Importance of biomass for the decarbonization of industrial process heat supply

6. Central European Biomass Conference
24.01.2019
Graz

Martin Meiller, Lars Komogowski

Fraunhofer UMSICHT

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Agenda

Background

- Where are we now and where do we go?
- Germany's goals for CO_2 mitigation
- Importance of renewable primary energy

Technology comparison

- Possible solutions
- Pros / Cons
- Gaps in the bioenergy portfolio

Project examples

- BioBrick
- TheMaTik

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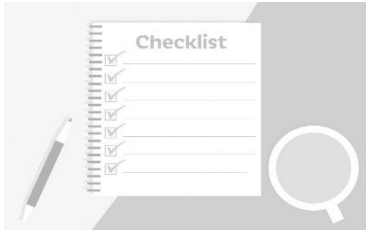

Summary

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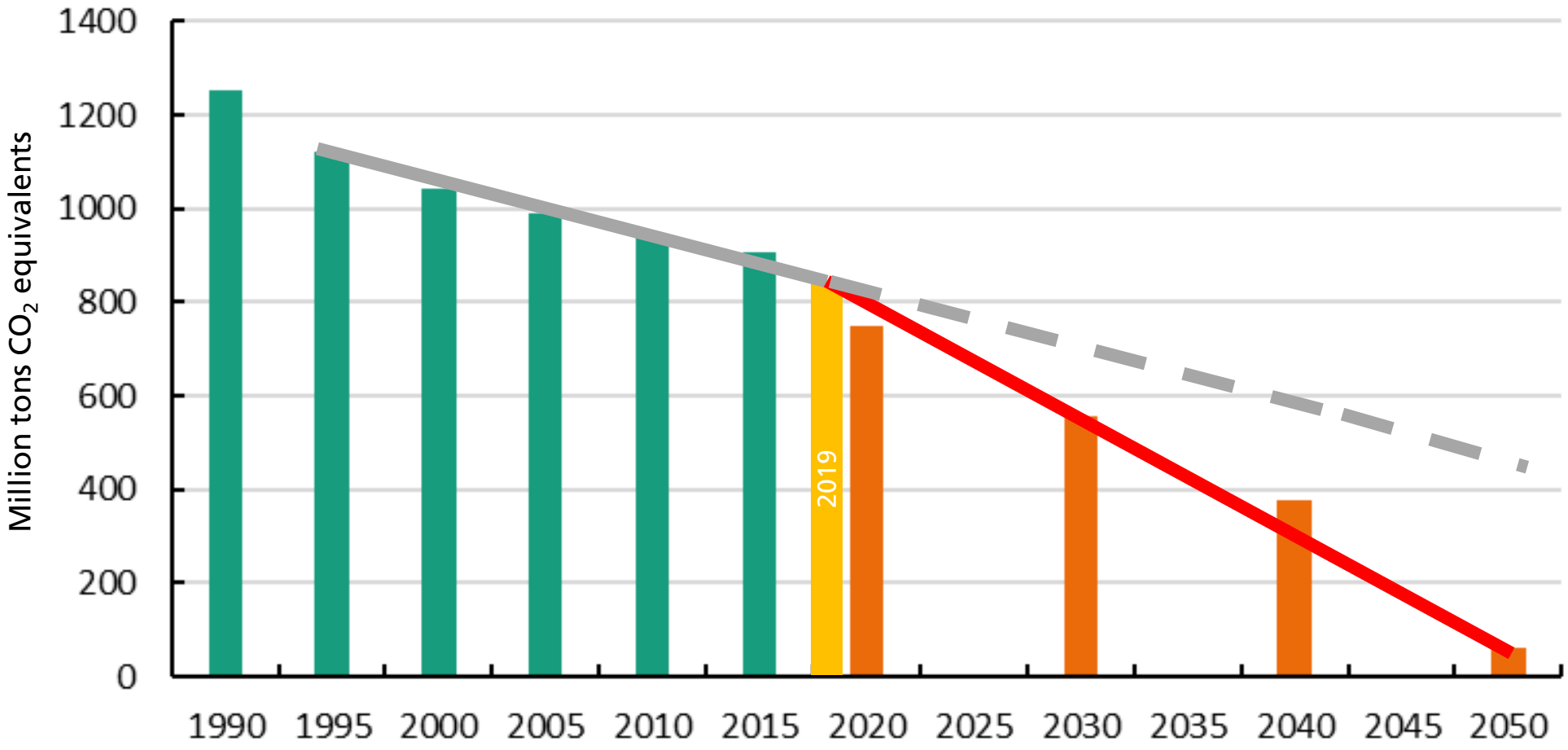
Achieving the climate goals requires a massive effort in all sectors and industries



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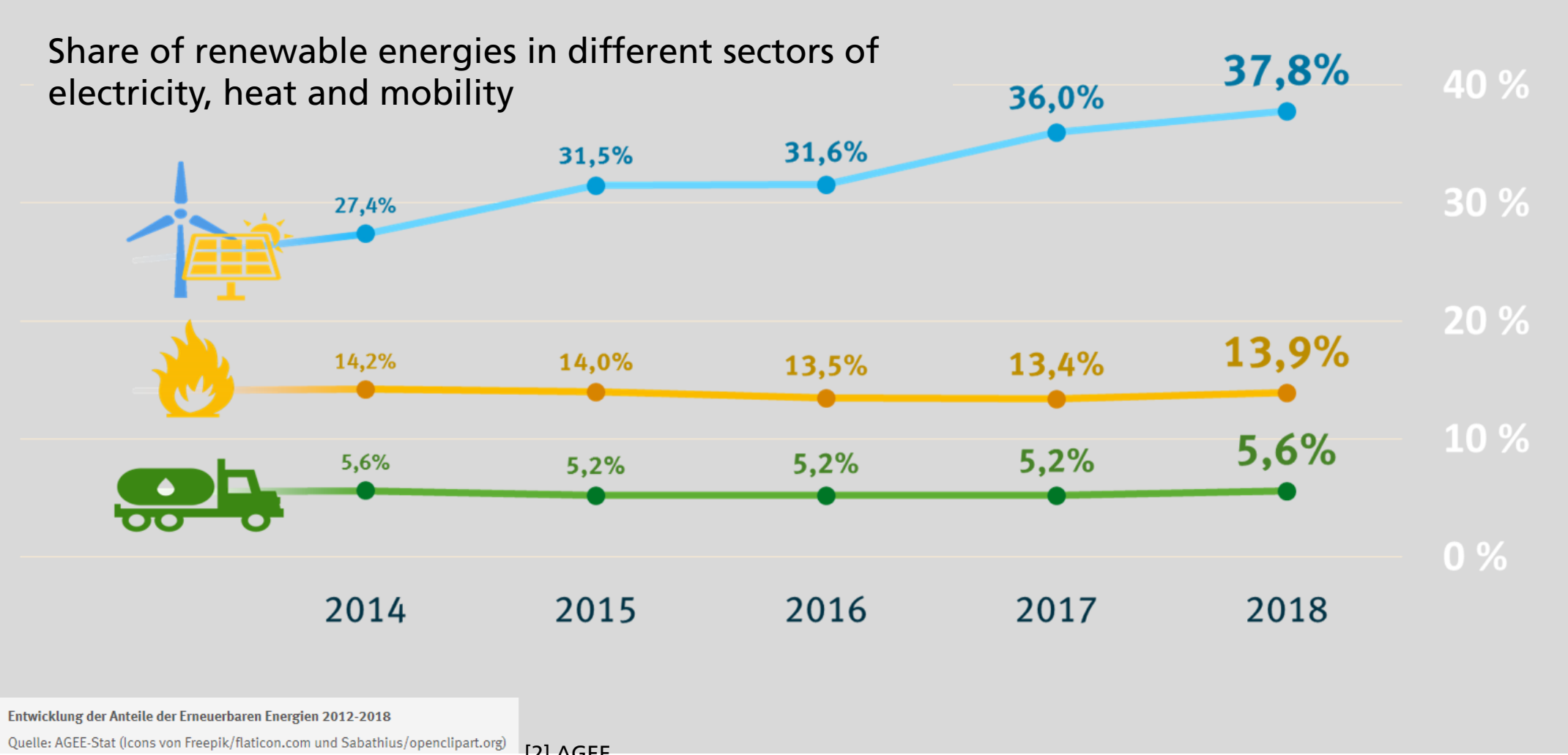
Share of renewable energies in the heat sector stagnates



Entwicklung der Anteile der Erneuerbaren Energien 2012-2018

Quelle: AGEE-Stat (Icons von Freepik/flaticon.com und Sabathius/openclipart.org)

[2] AGEE

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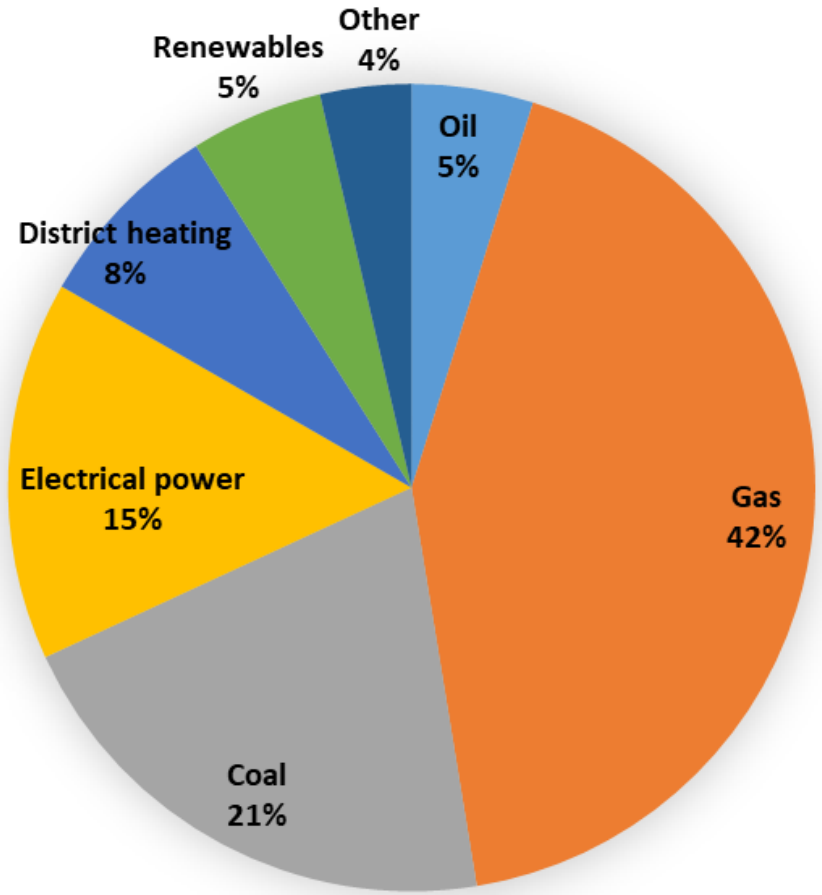
So far, for process heat renewable energy sources have played a minor role

Energy mix industrial process heat supply Germany 2018



- Final energy demand 2018 for industrial process heat **2,035.41 PJ**
- Share of renewables **5%**

Eigene Darstellung basierend auf [3]

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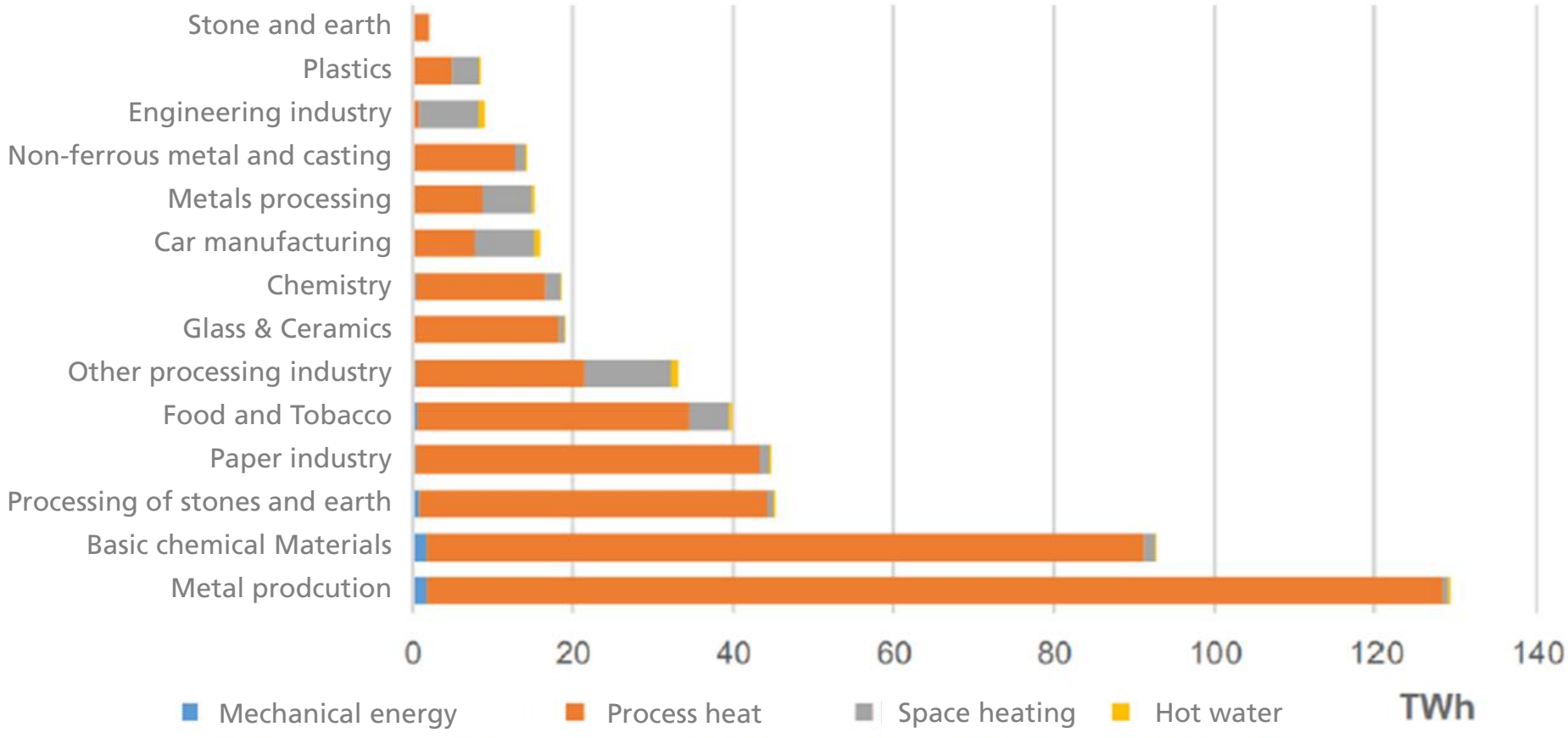
Heat demand in industry is dominated by process heat



- Around 88% of the heat required in industry is process heat

[4] VDIEK

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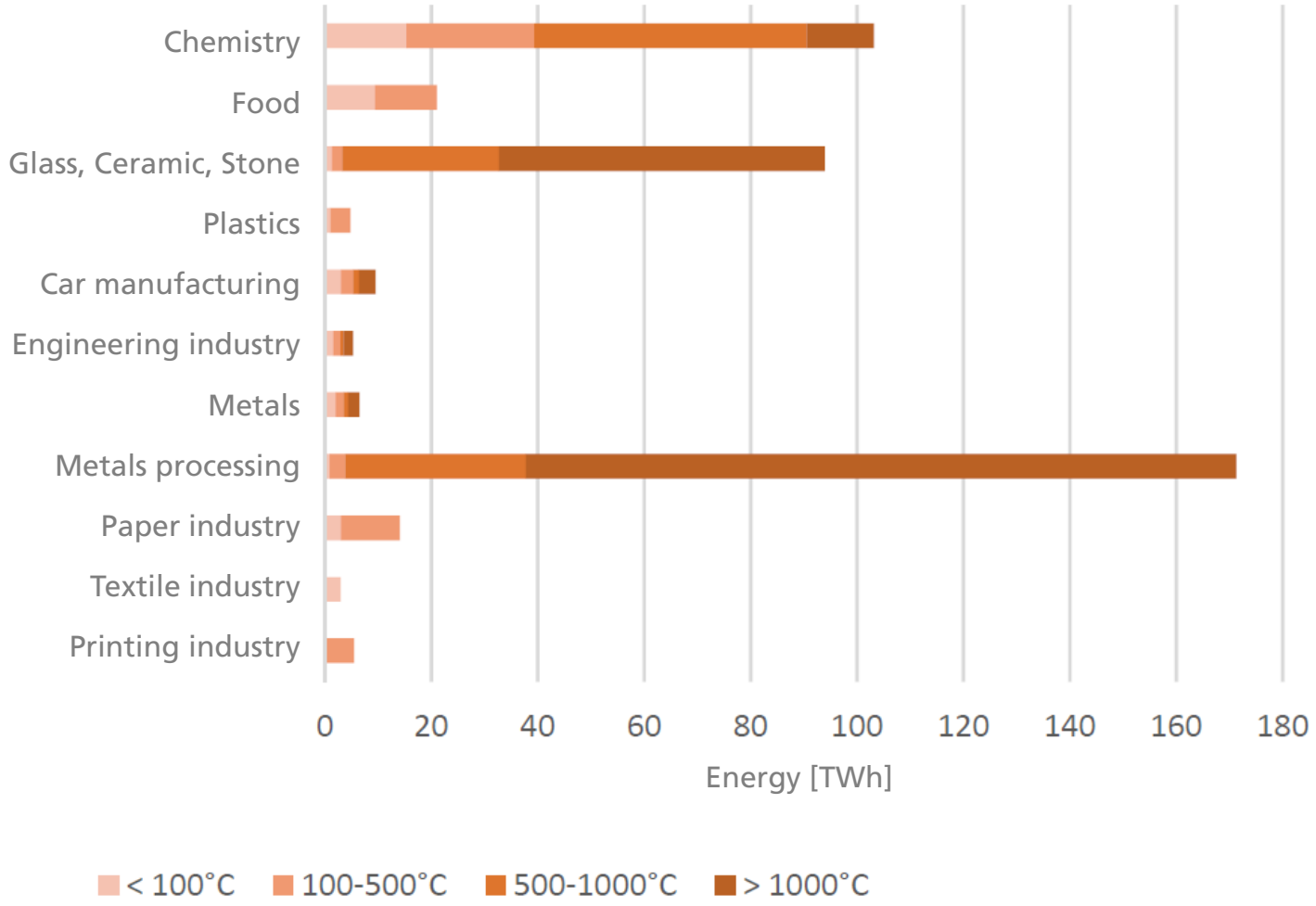
Enormous range of branches, requirements and temperatures



[4] VDIEK

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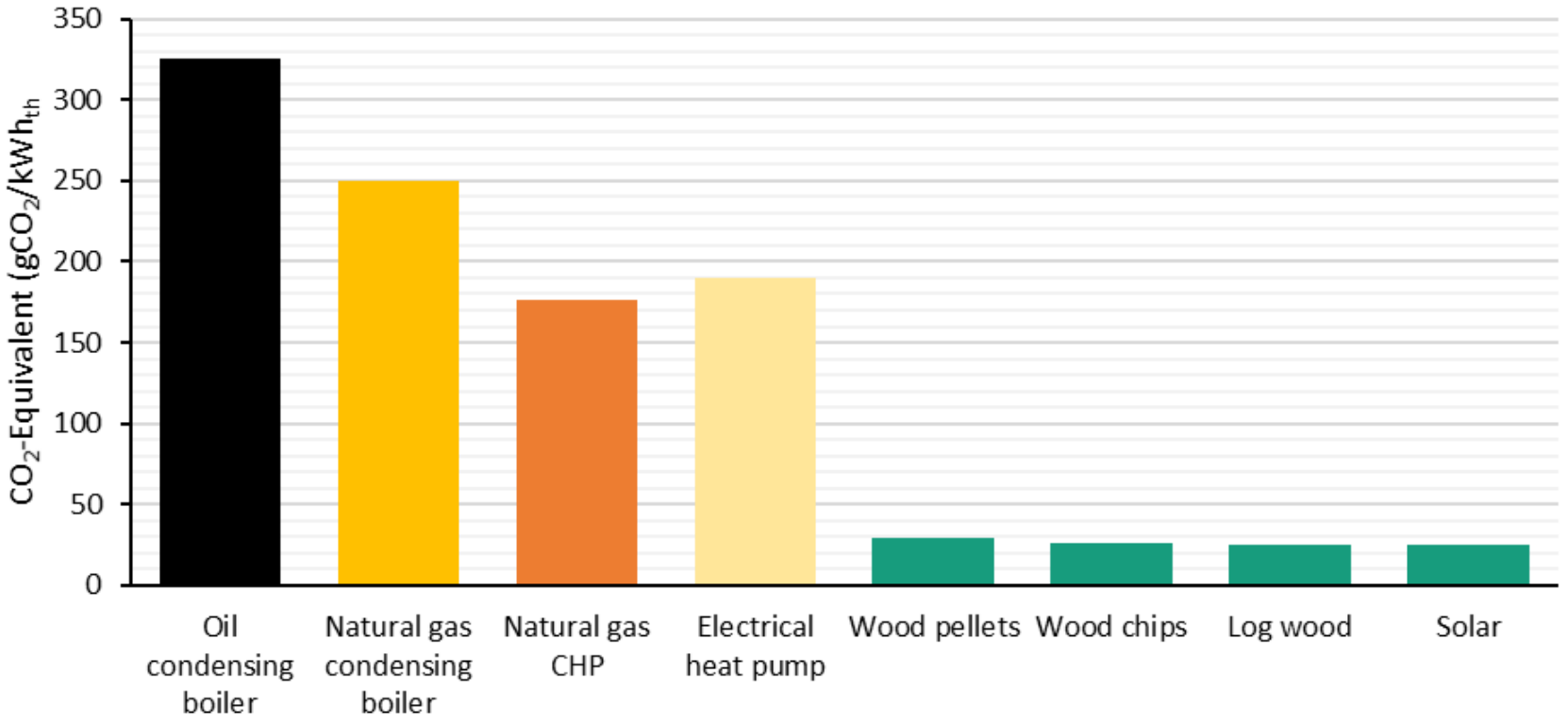
Which solutions can be used to achieve sufficient CO_2 savings?



[5] Fachagentur Nachwachsende Rohstoffe e.V. (FNR)

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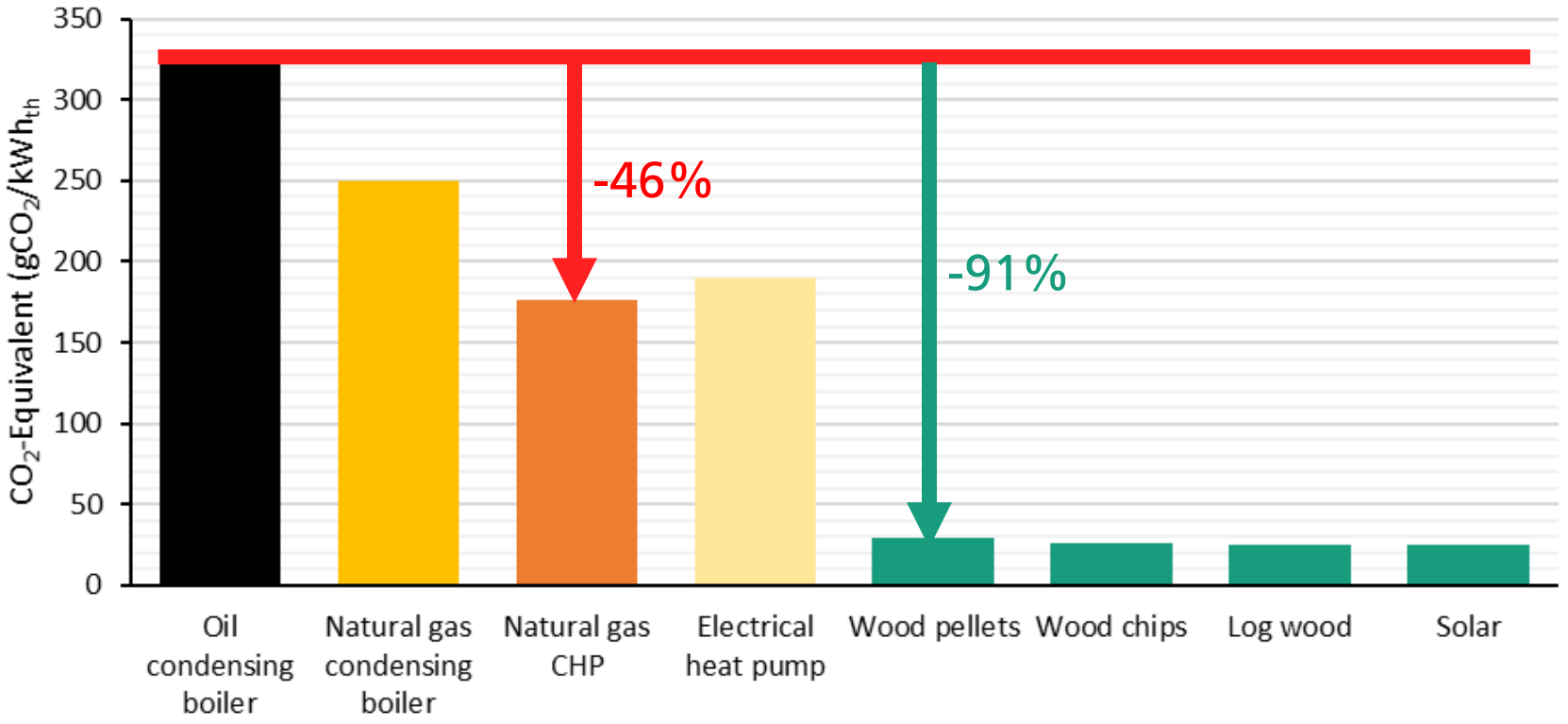
Efficiency is not enough! Renewable primary energy sources required



[5] Fachagentur Nachwachsende Rohstoffe e.V. (FNR)

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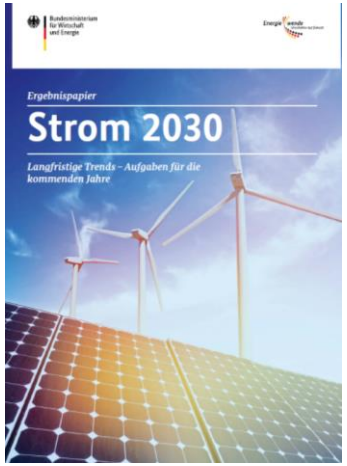
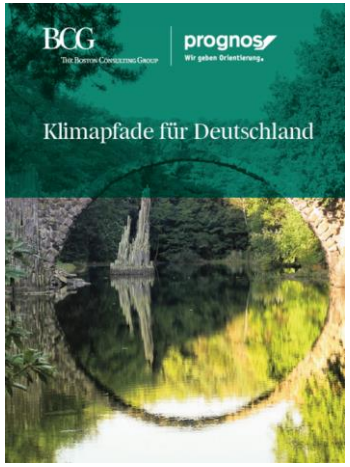
Germany seems to wake up…

Policy and government



Industry and associations



Funding for renewable heating systems
up to 45%

Funding for renewable process heat
up to 55%

Lutz Weidner
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„Ungedaemmte Aussenwand", httpscreativecommons.orglicensesby-sa3.0legalcode

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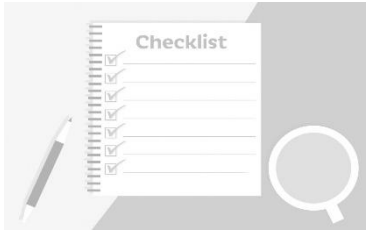

Summary

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What options are technically available?

Solar

Electrical power

Natural gas network

Bioenergy

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What options are technically available?

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Bioenergy

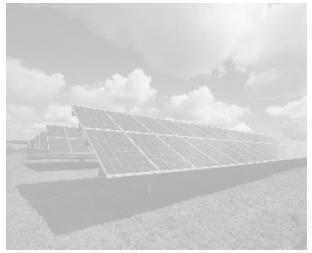
- Solar thermal energy (e.g. flat, tube collector) <100 °C
- Concentrated solar power (e.g. parabolic trough collector) > 100 ° C

+ High CO_2 reduction
+ No fuel costs

- Fluctuations: seasonal, day, due to the wheather
→ Back-up systems required

Approximately 1,400-1,600 hours of sunshine per year
High space requirement: 800-1,200 kWh / m²a
→ Critical especially in cities

Heat pumps with renewable electricity - an option in perspective



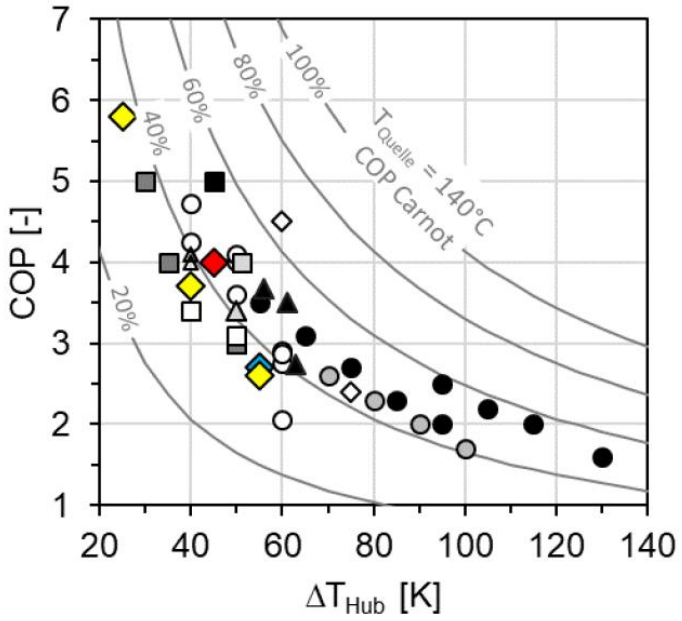
Solar

Electrical power

Natural gas network

Bioenergy

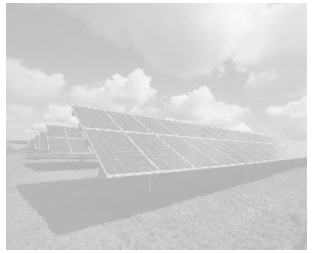
<80°C	established
80-120°C	established
100-140°C	Prototypes, R&D on going
>140°C	Lab scale



- Precondition: electricity comes from renewable sources
- So far limited to below 120 ° C
- Temperatures up to 140 ° C can also be achieved in the short and medium term
- Main challenge for process heat: efficiency

→ The higher ΔT, the worse COP
→ Combination of heat pump with other heat generation unit

Power-to-gas as a storage option



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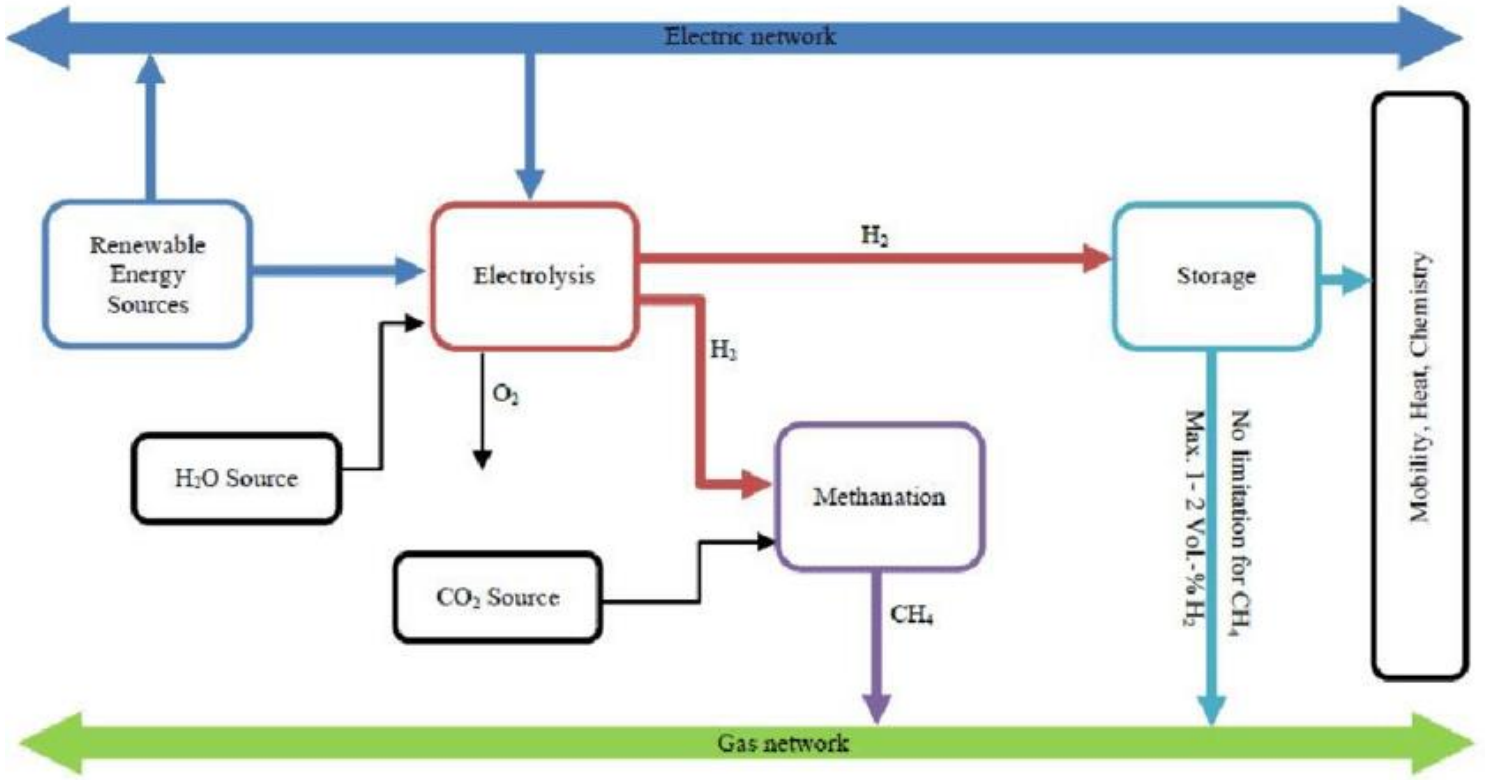

[9] Götz et al.

- Low overall efficiency
- Where does the CO_2 come from?
- Location: Use of O_2 / Use of the waste heat generated?
- Operating hours dominate economy: 7- 45 ct / kWh forecast

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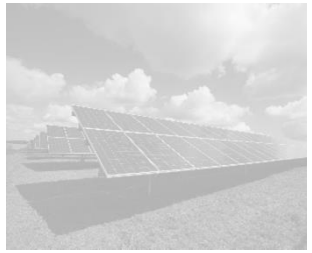
Biomass as a source for process heat



Solar

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Bioenergy

- Combustion, gasification, pyrolysis and fermentation

+ Flexibility regarding heat supply:
  - hot water
  - steam
  - hot air
  - thermal oil
  - Gas

+ Flexibility
+ Good storage properties
+ Available technology

- Footprint of the plant
- Logistics
- Usage competition
- More know-how required

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Challenges for the future

Producers | **Associations and politics**

Technical challenges

- Power ranges?
- Heat transfer media?
- Temperature ranges?
- Fuel flexibility?
- Flexibility of heat supply?

System integration

- Interaction with different energy generation products?
- Interaction with the production process?
- Energy storage technology?

Demonstration and marketing

- Customer know-how?
- Training users and decision makers?
- Image bioenergy?
- Remove obstacles
- Targeted funding

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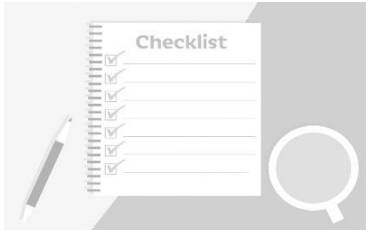

Summary

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BioBrick –Using biomass in brick production as material and as a source of energy

BioBrick

BURKHARDT
ENERGIE- UND GEBÄUDETECHNIK

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ERNST ZIEGELWERK

Bundesministerium für Wirtschaft und Energie

Energetische Biomassenutzung

Biomass gasifier

Industrial process heat

Carbonisate

Brick Production

- Cost efficiency
- Product quality
- CO_2-Emissions
- Disposal costs

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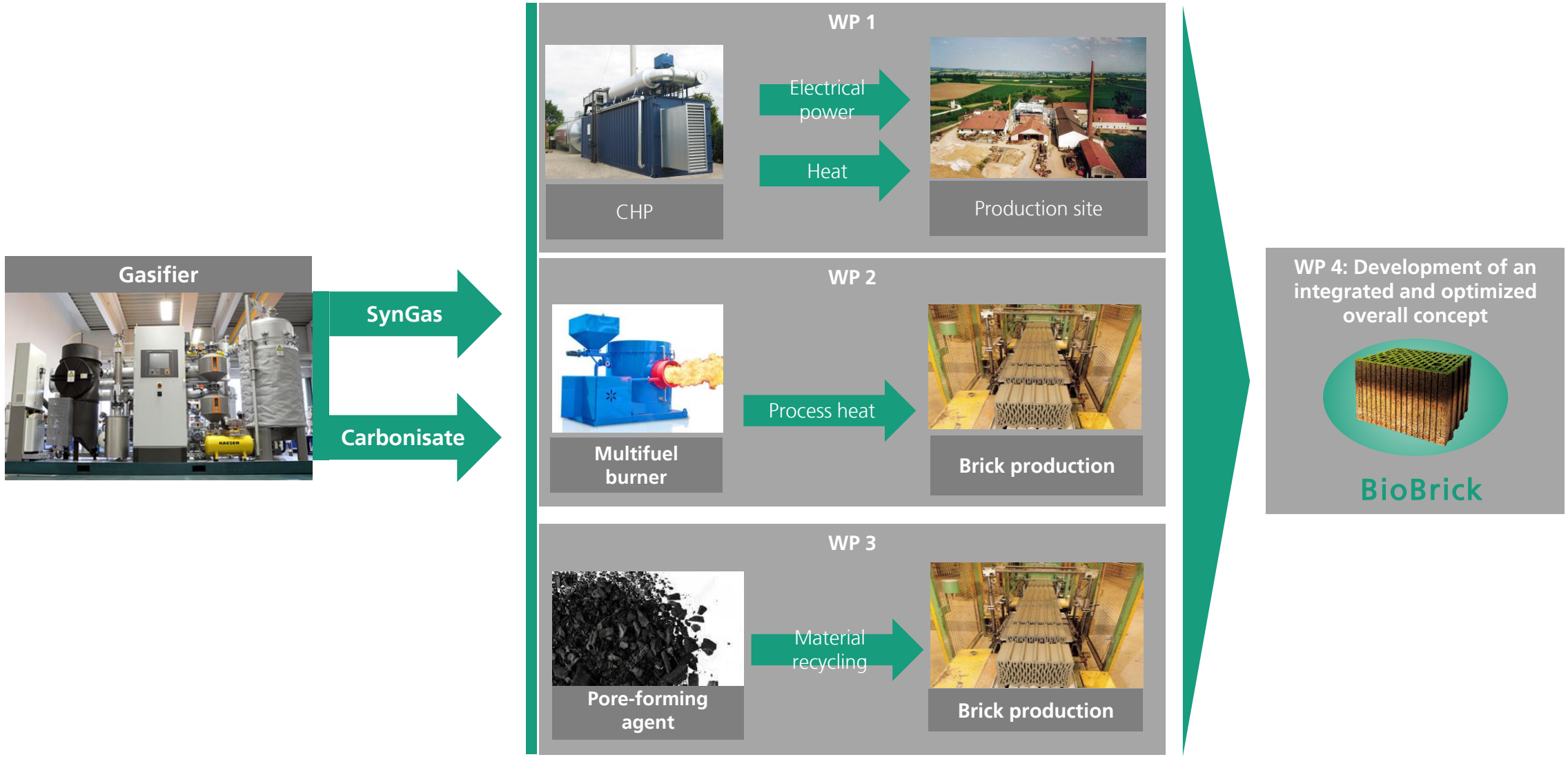
BioBrick – project plan



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TheMatIK – metal based latent heat storages ensure process steam supply

Project scope:

- Flexibilization of industrial power plants

  using latent thermal energy storages (LTES)

- Metal alloys as phase change materials (PCM)

Project information:

- Project name: TheMatIK
- Publicly funded by the German government
- Project duration: 3 years until the end of 2019

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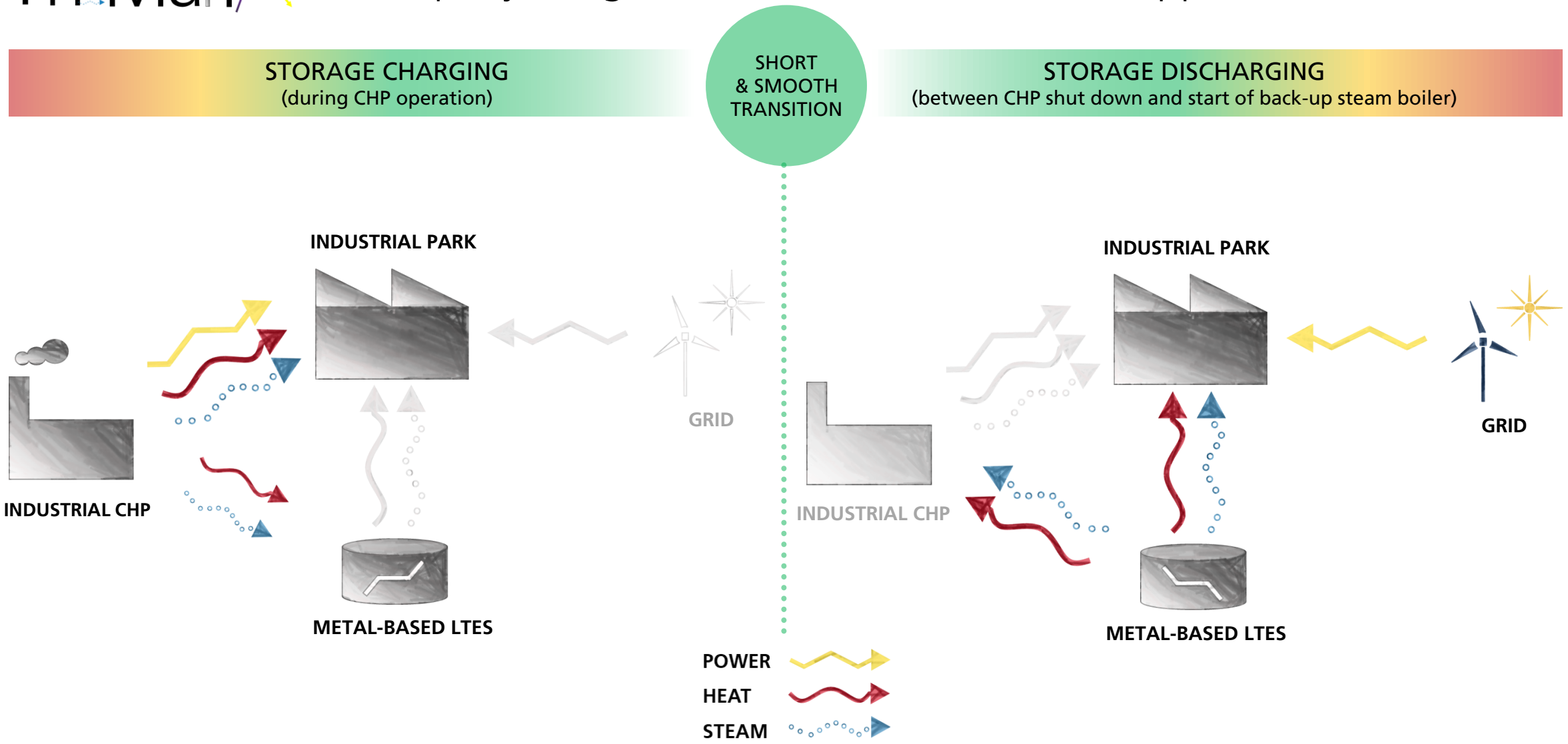
Federal Ministry of Education and Research

Projektträger Jülich
Forschungszentrum Jülich

ThMaX – exemplary integration scheme for industrial application



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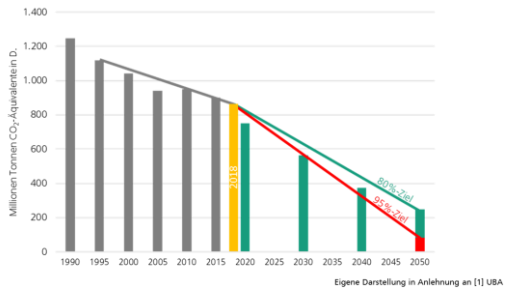
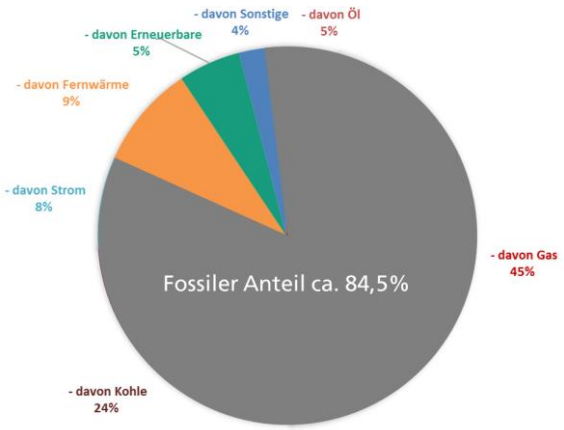


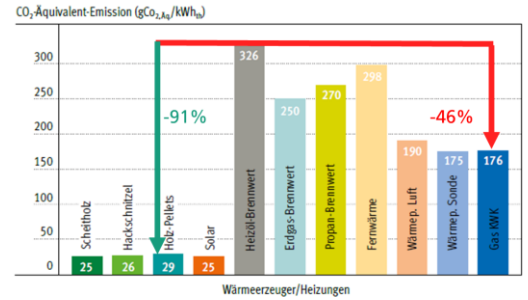
Eigene Darstellung in Anlehnung an [1] UBA

If the climate goals are to be achieved, efforts must be intensified in all industries

Efficiency alone is not enough! Renewable primary energy sources are needed



The provision of renewable process heat is a particular challenge



Quelle: IER Universität Stuttgart 2016 (gemäß GEMIS, Version 4.94) © FNR 2017

Bioenergy will play a key role in the industrial process of heat supply

Hersteller		Politik / Verbände
Technische Herausforderungen	**Systemintegration**	**Demonstration und Dokumentation**
▪ Leistungsbereiche?	▪ Zusammenspiel mit unterschiedlichen Erzeugungskonzepten?	▪ Kunden Know-how?
▪ Wärmeträgermedien?	▪ Zusammenspiel im Produktionsprozess?	▪ Schulung von Anwendern und Entscheidungsträgern?
▪ Temperaturbereiche?	▪ Speichertechnik?	▪ Image Bioenergie?
▪ Brennstoffflexibiliät?		▪ Beseitigung von Hemmnissen
▪ Flexibilität der Wärmebereitstellung?		▪ Gezielte Förderung

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Thank you very much

Contact

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Quellen

[1] UBA Abruf Homepage https://www.umweltbundesamt.de/sites/default/files/medien/384/bilder/dateien/de_indikator_klim-01_emission-treibhausgase_2019-04-25.pdf

[2] AGEE Stat; Abruf von UBA Homepage https://www.umweltbundesamt.de/themen/klima-energie/erneuerbare-energien/erneuerbare-energien-in-zahlen

[3] Energiedaten BMWi

[4] FNR 2017: Abruf von Website: https://www.google.de/search?q=fnr+w%C3%A4rmebereitstellung&source=lnms&tbm=isch&sa=X&ved=0ahUKEwiM5cPU7objAhUJPFAKHaC_BrUQ_AUIESgC&biw=1400&bih=755#imgrc=OH2wOAqpAdGCPM:&spf=1561542376388

[5] Vortrag Gebhard 2018 in Würzburg; Verband der industriellen Energie- und Kraftwirtschaft

[6] Vortrag Bastian Schmitt 2015; IdE Kassel gGmbH: Solare Prozesswärme - Wirtschaftlichkeit und Umsetzungsbeispiele aus Industrie und Gewerbe

[7] Vortrag Cordin Arpagaus 2018: Potential für Hochtemperatur Wärmepumpen in industriellen und gewerblichen Anwendungen

[8] Vortrag auf der Enerstorage 2015 von Helene Neugebauer: POWER-TO-HEAT IN DER INDUSTRIE. Erfahrungen aus Betrieb und Vermarktung.

[9] Götz et al.: Renewable Energy 85 (2016) 1371e1390 Renewable Power-to-Gas: A technological and economic review

[10] BMWi 2017: Ergebnispapier: Strom 2030 - Langfristige Trends – Aufgaben für die kommenden Jahre; Abruf von Website: https://www.bmwi.de/Redaktion/DE/Publikationen/Energie/strom-2030-ergebnispapier.pdf?__blob=publicationFile&v=32

[11] BCG, Prognos AG: Klimapfade für Deutschland; Abruf von Website: https://www.zvei.org/fileadmin/user_upload/Presse_und_Medien/Publikationen/2018/Januar/Klimapfade_fuer_Deutschland_BDI-Studie_/Klimapfade-fuer-Deutschland-BDI-Studie-12-01-2018.pdf

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