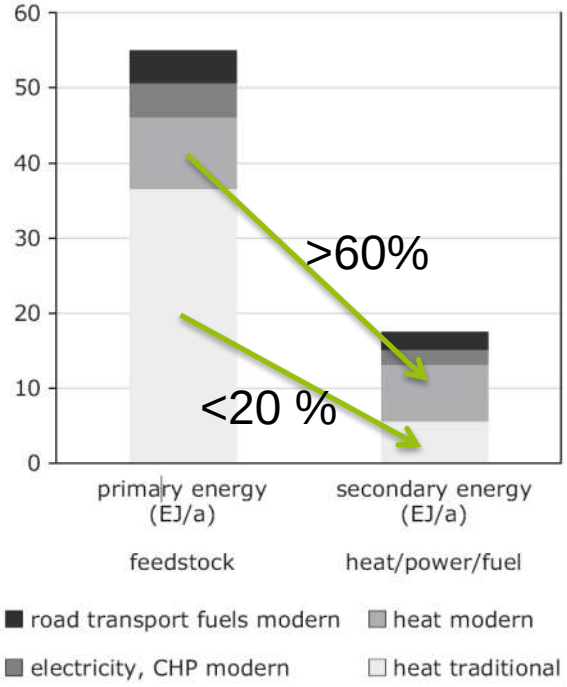
Bioenergy status quo

Estimated Renewable Energy Share of Global Final Energy Consumption 2014



Source: Schinkel, DBFZ, Data from REN21 Renewables 2016 Global Status Report

Global biomass flows in 2012

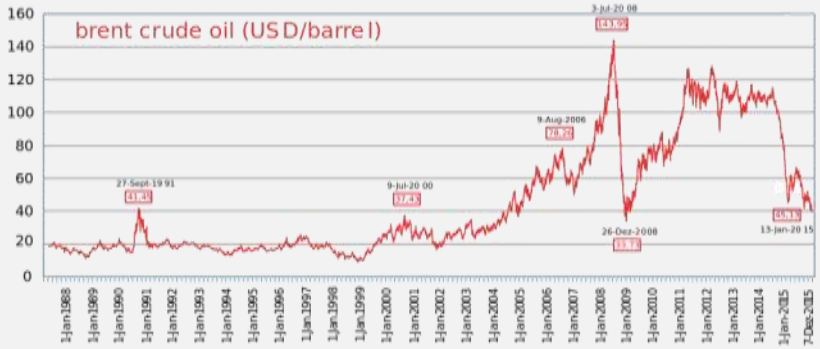


Source: Thrän, Smart Bioenerg, 2015

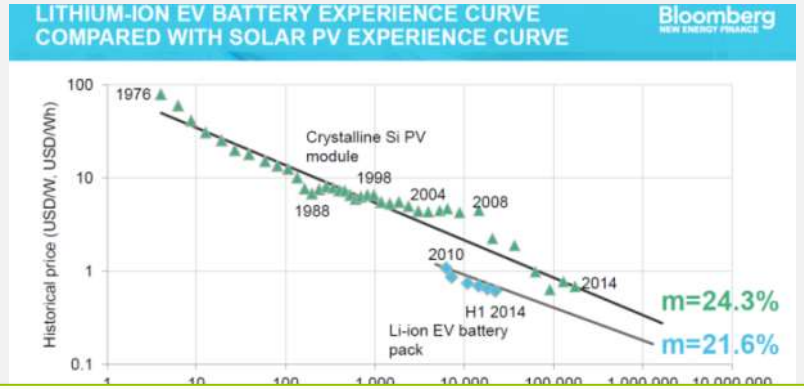
With higher efficiency, especially in wood combustion, high potential of final energy without additional feedstock is available.

Bioenergy challenges

Costs

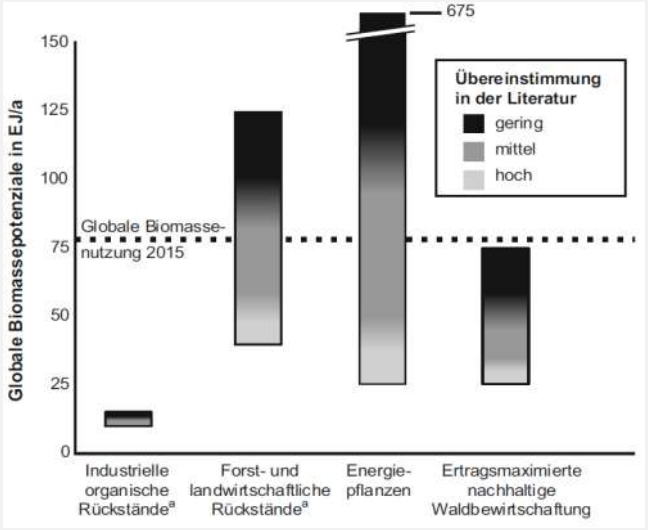


Source: Wikipedia.com / originally from the US Department of Energy



=> Focus on residues, waste and by-products

Sustainable Raw Materials



Source: Karina Bloche-Daub, Hans Hartmann, Hermann Hofbauer, Martin Kaltschmitt, Diana Pfeiffer, Lisa Thormann und Daniela Thrän. Energie aus Biomasse Kapitel 1

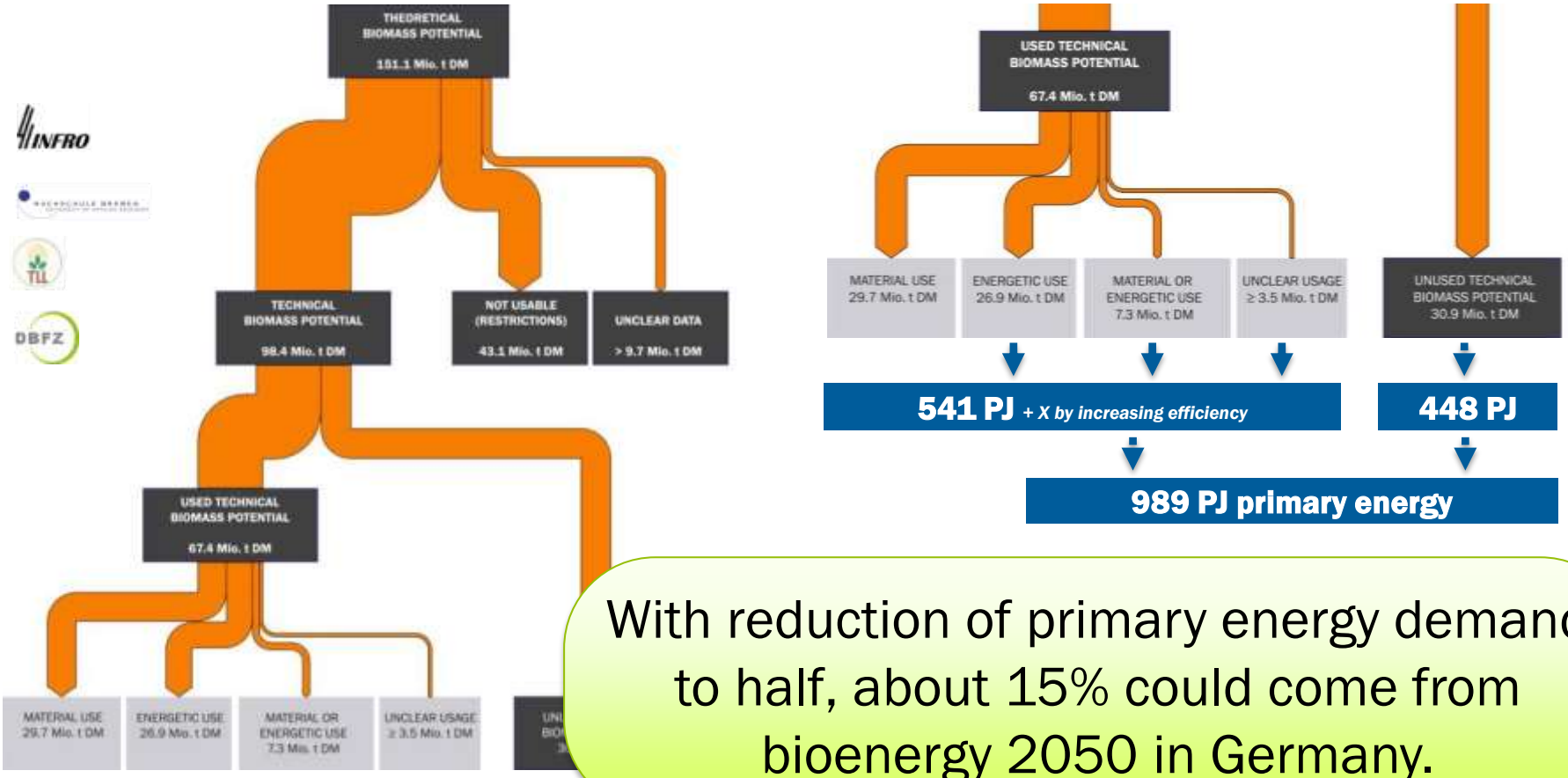
Source: UN, Sustainable development agenda, 2015

With support from
Federal Ministry of Food and Agriculture
by decision of the German Bundestag

Various biogenic residues

Biomass potentials from Waste and residues and their actual use – Status quo in Germany

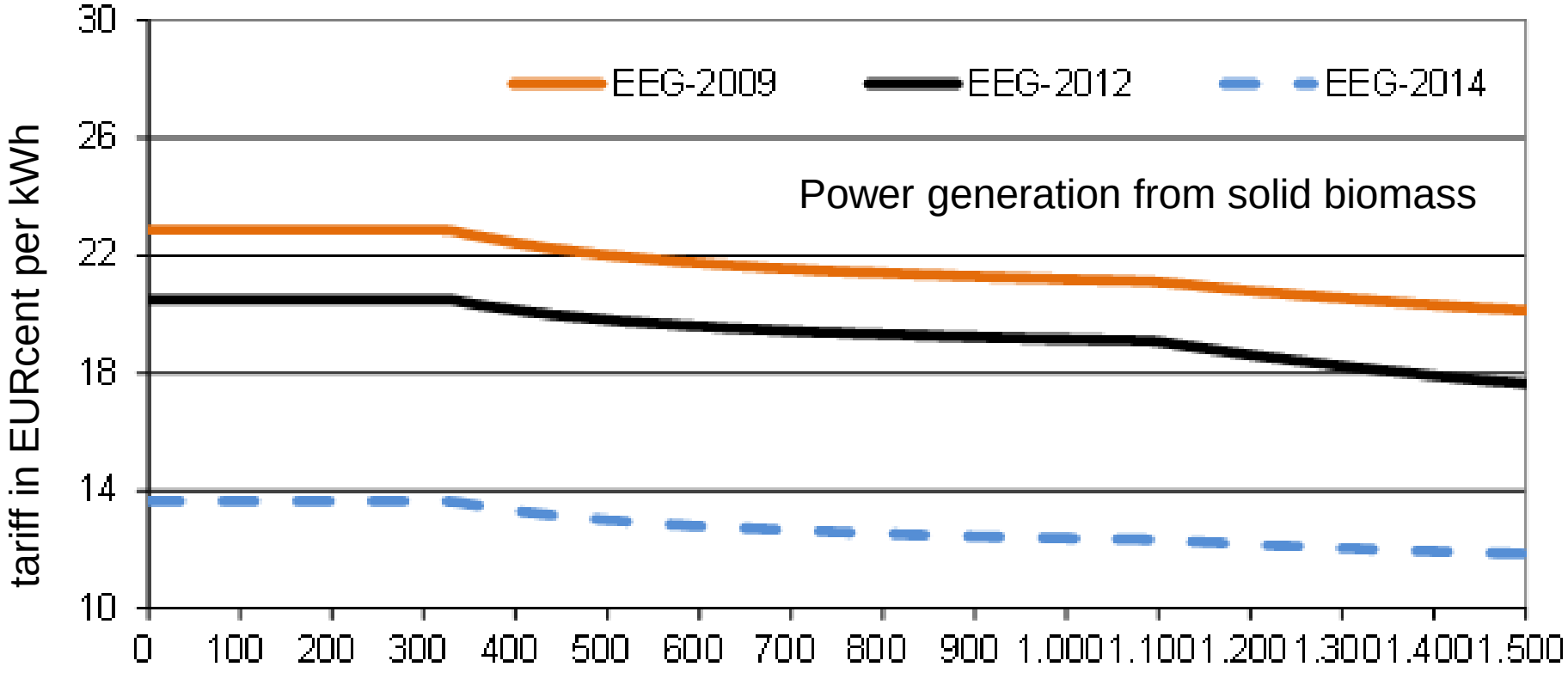
77 Single biomasses have been considered



With reduction of primary energy demand to half, about 15% could come from bioenergy 2050 in Germany.

Source: Brosowski et al: A review for biomass potentials and its current utilisation – Status quo for 93 biogenic wastes and residues in Germany; Energy, Sustainability and Society (under review)

Challenge: Changes of the German Feed-In-System

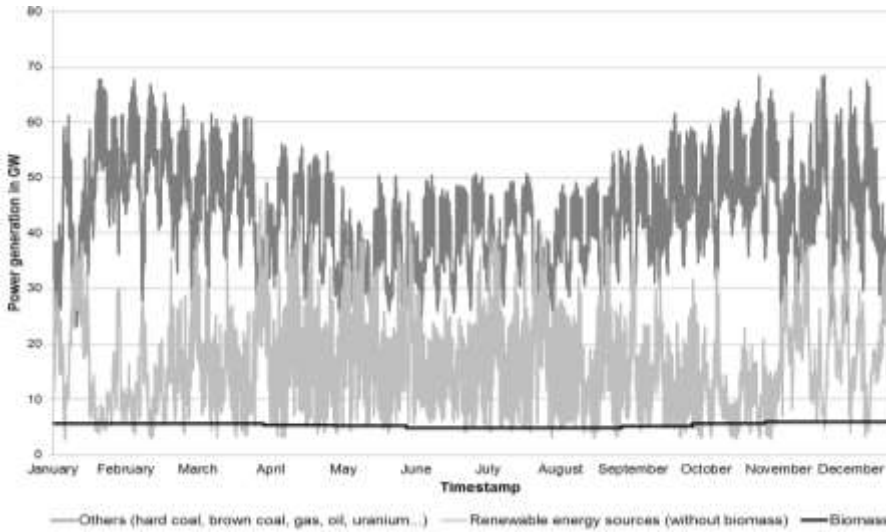


(source: DBFZ 2017)

Starting 1.1.2017 bioenergy plants above 150 kW electrical power have to undergo a bidding system. For 2017 and 2018 the government will subsidies a total of 150 MW_{el} each year of new or existing installations. Maximum price for new installations: 14,88 cent€/kWh for 20 years
and existing ones: 16,9 cent€/kWh for 10 years

Decarbonizing -> Renewable energy system

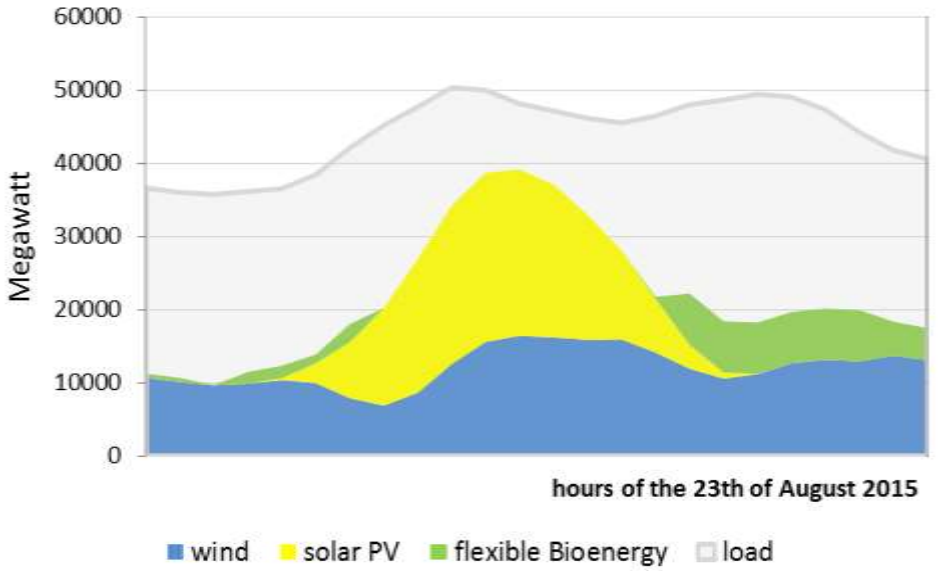
- To keep **global warming below 2°C** means immediately transition of energy system to **more or less only renewables**.
- Main energy supply comes from **Wind and Solar**.
- **High fluctuations** in power, but also within heat supply system.
- **Energy storage** and **demand side management** becomes immanent.
- Europe is thinking about **more significant price signals** in the electricity market also for end users.
- Biomass could **no longer be used as a base load** technology!



Power generation 2015

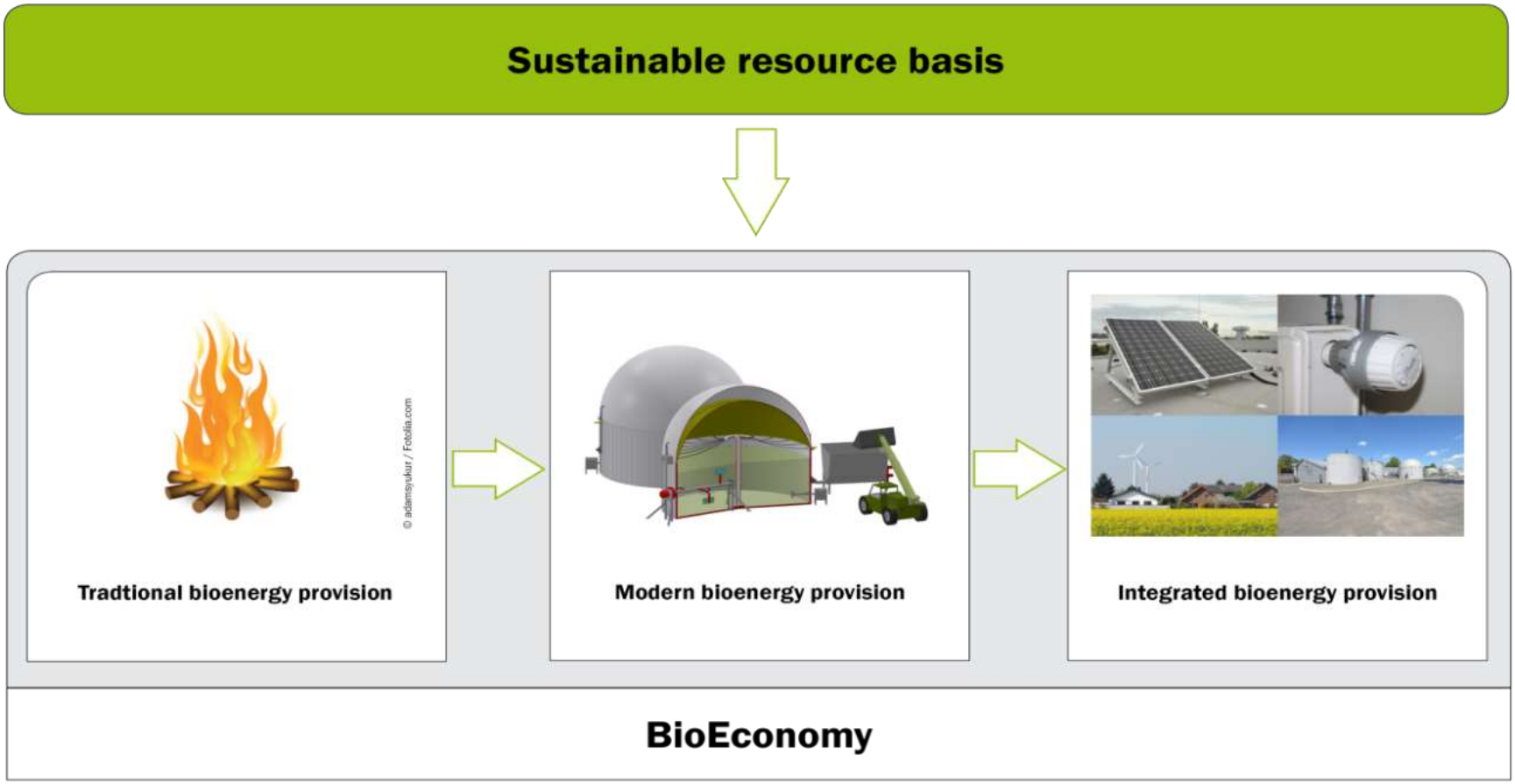
(source: open power system data)

Modelled flexible power generation



***Biogas feed-in continuous 2,7 GW**

From modern to smart bioenergy – The vision



Source: Thrän, Smart Bioenergy, 2015

- Use of sustainable raw materials
- Further development of technologies for smart integration into the energy systems with high shares of renewables
- Integration into future BioEconomy concepts

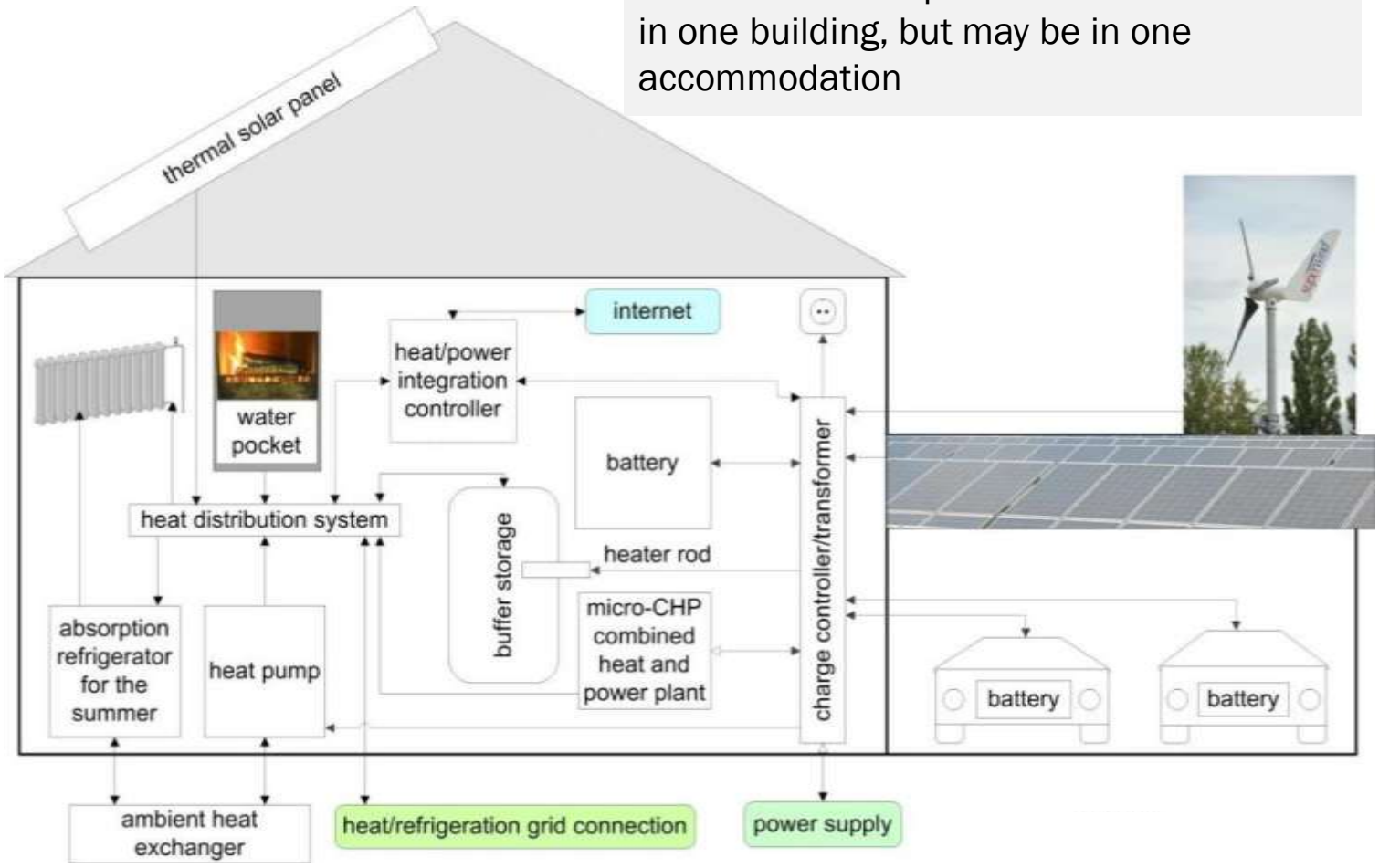
What does Smart Bioenergy mean?

Size of biomass to bioenergy conversion plants and operation is adapted to regional resource basis and opportunities for high value utilisation (Efficiency and Effectivity) of the sustainable biomass (waste, residues and by-products):

- Future heat supply from solid biofuels – especially woody biomass - has to **close heat supply gaps** in a renewable heating system with all renewable sources and **shall stabilize the local power grid** as efficient and effective as possible (Back-up-stoves and CHP-technologies in all scales).
- **Optimized integration of biogas plants** in regional waste disposal, heat supply and flexible power generation to compensate fluctuations of wind and solar (also integration of wind- and PV-power-hydrogen into biogas plants for methane generation).
- **Integrated biorefineries** coupled with renewable wind- and PV-power (SynBioPtX) and storable intermediates.
- Integration of bioenergy into **hybrid- and multibrid-systems**.

Example: Flexible heat provision – fundamental concept of SmartBiomassHeat

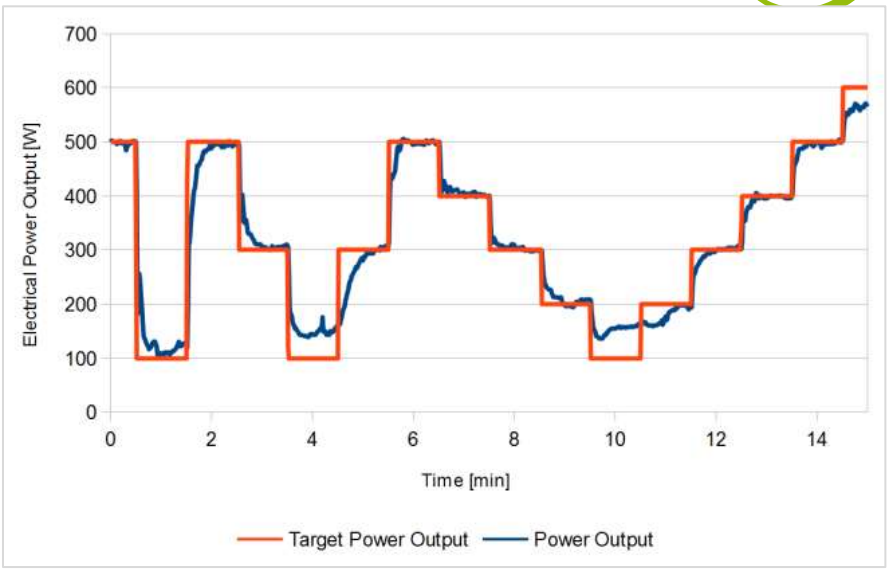
Example of connection of components – not all of the components will be installed in one building, but may be in one accommodation



Source: Lenz 2015

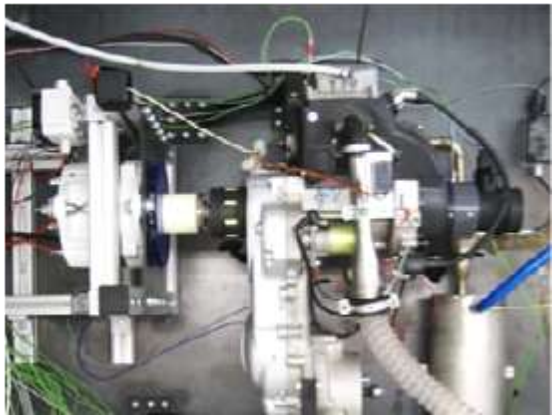
Micro CHP for solid biofuels

- micro- and mini-combined heat and power plants for heat supply and power grid stabilization



- laboratory charcoal gasifier with 0.55 kWel motor engine

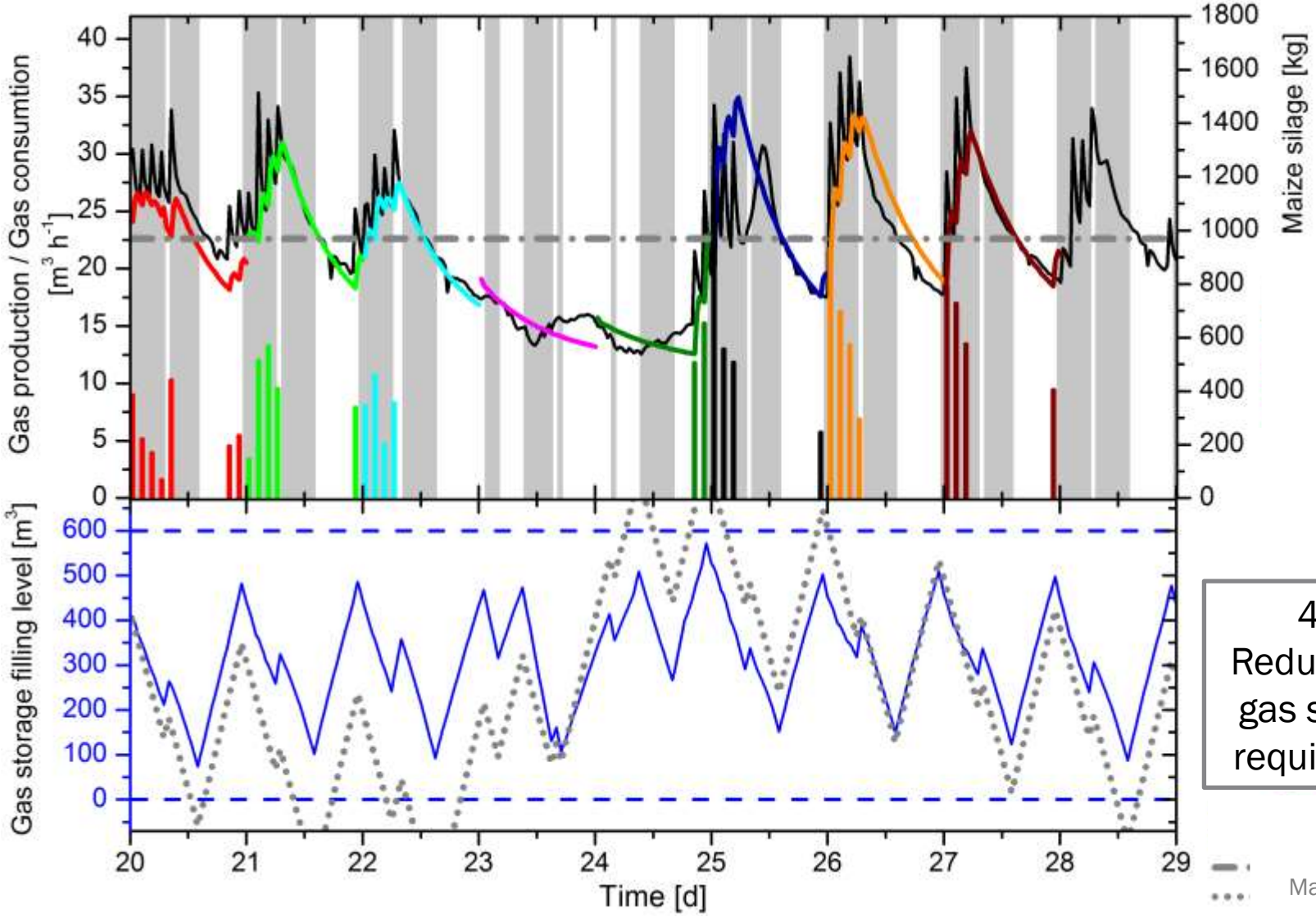
→ high operational flexibility proven!



Europa fördert Sachsen.
ESF
Europäischer Sozialfonds

Source: Krüger, DBFZ 2014

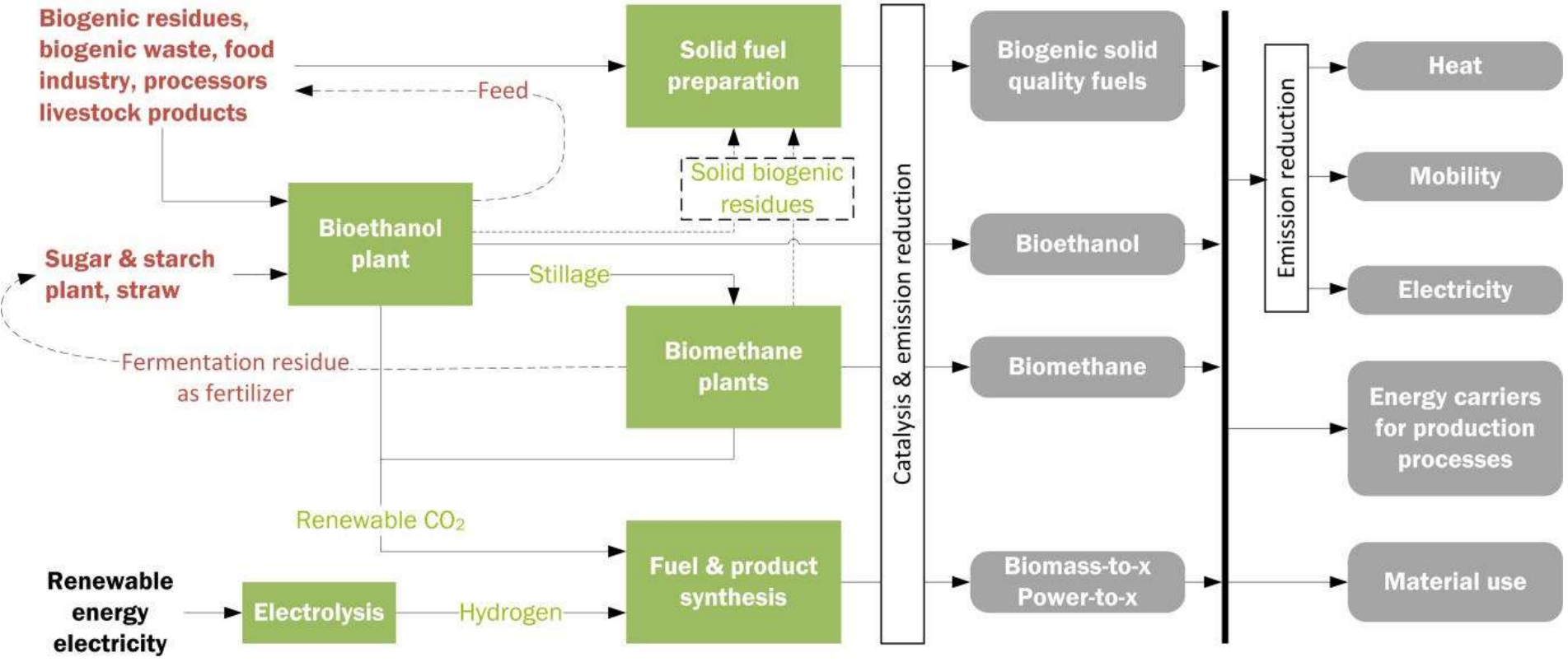
Example: Flexible biogas generation by feeding adjustment



45% Reduction in gas storage requirement

Source: Mauky et al 2016

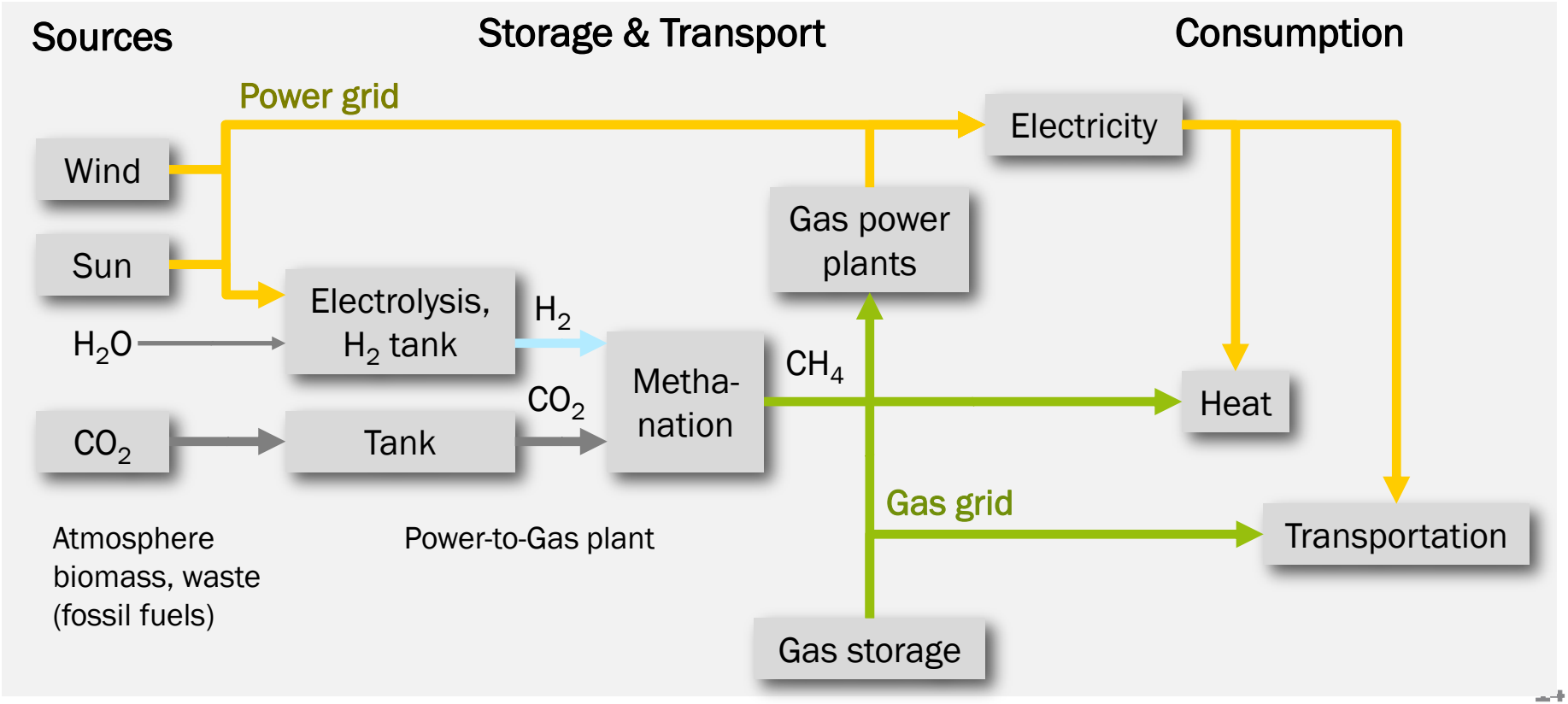
Example: SynBioPtX



Source: © DBFZ 11/2016 (w/o verification of compliteness)

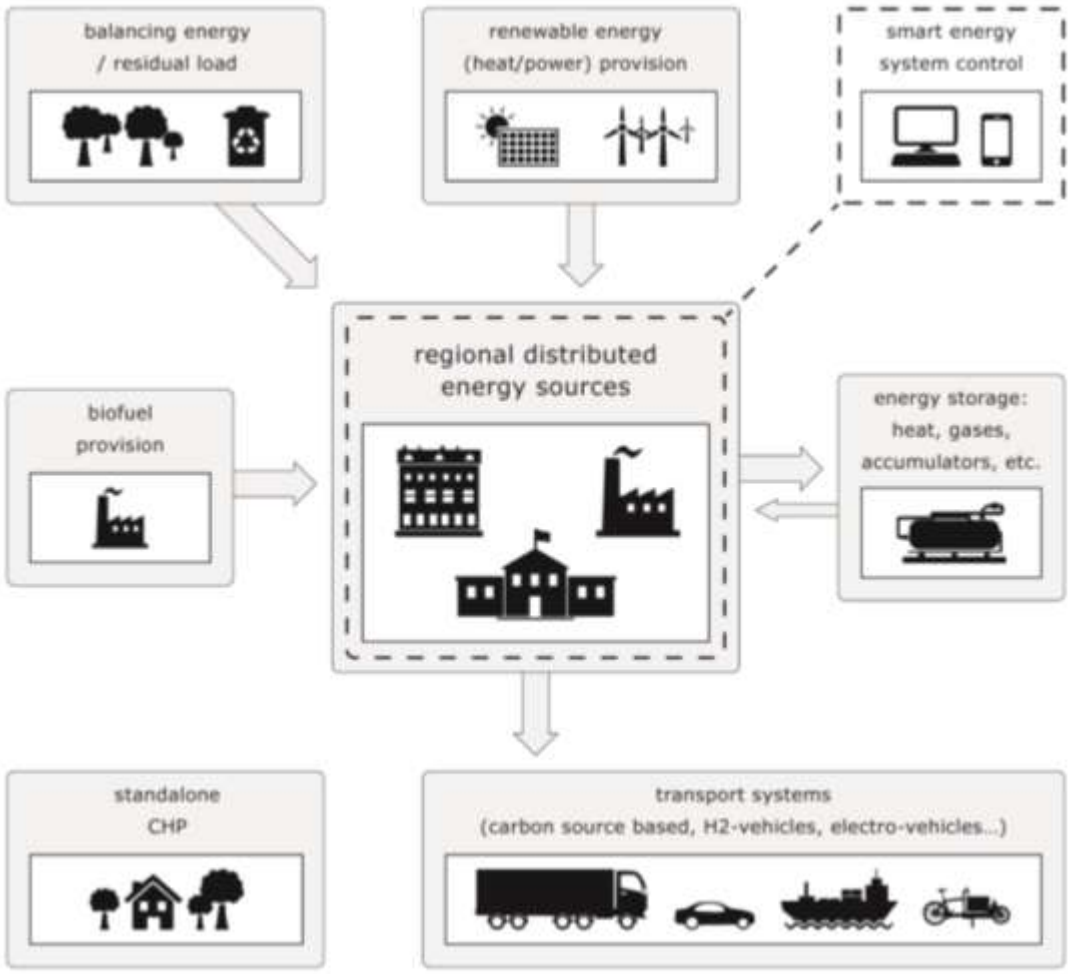
Example: HybridSystems

- Combination of wood pellet boilers with solarthermal.
- Combination of biogas plants or wood chip combustion CHP with big solarthermal or geothermal systems.
- Combination of heat-pumps with back-up stove or biomass-CHP.
- Integration of wind- and solar-power into biogas plants via hydrogen generation and additional methane generation.



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

Outlook: Integrated Supply



Source: Thrän: Smart Bioenergy, 2015

Conclusions

- The **role of bioenergy is changing** towards an **integrated and supply securing** utilisation of **sustainable** biomass potentials, especially **residues, by-products and biowaste** – smart bioenergy.
- Innovative methods, coupling and cascade use, precise and flexible controllable systems and integrated provision concepts are important components. Their development need a **reliable framework**.
- Regional adapted plant size, fuel preparation (analysing, drying, mixing, pelletisation, torrefication, HTC) and demand-oriented plant operation will improve **efficiency and effectivity** of biomass utilisation integrated in a renewable energy system with **significant price differences** according to availability of wind and solar.
- **Development of new products and new value-chains** need time for research and development (5 to 10 years) – so start with new and sometimes extraordinary ideas **now**.

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Smart Bioenergy – Innovations for a sustainable future!

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