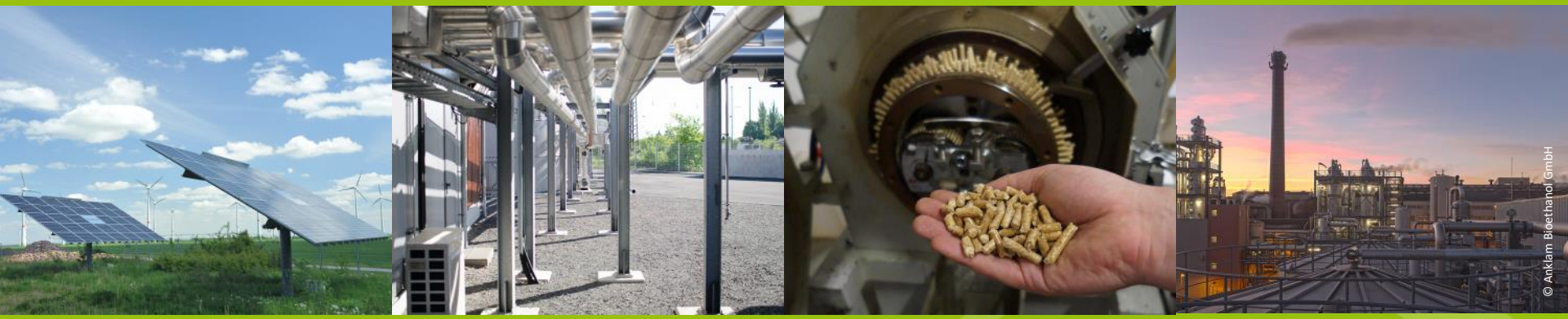
Deutsches Biomasseforschungszentrum
gemeinnützige GmbH

DBFZ

Woody bioenergy in Germany – utilisation and perspectives

SmartBiomassHeat

Volker Lenz



International Bioenergy Conferences in Japan,
24th May 2017, Nagano

The bioenergy journey until today

„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.lotus.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, Fachtagung, 1951 Palz,W. (Hrsg) : Neue Energien et. al.


Quelle: Verweis Folie 1

2010

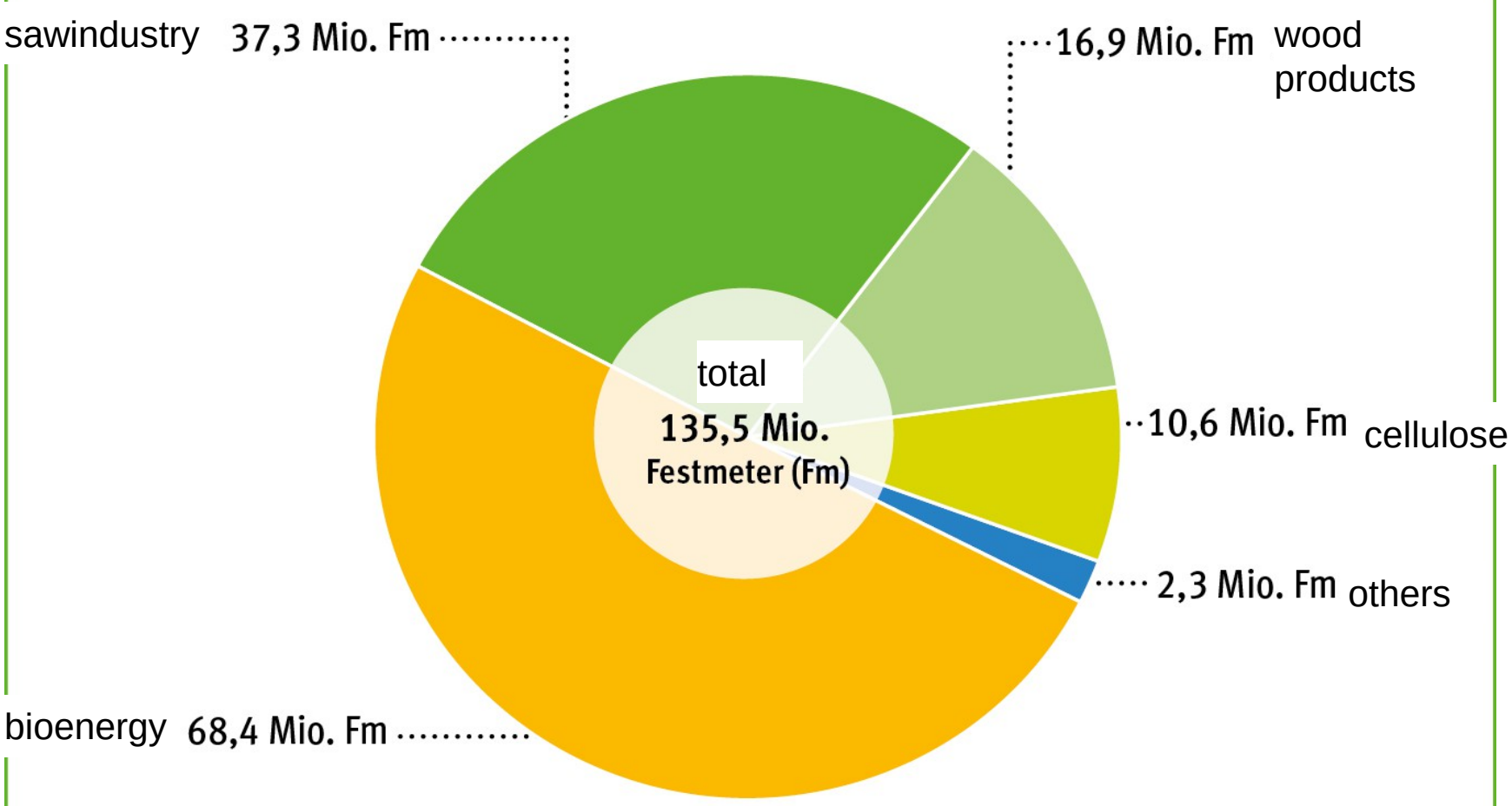
Efficient technologies

First Downburn-Oven


Quelle: Universität Leipzig, Xeoos

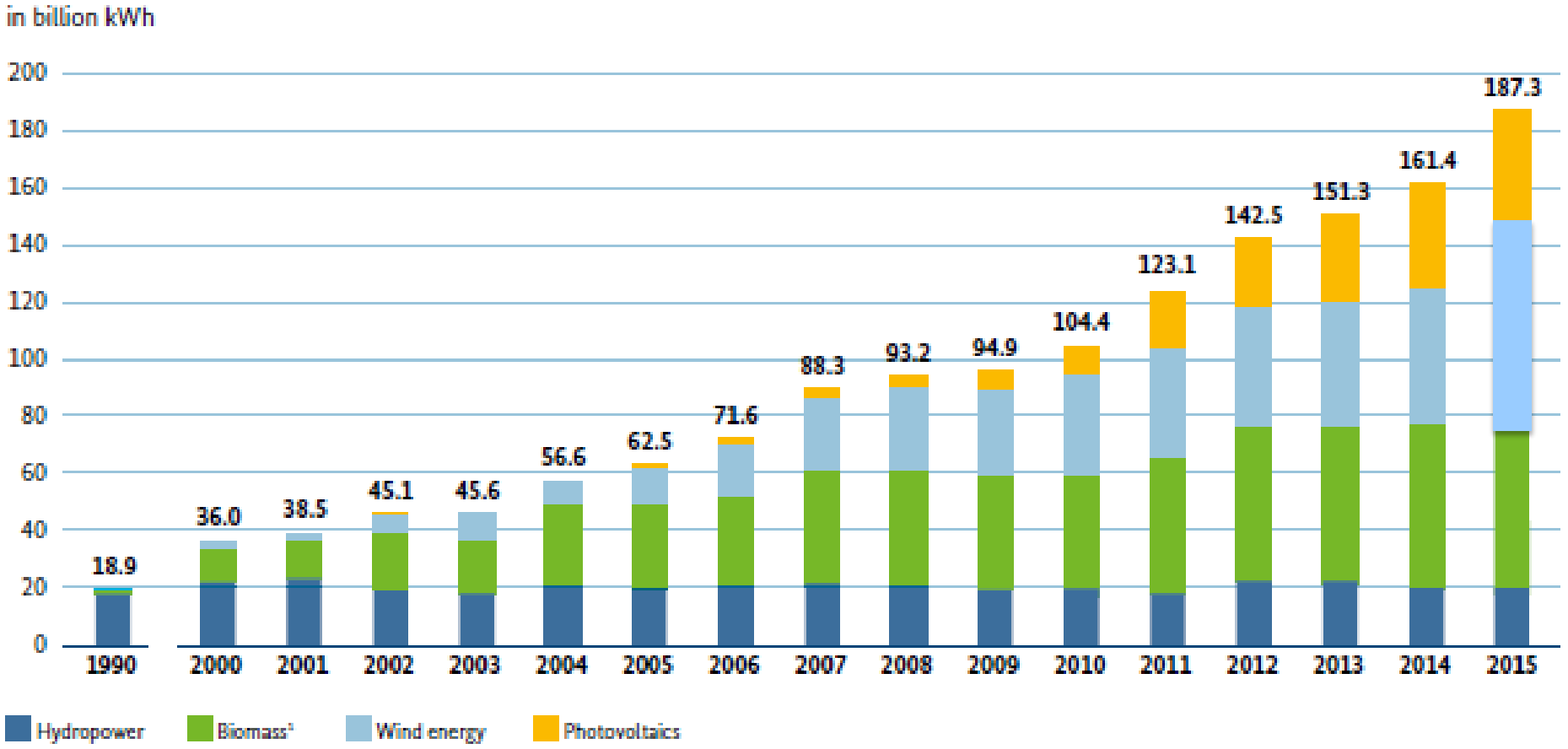
INNOVATION | PROGRESS

Woody biomass resources in Germany (2010)



Quelle: Mantau/Holzrohstoffbilanz Deutschland 2012

Development of renewable power generation in Germany



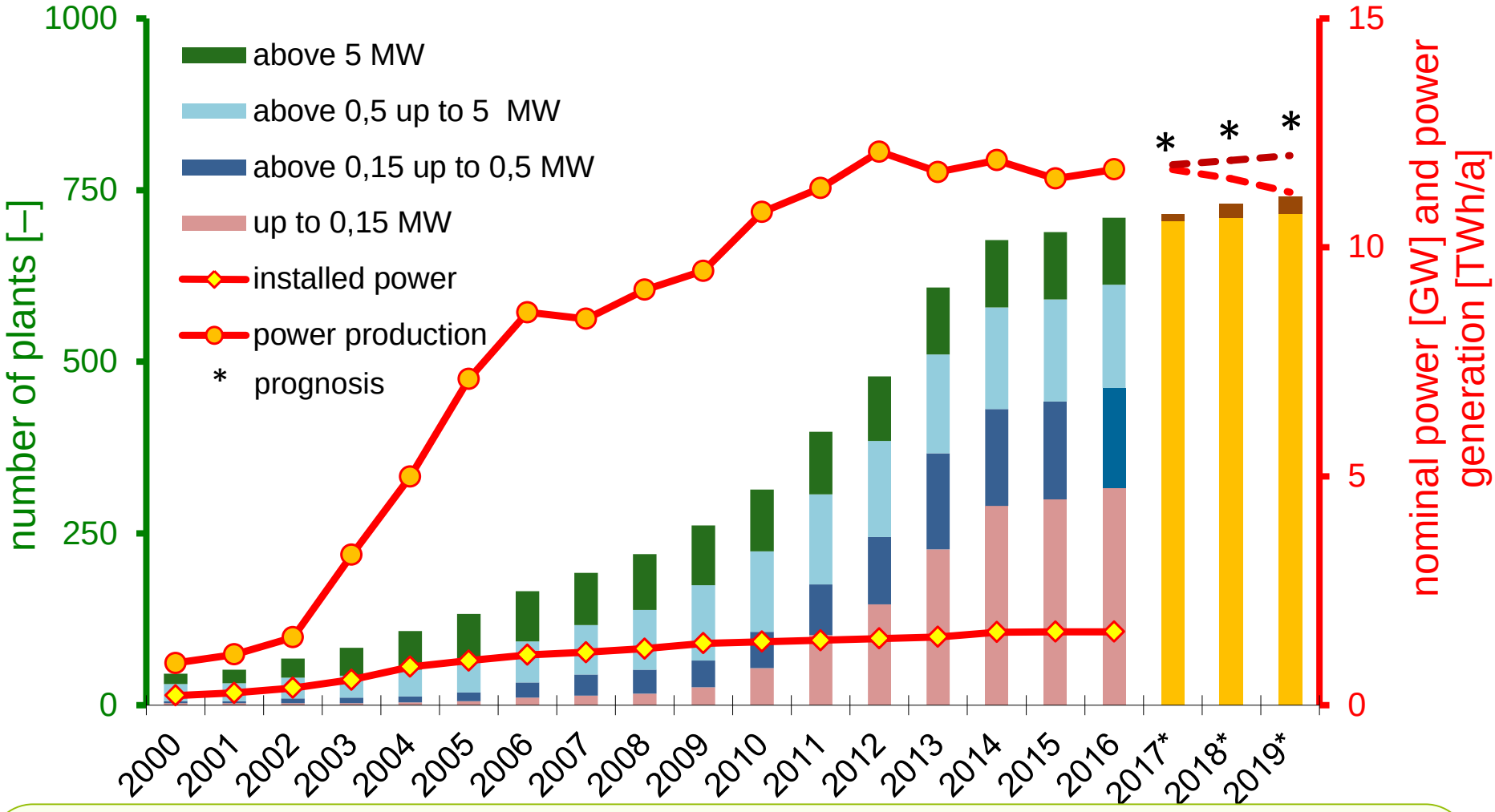
Geothermal power plants are not shown here because of their very small share.

[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 2010

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

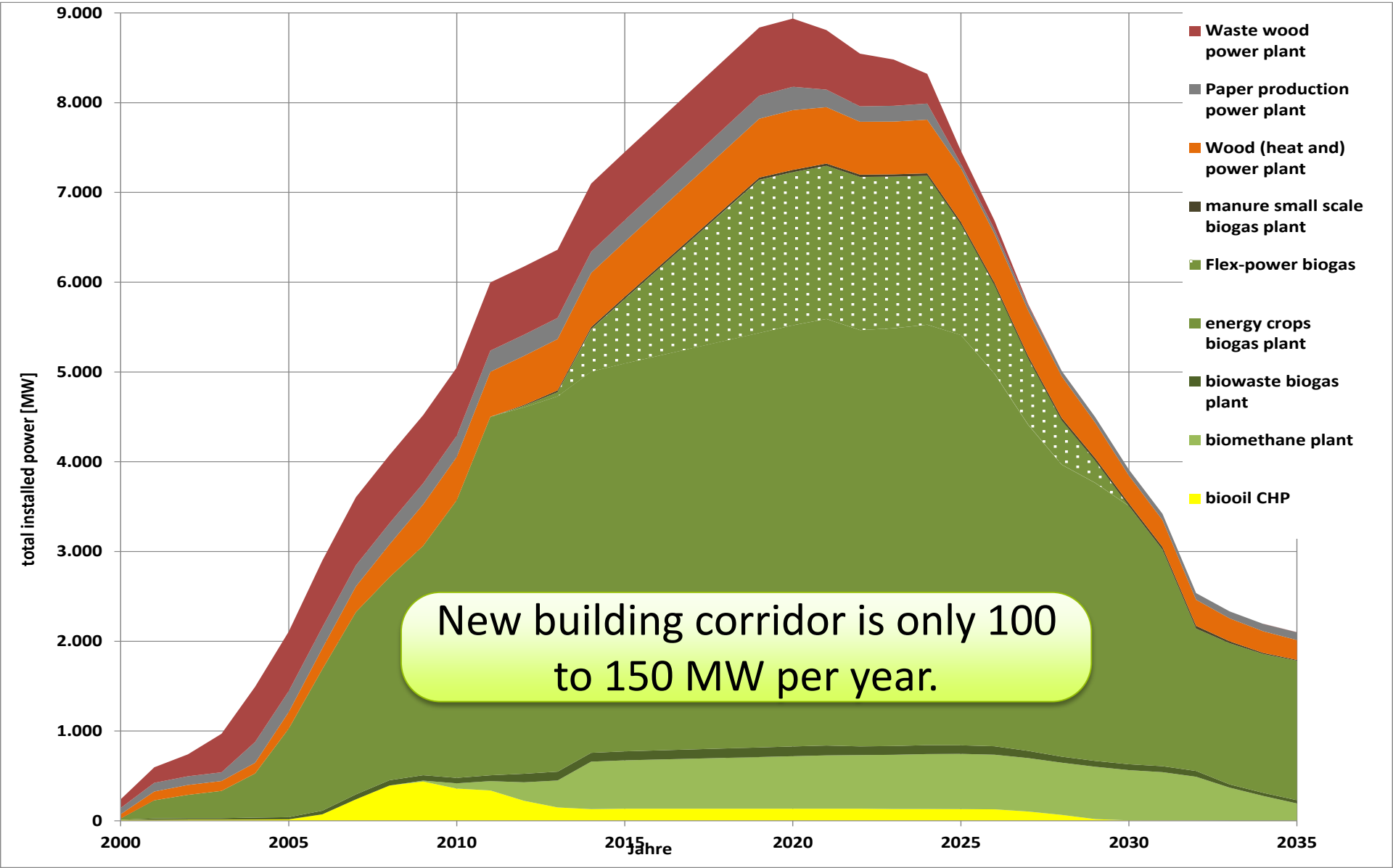
Source: BMWi, Renewable energy sources in figures. 2015

Power generation from woody biomass in Germany

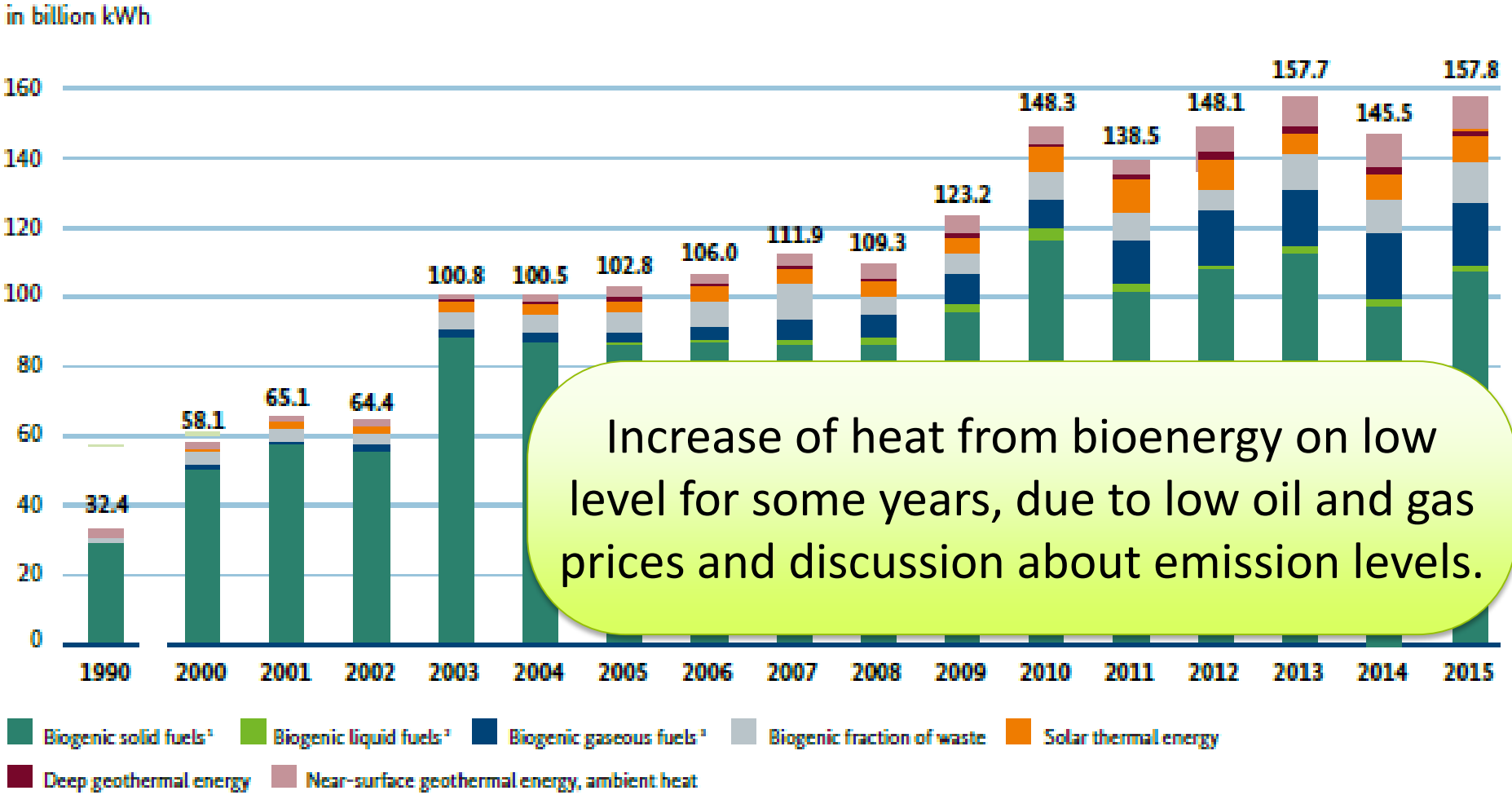


Reducing feed-in-tariffs in 2014 stopped the increase more or less.

Power generation from biomass - future perspectives



Development of heat generation from renewables in Germany

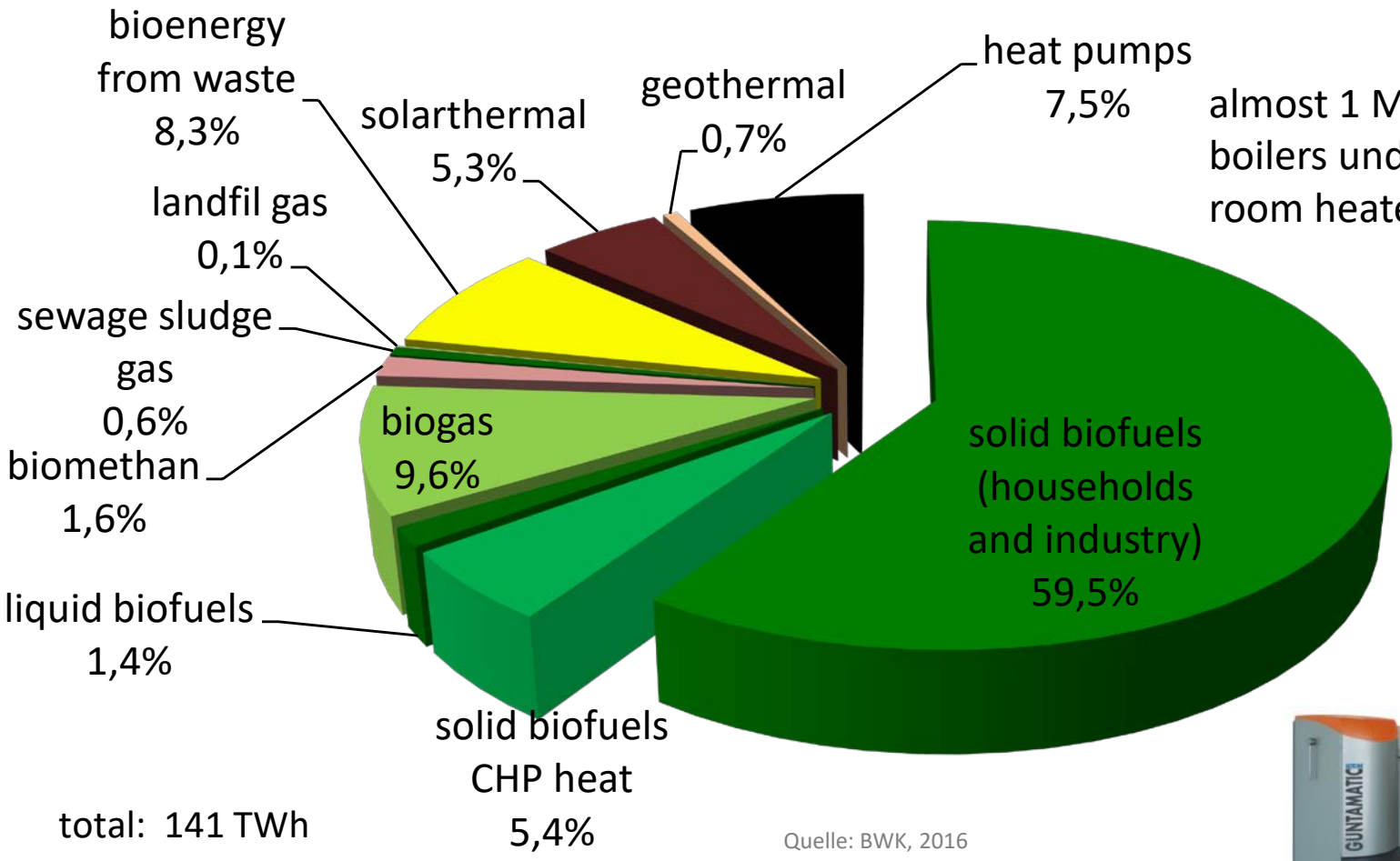


Increase of heat from bioenergy on low level for some years, due to low oil and gas prices and discussion about emission levels.

1 including biogenic fraction of waste; including sewage sludge as of 2010; information for TCS sector (trade, commerce and service sector) available at 2003
2 including agricultural consumption of biodiesel
3 biogas including biomethane, sewage gas and landfill gas

Source: BMWi, Renewable energy sources in figures. 2015

Sources of heat from biomass (2015)



total: 141 TWh

Quelle: BWK, 2016

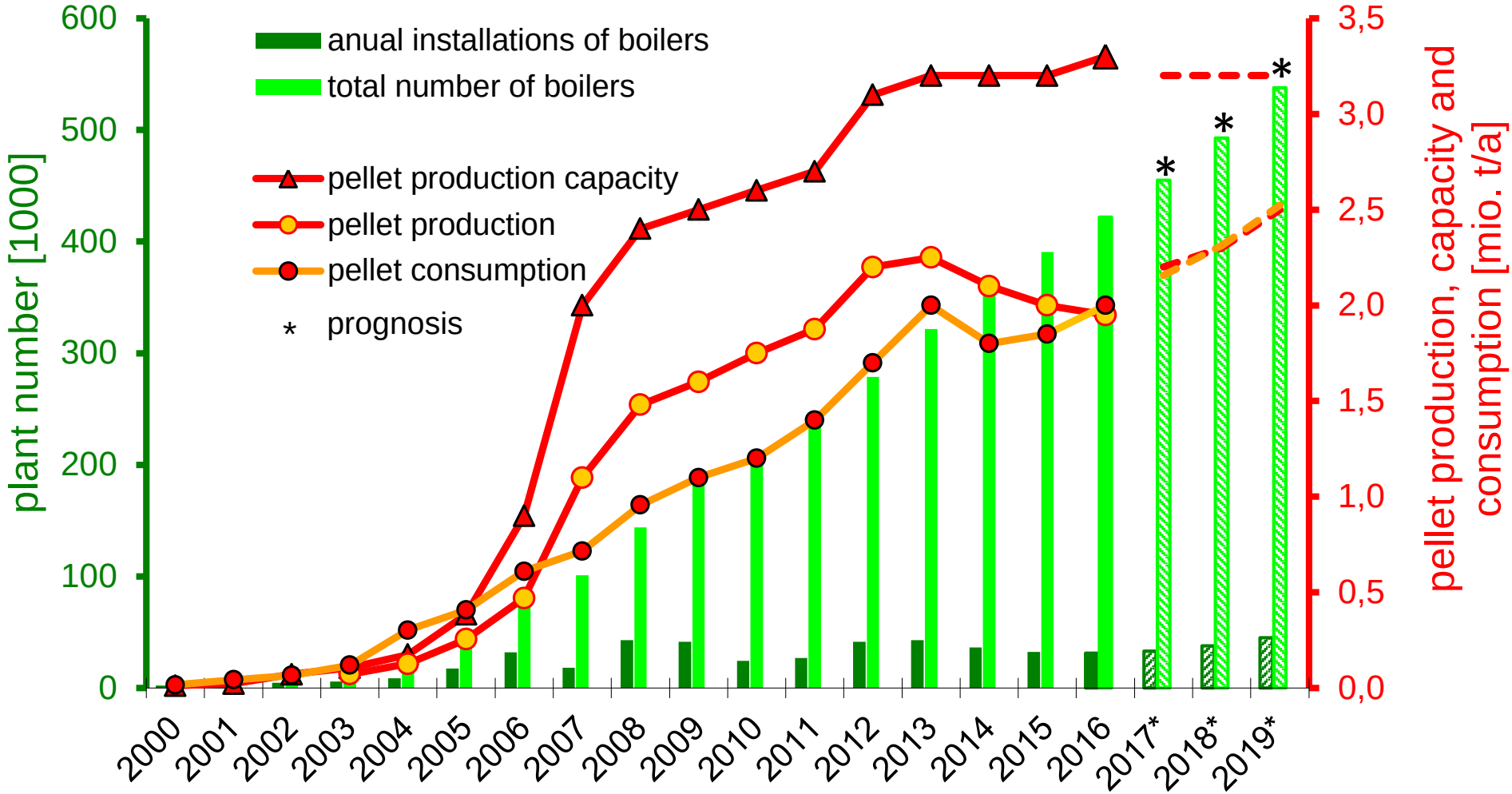
almost 1 Mio. biomass boilers und 10-12 Mio. single room heaters

Source: Wodtke

Source: Guntamatic

Up to now most biomass heat systems as single technology or base load supply (70-100%).

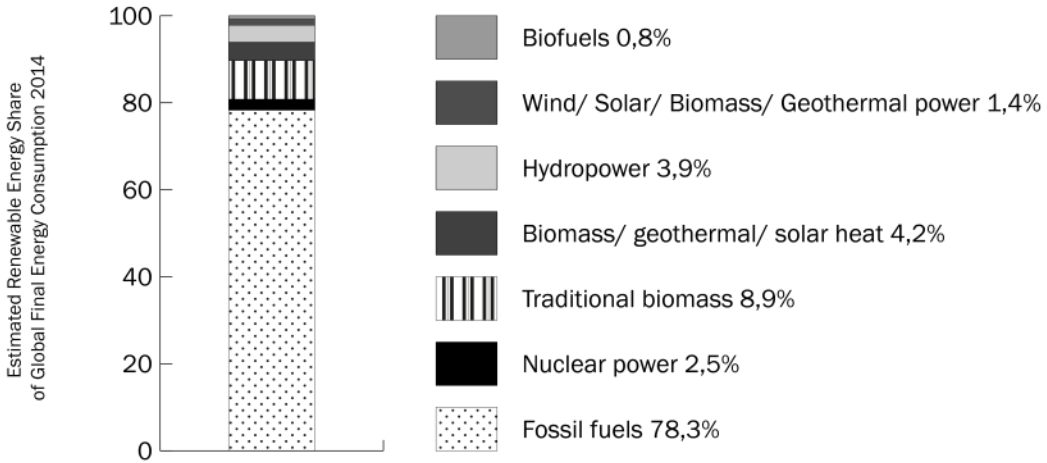
Development of wood pellet market in Germany



Source: DEPI, 2017

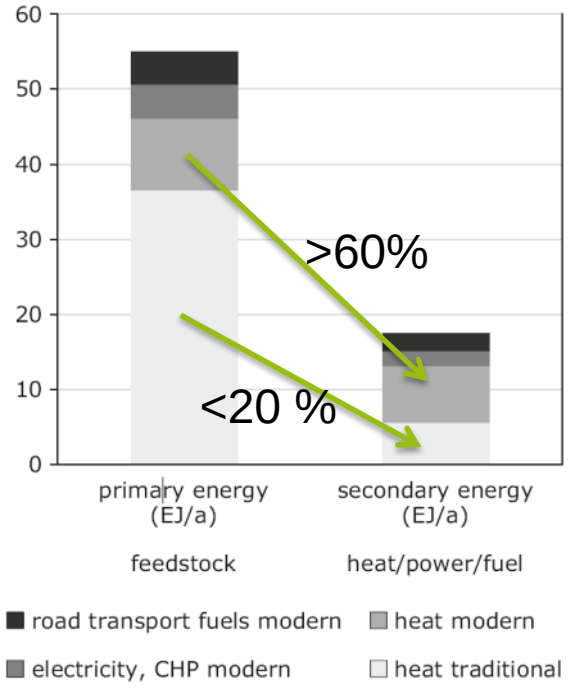
Bioenergy status quo

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

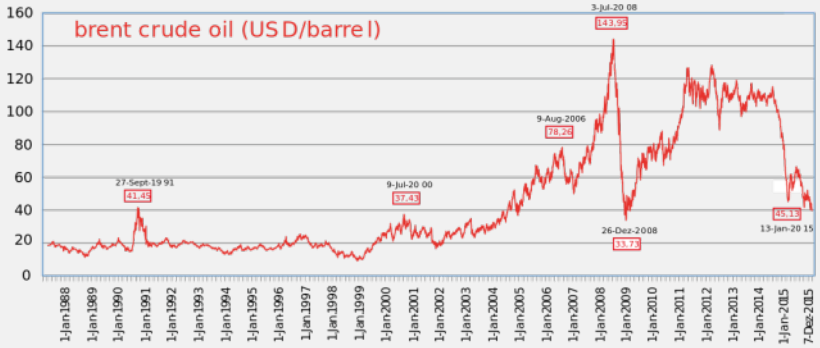


Source: Thrän, Smart Bioenerg, 2015

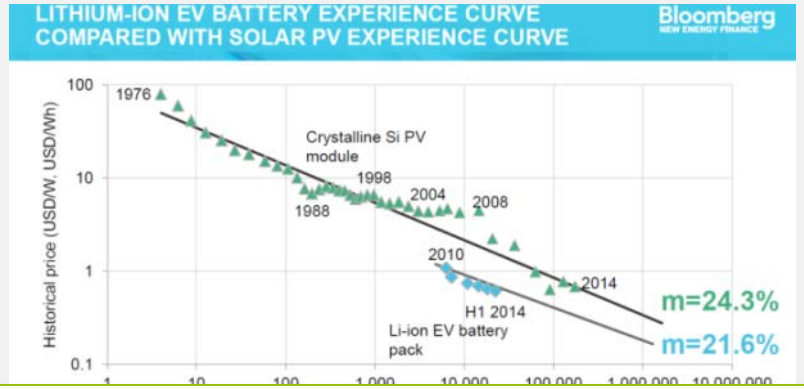
With higher efficiency, especially in wood combustion, high potential of final energy without additional feedstock is available.

Bioenergy challenges

Costs

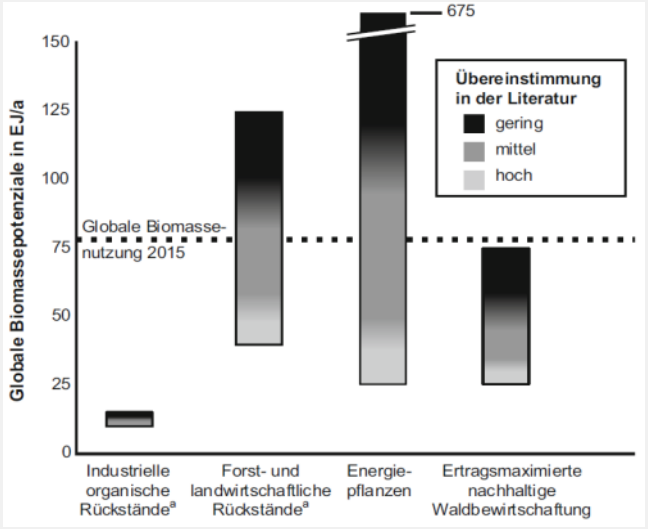


Source: Wikipedia.com / originally from the US Department of Energy



=> Focus on residues, waste and by-products: wastewood, landscape cleaning, forest residues

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

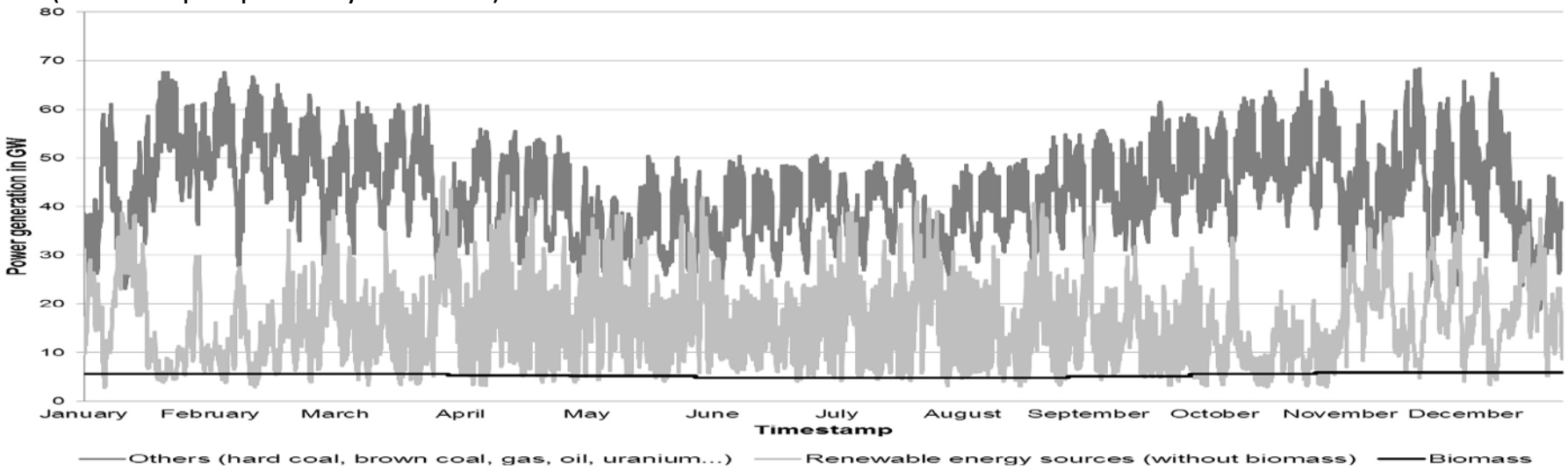
rce: UN, Sustainable development agenda, 2015

Decarbonizing -> Renewable energy system

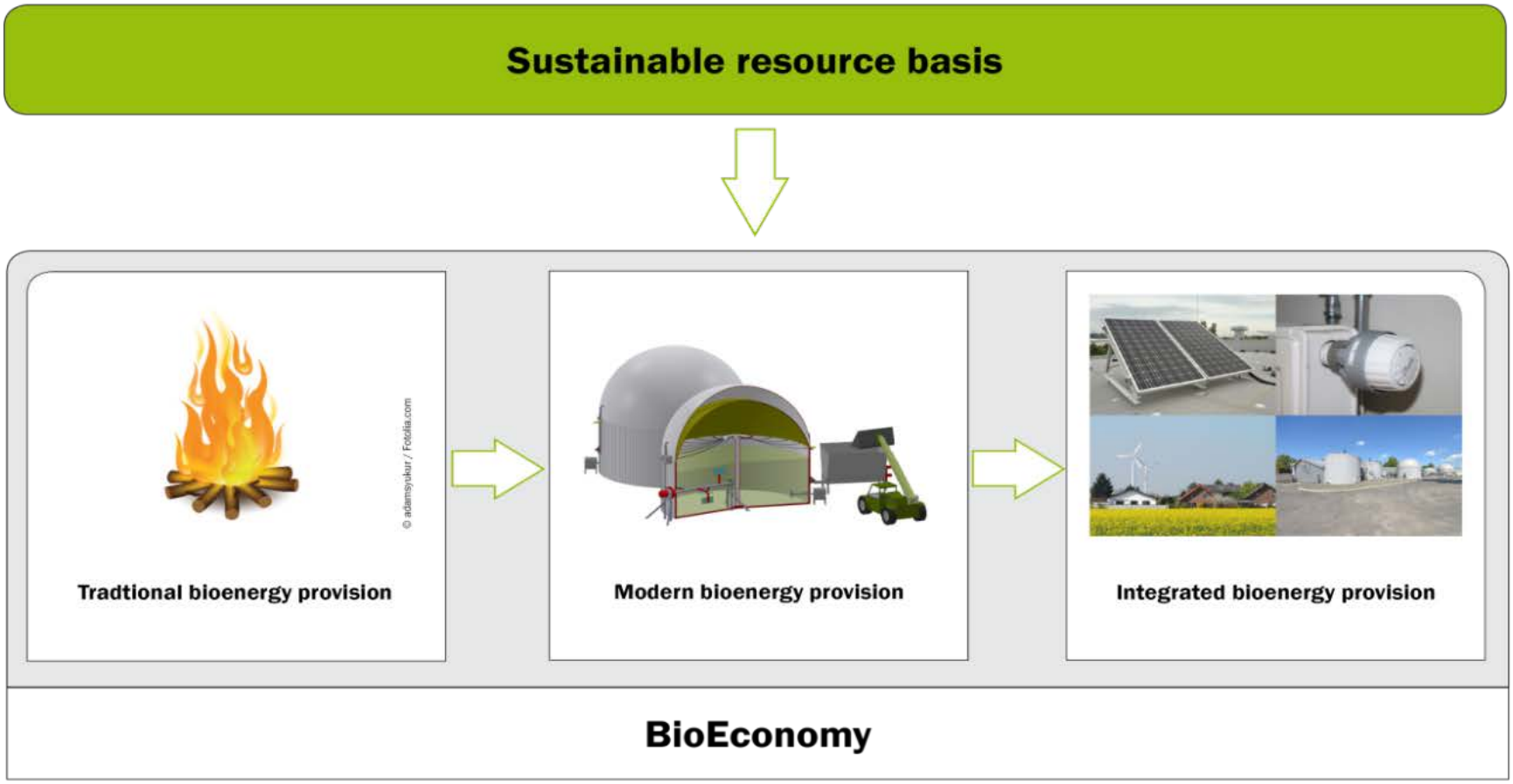
- To keep **global warming below 2ºC** means immediately transition of energy system to **more or less only renewables**.
- Main energy supply comes from **Wind and Solar**.
- **High fluctuations** in power, but also within heat supply system.
- **Energy storage** and **demand side management** becomes 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)



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 a energy systems with high shares of renewables – hybrid- and multibrid-systems
- Integration into future BioEconomy concepts

Modern CHP-technologies for solid biomass

Stirling-engine

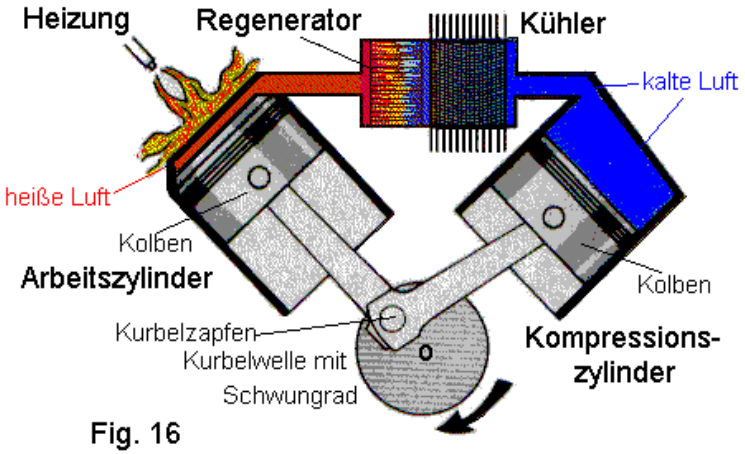


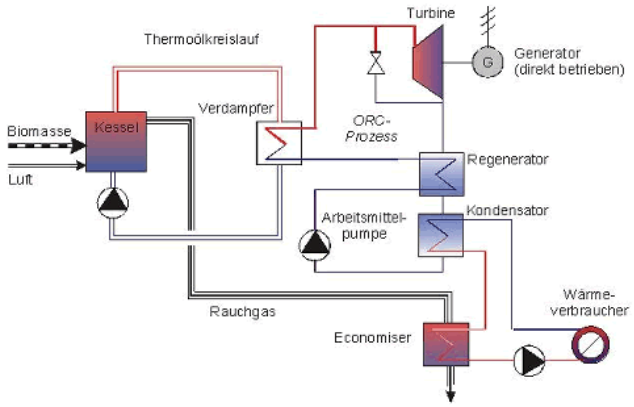
Fig. 16

Source: DBFZ

Small-gasifier-CHP

Source: Thermochemical Testing Ground University Zittau

Biomass ORC



Source: DBFZ

Waste wood power plant

Source: hessenENERGIE

Industrial gasifier Güssing

Source: DBFZ

Flexible power production from solid

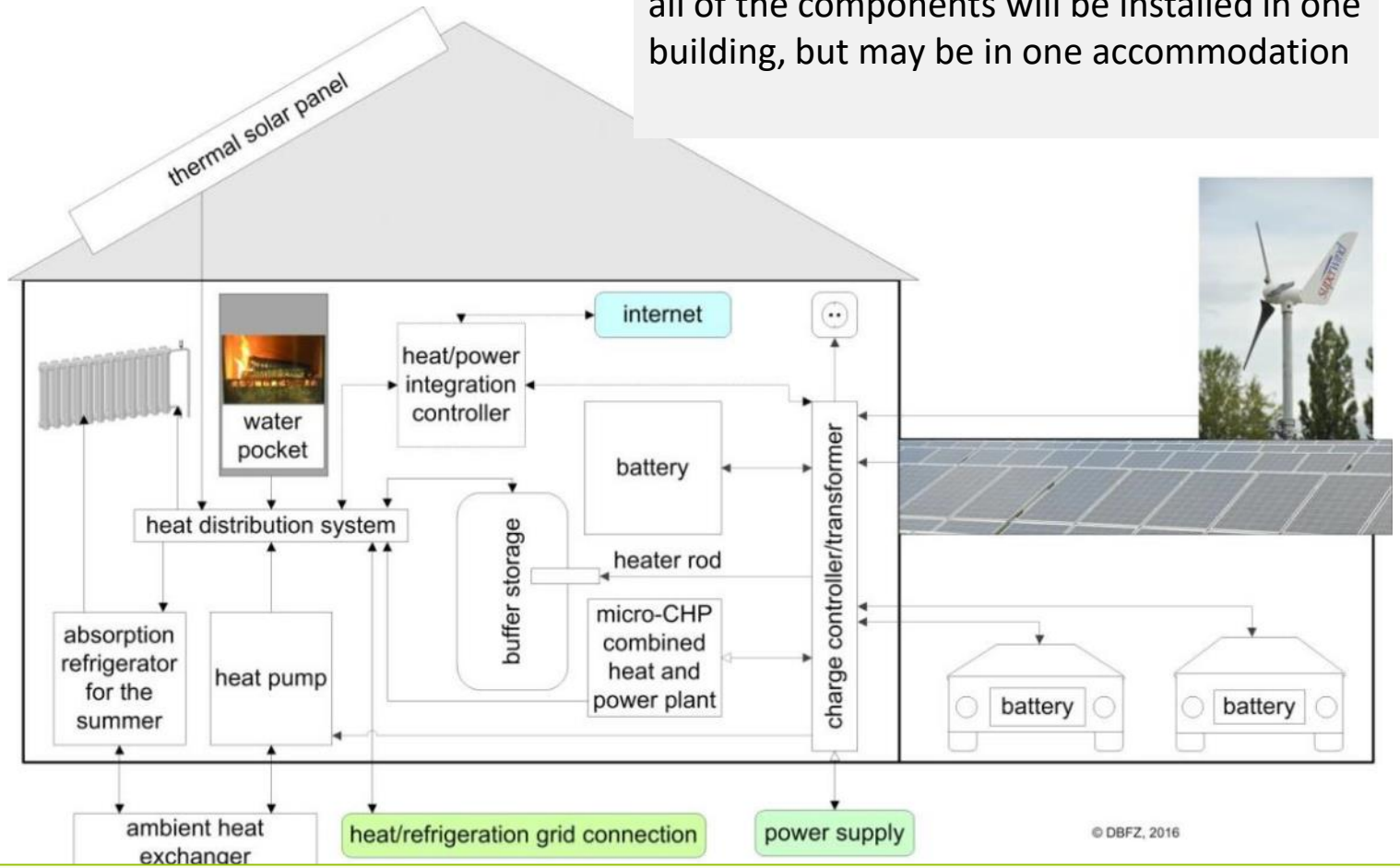
Comparison of different concepts for flexible power generation from solid biomass

Power generation concept	Status	Load change rate	Potential electrical output range	Electrical efficiency
Combustion + steam turbine or steam engine	State-of-the-art	o/+	30% - 110% (0 - 110% with steam storage)	o
Combustion + ORC	State-of-the-art	o/+	0 - 100%	-
Combustion + EFGT	Available technology	+	30% - 110%	o
Gasification + gas turbine	Available technology	o/+	50% - 110% (0 - 110% with syngas storage)	+
Gasification + gas engine	State-of-the-art	+	50% - 110% (0 - 110% with syngas storage)	+
Hybrid IGCC	New concept	++	50% - 110% (0 - 110% for the gas turbine part)	++
Gasification + fuel cell	New concept	++	-100% - +100%	++

Source: Ortwein, Smart Bioenergy, 2015

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

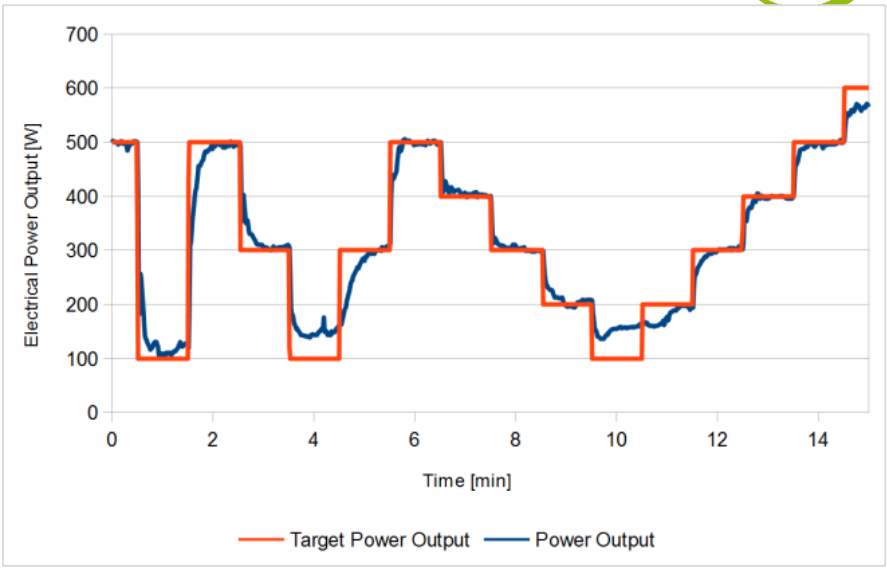


Source: Lenz 2015

Biomass to close heat gaps and stabilize local power grid.

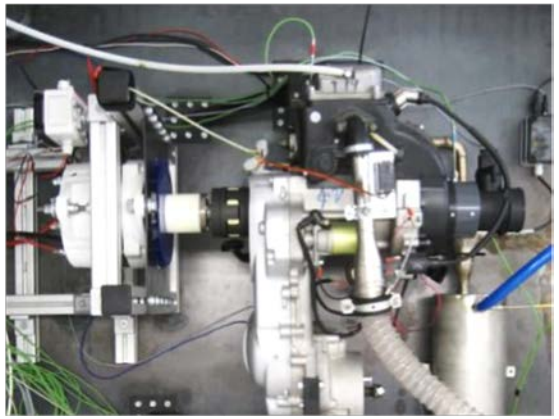
Micro CHP for solid biofuels

- 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!

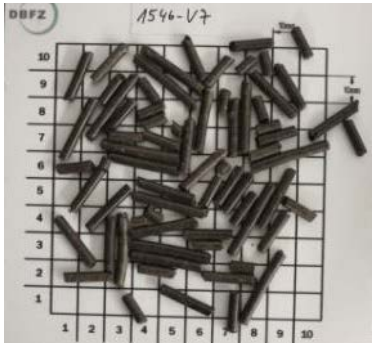


Europa fördert Sachsen.
ESF
Europäischer Sozialfonds
SACHSEN

Source: Krüger, DBFZ 2014

What is necessary: High quality solid fuels

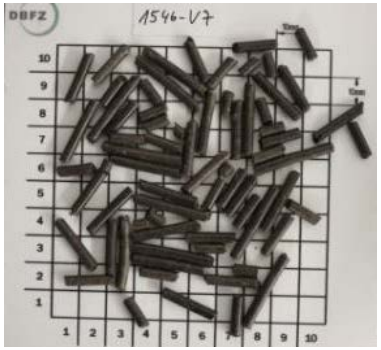
- washed leave pellets



Florafuel AG Anlage

- torrefied, washed and pre-conditioned High-End-Compactates for high reliable and flexible use also in small scale units

Source: Pusch AG



Research needs

	Innovative Products …	… for Future Markets
Innovative Bioenergy Carriers		
Smart Bioenergy Provision		
Specific Use of Bioenergy		

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 (co-generation and hybrid-systems).
- S**ignificant price differences in the electricity market** according to availability of wind and solar can **increase adaption of energy use from biomass** to more **system suitability**.
- **High subsidies help market integration** of new technologies, but they have the **risk of high costs and not optimized solutions**! Therefore **continue the further optimization and integration** of woody energy!

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Smart Bioenergy – Innovations for a sustainable future!

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