TECHNISCHE UNIVERSITÄT DRESDEN

Fakulty of Forestry, Geo and Hydro Sciences, Institute of waste management and contaminated site treatment

WASTE TO ENERGY PLANTS AS AN OPPORTUNITY FOR ENERGY PRODUCTION TO SUBSTITUTE FOSSIL FUELS AND TO AVOID GREENHOUSE GAS EMISSIONS

Dr.-Ing. Christoph Wünsch
Prof. Dr.-Ing. Bernd Bilitewski

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DRESDEN concept Exzellenz aus Wissenschaft und Kultur

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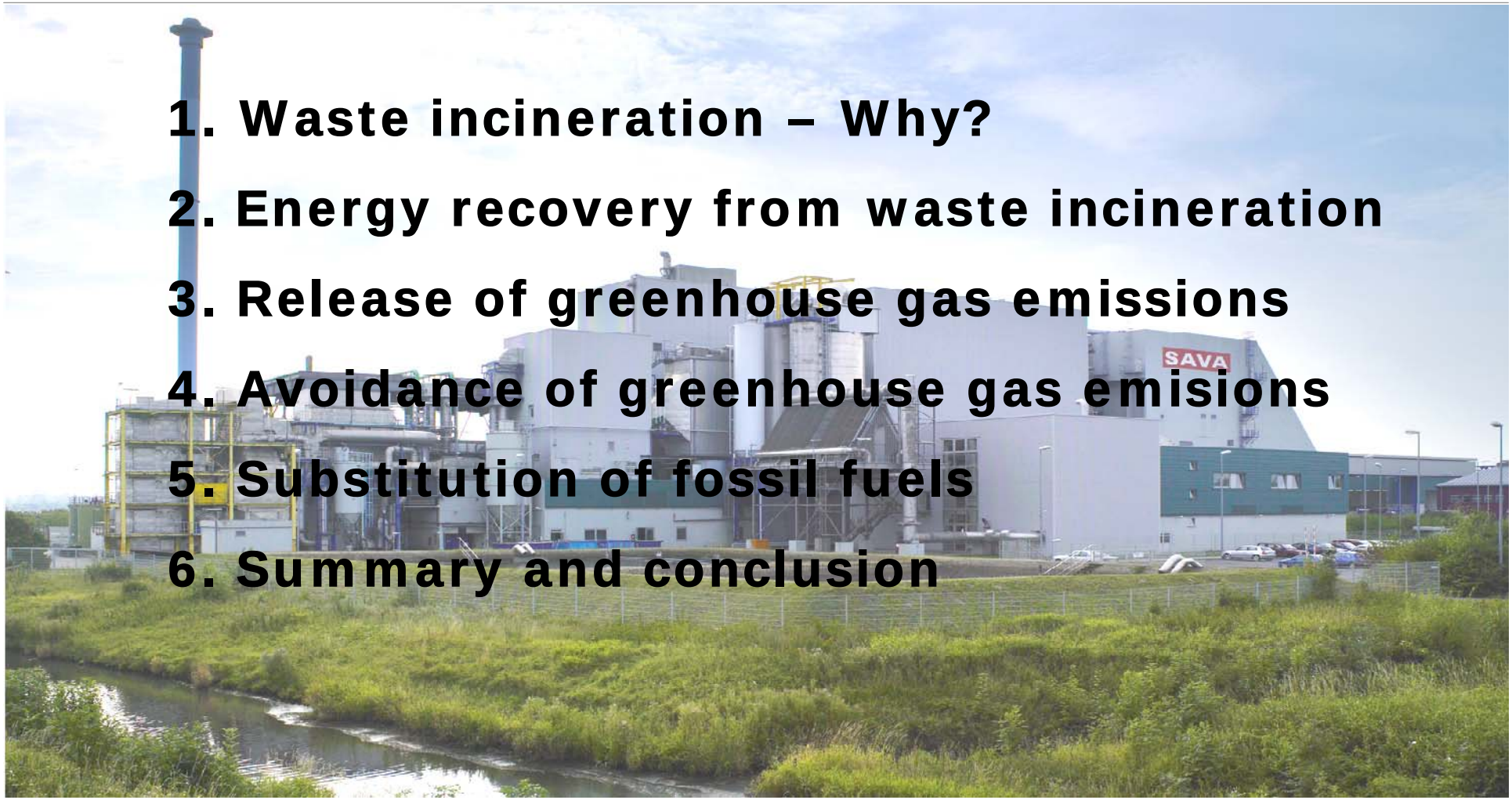

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Waste incineration – Why?

- treatment in sanitary landfill gas can reduce GHG-emissions to up to 75 %
- mechanical, biological and/or thermal treatment lowers GHG- emissions additionally
- primary target of waste incineration plants is the environmentally compatible disposal of wastes
- secondary target is the recovery of energy
- use of electrical power and heat/cold results in a further decrease of GHG-emissions

Energy recovery

Direct use as process steam or district heat or with 30 % efficiency as district cold

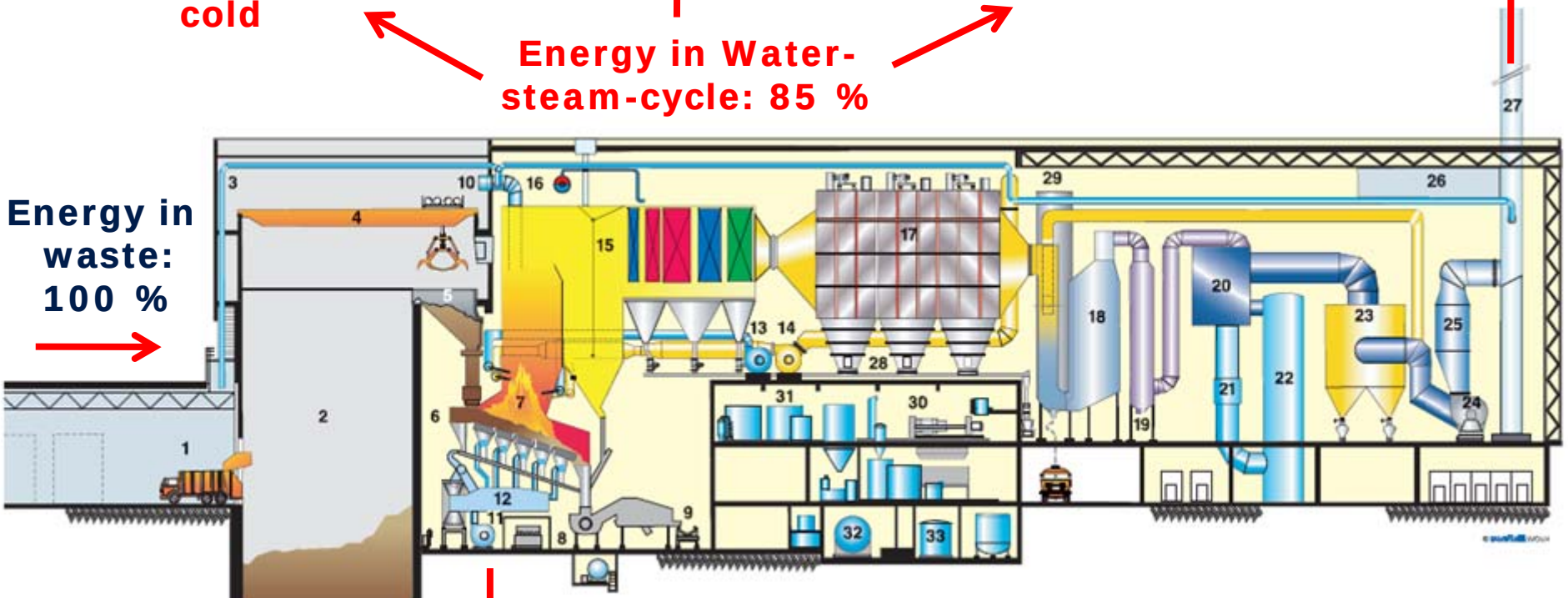
Energy in electrical power: app. 22 % net

Up to 70 % thermal and 10 % electrical in CHP-generation

Energy in Flue gas: 13 %

Energy in waste: 100 %

Energy in Water-steam-cycle: 85 %



Energy in Slag: 2 %

Energy recovery

– town/area with 1 million people producing 200 kg MSW/a with a caloric value of 9,000 kJ/kg

⟶ thermal power: 60 MW or 500.000 MWh/a

	thermal input in MWh/a	**net efficiency factor**	**Energy output in MWh/a**
Thermal	500.000	85 %	425.000
Electrical power		22 %	110.000
CHP thermal		70 %	350.000
CHP electrical power		10 %	50.000

Release of GHG-emissions

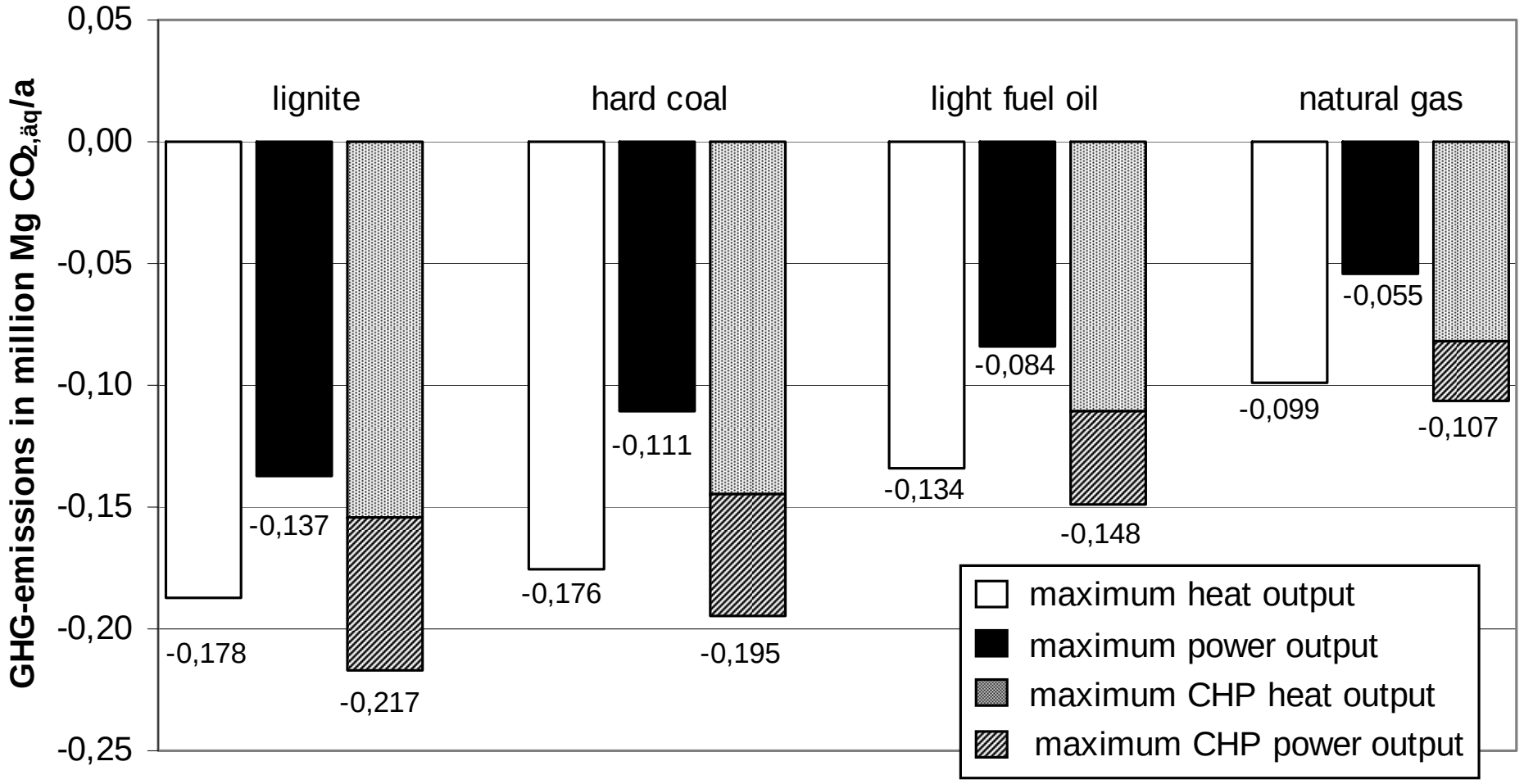
- released climate relevant carbon dioxide depends on incinerated amount of fossil fixed carbon
- amount is influenced by the following waste characteristics:
  - incinerate type of waste
  - composition of the differend fractions in the waste
  - biogenic/fossil portion in the type of waste
  - carbon content of the type of waste
  - efficiency of combustion
- for MSW in industrial countries between 0.253 and 0.557 Mg $CO_{2,f}$/Mg MSW were calculated

1 million people → 200,000 Mg/a: 50,600 Mg $CO_{2,f}$/a released

Avoidance of GHG-emissions

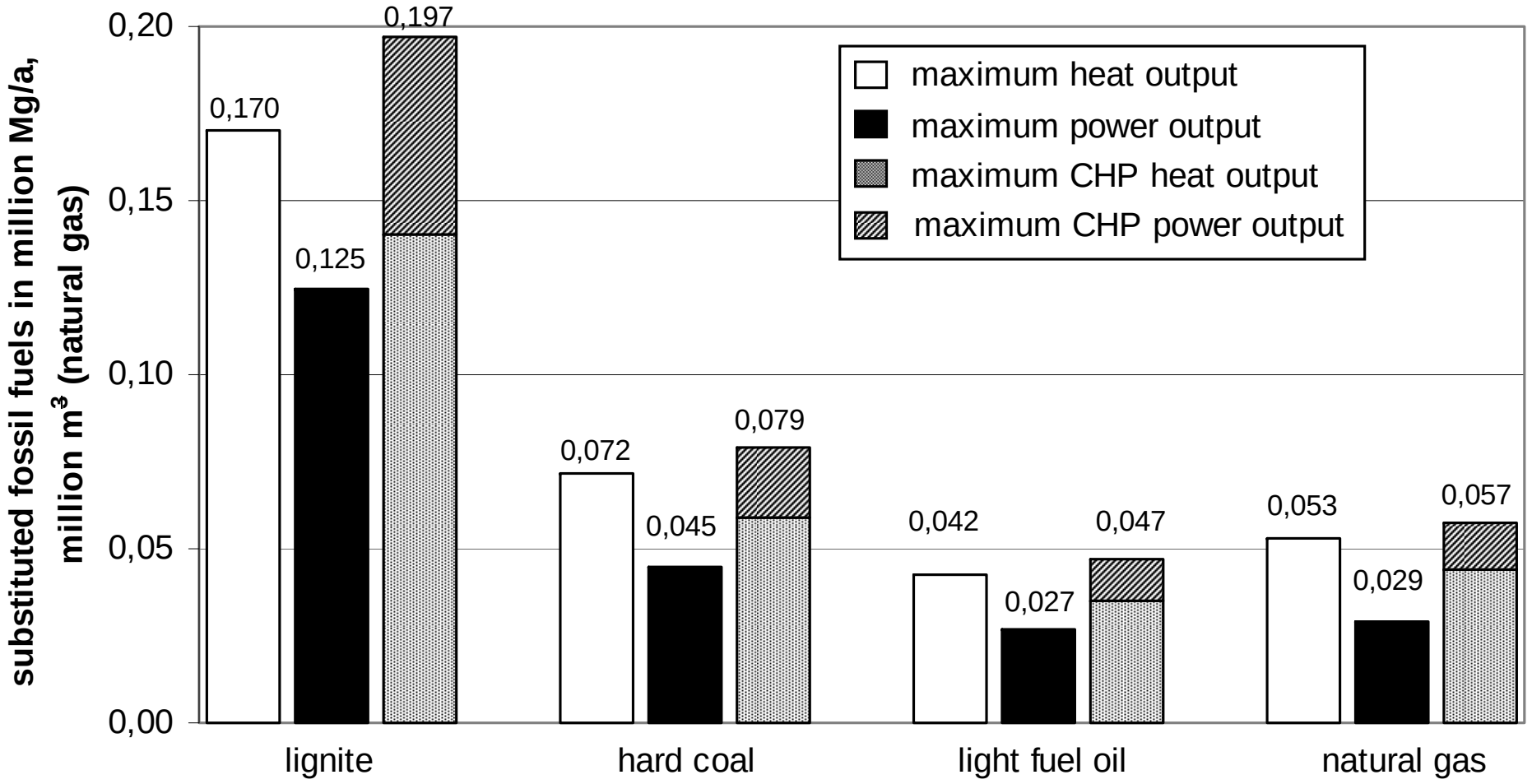
	lignite	hard coal	light fuel oil	gas
GHG-emissions factor in Mg CO_2/Mg fuel	1.101	2.455	3.169	1.865
calorific value in MWh/Mg fuel	2.941	6.98	11.836	9.392
GHG-emissions factor in Mg CO_2/MWh fuel	0.374	0.352	0.268	0.199
electrical net efficiency	30 %	35 %	35 %	40 %
substitution factor power in Mg CO_2/MWh power	1.248	1.005	0.765	0.496
thermal net efficiency	85 %	85 %	85 %	85 %
substitution factor heat in Mg CO_2/MWh heat	0.44	0.414	0.315	0.234

Avoidance of GHG-emissions



- greenhouse gas balance by adding 50,600 Mg $CO_{2,f}$/a

Substituted fossil fuels



Summary and conclusion

- high organic content in MSW of developing and emerging countries release low amounts of climate relevant GHG-emissions during incineration
- with high energy recovery rates, high amounts of primary fossil fuels can be saved

  → additional climate relevant greenhouse gas emissions can be avoided
- modern waste incineration plants are expensive and well trained and very experienced people are necessary
- integration of waste incineration plants in power supply systems with a high recovery rate of heat, combined with the production of electrical power **!**
- use of produced energy leads to a reduction of the payback period for the investment

Thanks for your attention

Contact:

Christoph Wünsch

Institut für Abfallwirtschaft und Altlasten

Pratzschwitzer Str. 15

01796 Pirna

Tel.: +49 3501 530044

E-Mail: christoph.wuensch@tu-dresden.de

»Wissen schafft Brücken.«