„Einsatz von Biomasse für BtL – ein kritischer Blick“

„Biomass Utilisation for BtL – A Critical Look“

Dr. Ludwig Leible, Stefan Kälber, Gunnar Kappler

Institute for Technology Assessment and Systems Analysis (ITAS)

3rd BtL-Congress

October 15th/16th 2008, Berlin

Fig. 2: 23 years (1985/2008) – To highlight the changing situation

World population in 1985: 4.9 billion people

Sources: United Nations (2007); US Population Reference Bureau (2008)

World population in 2008: 6.7 billion people

Growth since 1985: 1.8 billion people

Fig. 3: Presentation outline

„Einsatz von Biomasse für BtL – ein kritischer Blick“

„Biomass Utilisation for BtL – A Critical Look“

(1) Major developments and preliminary remarks

(2) Biomass resources and supply in Germany

(3) Technologies for fuel production from biomass

(4) BtL-fuel from cereal straw and wood residues from forestry

(5) Comparison of BtL-fuel with electricity or heat production

(6) Conclusions / Outlook

(1) Major developments

Fig. 5: Major developments

(1) Growing world population

(2) Increasing demand for food and energy

(3) Increasing prices of food and energy

(4) Increasing CO_2 emissions

(5) ……..

Fig. 6: Crude oil prices (North Sea Brent) from January 2006 until October 2008

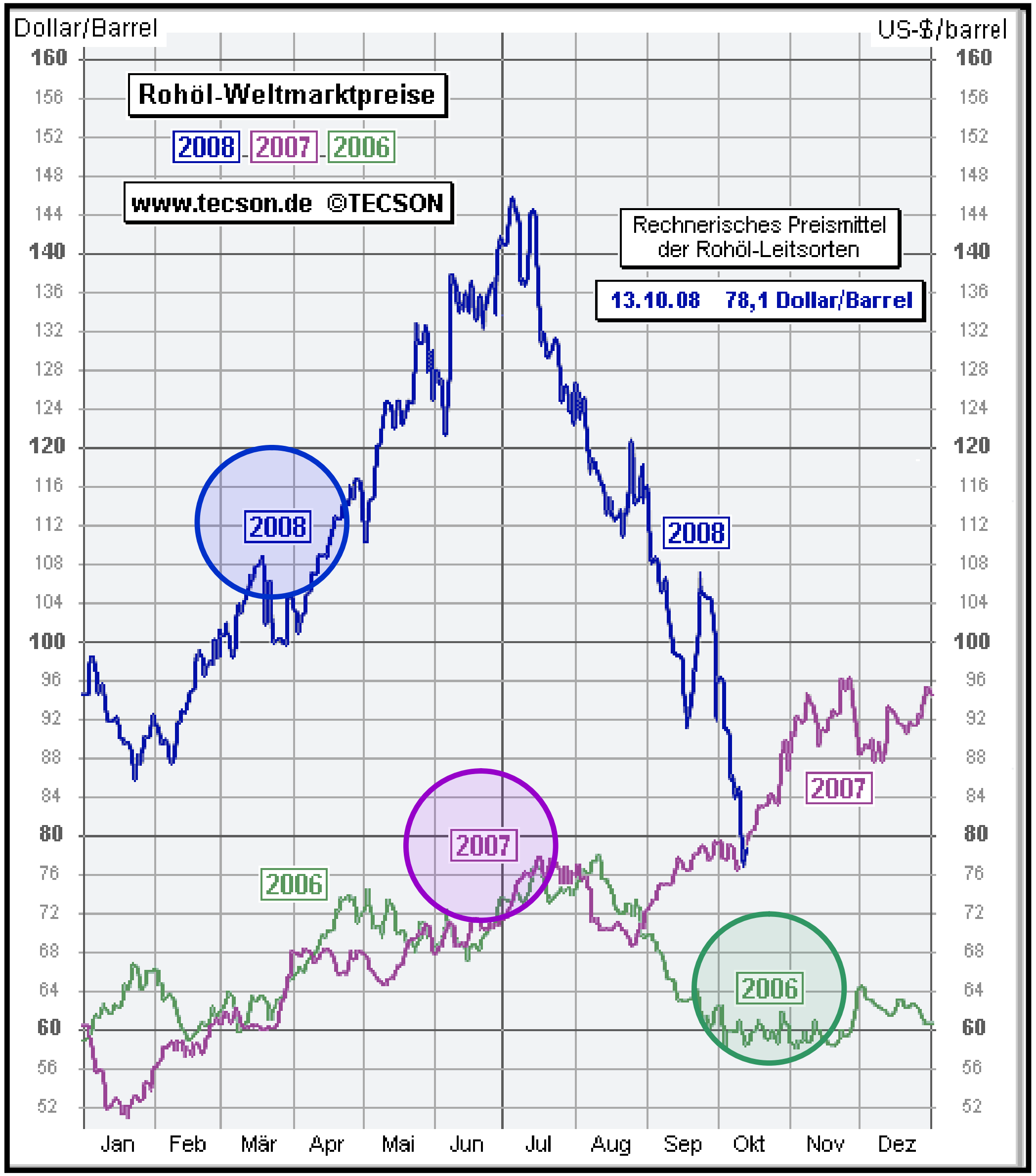
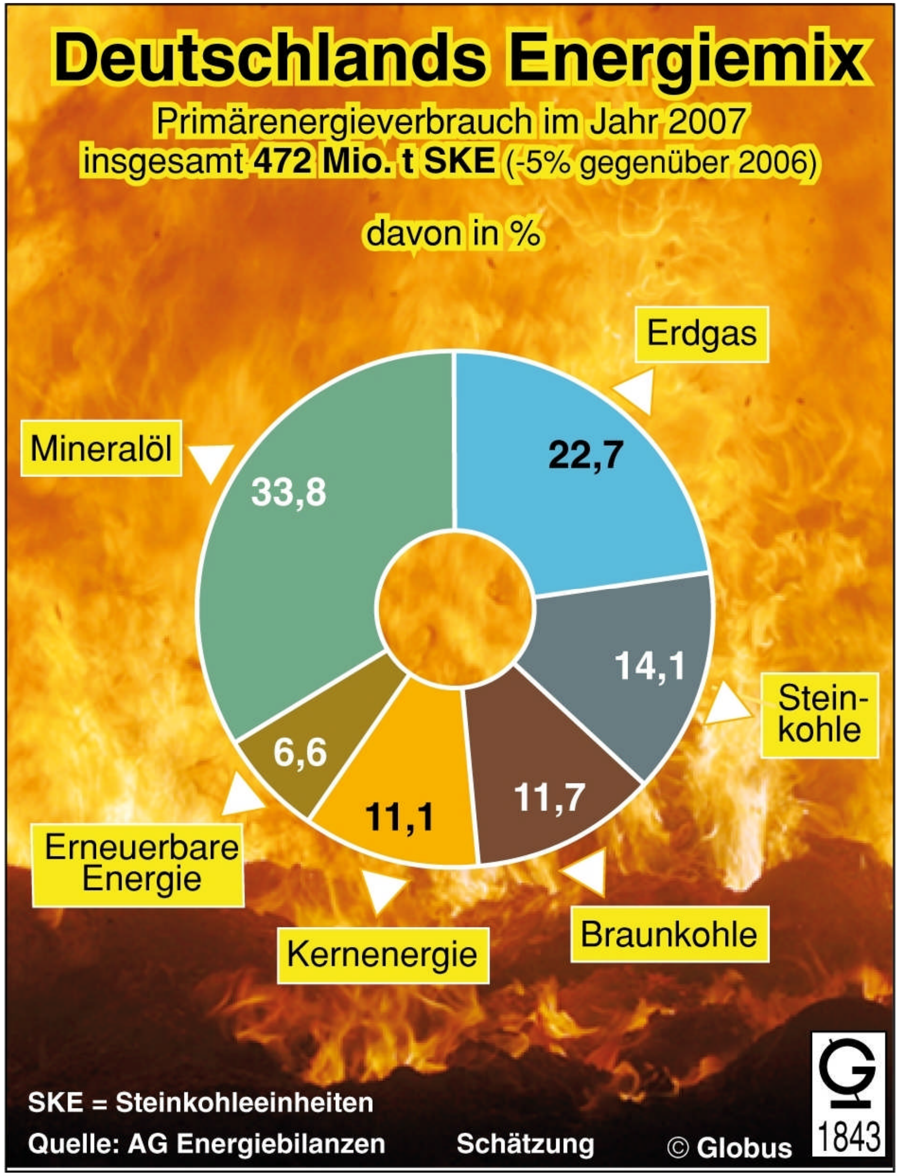
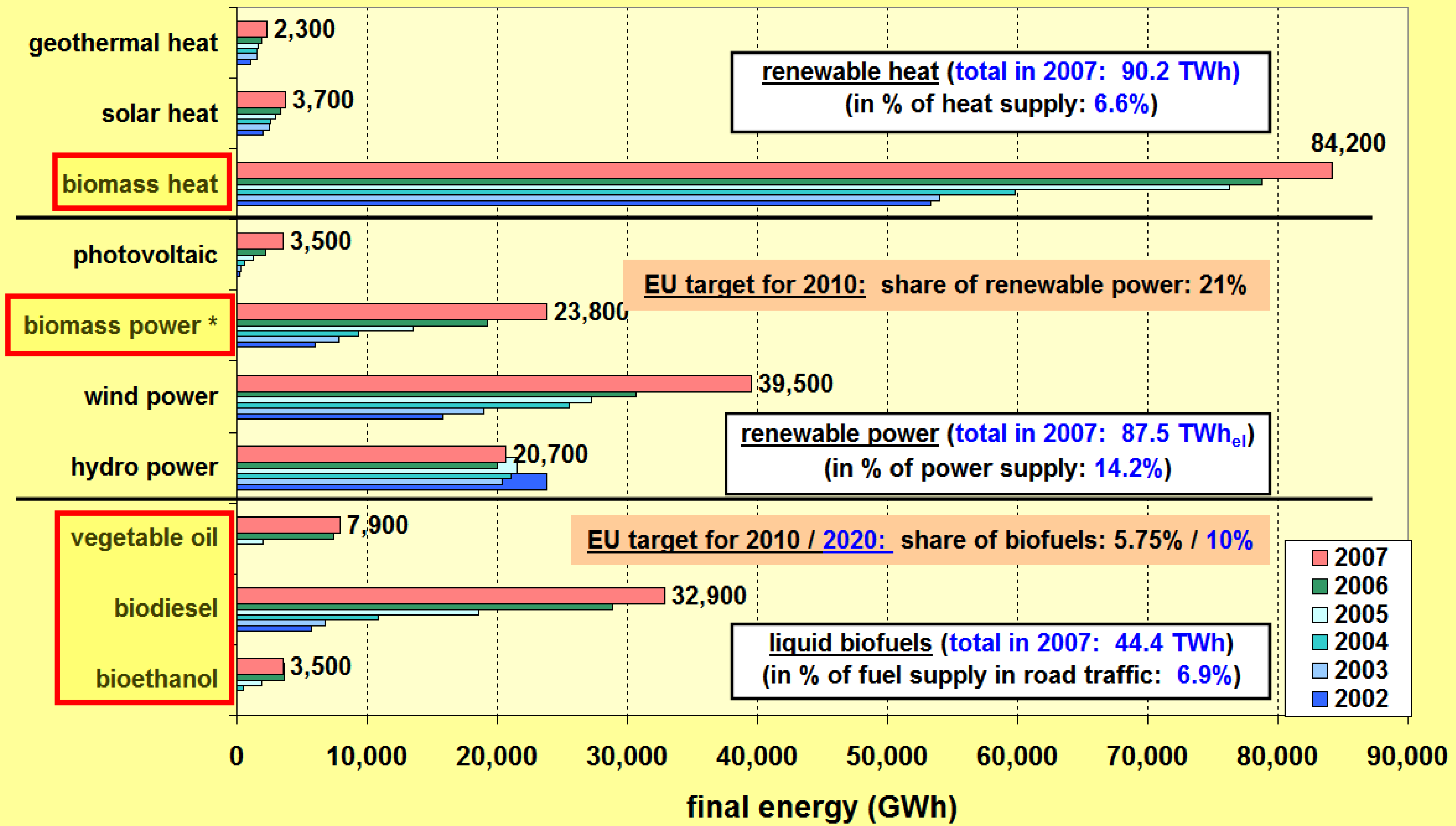


Fig. 7: German energy mix in 2007: 6.6% renewable energies



Source: ewt 2008, 58 (1-2), p91

Fig. 8: Importance of biomass as renewable energy in Germany (2002-2007)



* including biogenic part of municipal waste (amounting 50%)

Source: BMU/AGEE, status: March 2008, June 2007

ITAS LL/2008

Fig. 9: The preference of BtL-fuels – as measured by?

(1) Contribution to energy supply

(2) Competitiveness against

- Food production
- Heat and electricity from biomass
- fossil energy sources
- non biogenic renewable energy sources

(3) Contribution to reduce greenhouse effect

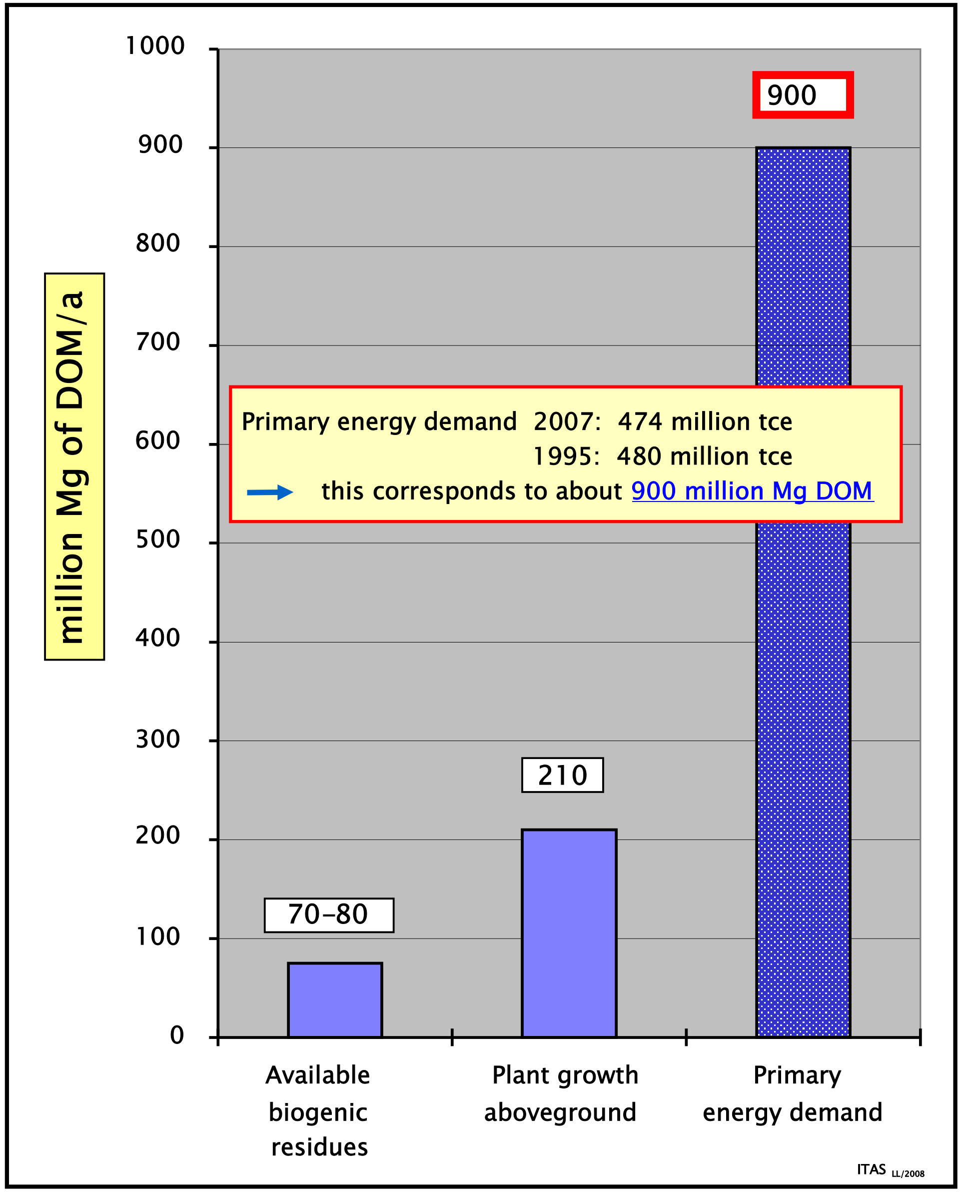
(4) Employment effects in rural areas

(5) Contribution to technology development/export chances

(6) ....

(2) Biomass resources and supply in Germany

Fig. 11: Volume of biomass and demand for primary energy in Germany



Conclusion:

From an optimistic point of view biomass can meet 10-15% of current primary energy demand!

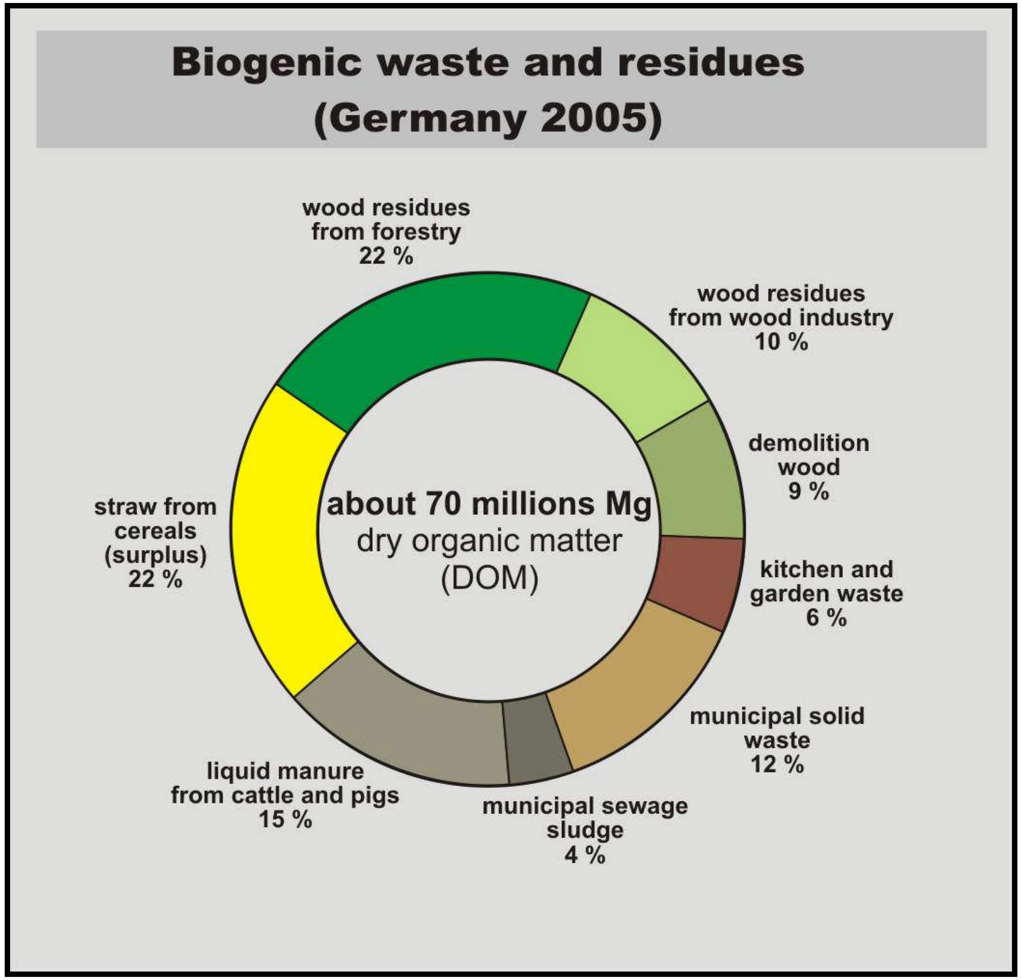
For comparison:

In 2007 biomass (including biogenic residues and wastes) covered around 4.8%.

DOM = dry organic matter

tce = ton coal equivalent = 29.3 GJ

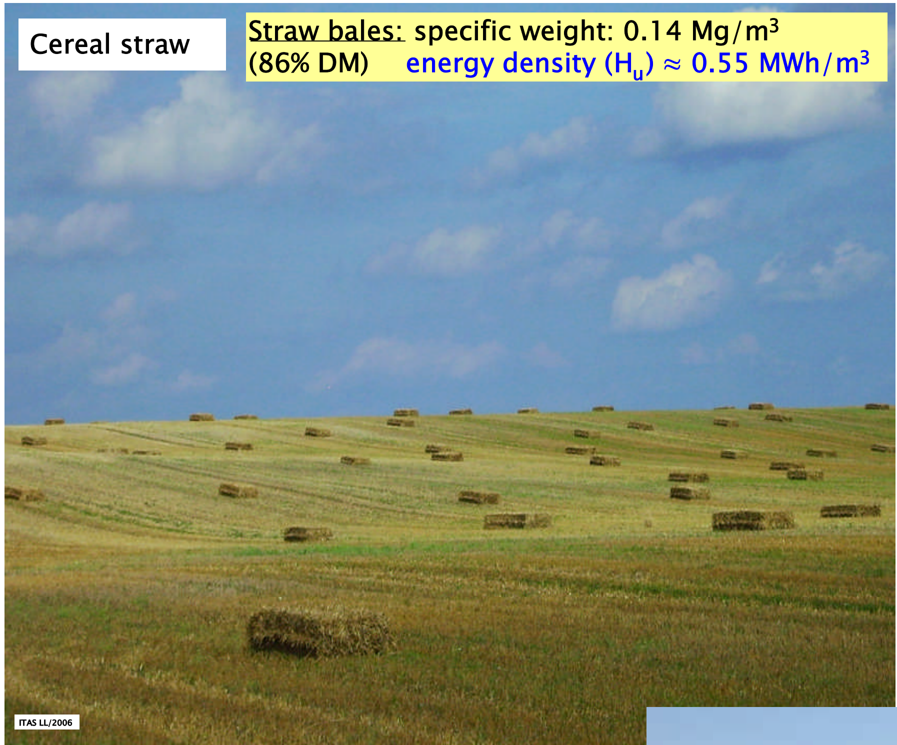
Fig. 12: Volume of biogenic waste and residues in Germany 2005



A simplified estimate shows:

This volume corresponds to **8%** of the primary energy demand **in Germany**.
In **2007**, **biomass** (including biogenic waste and residues) covered about **4.8%** in Germany.

Fig. 13: Logistic challenges regarding biomass supply:
– biomass is regionally distributed (decentral), energy density is low!



Cereal straw

Straw bales: specific weight: 0.14 Mg/m³
(86% DM) energy density (H_u) ≈ 0.55 MWh/m³

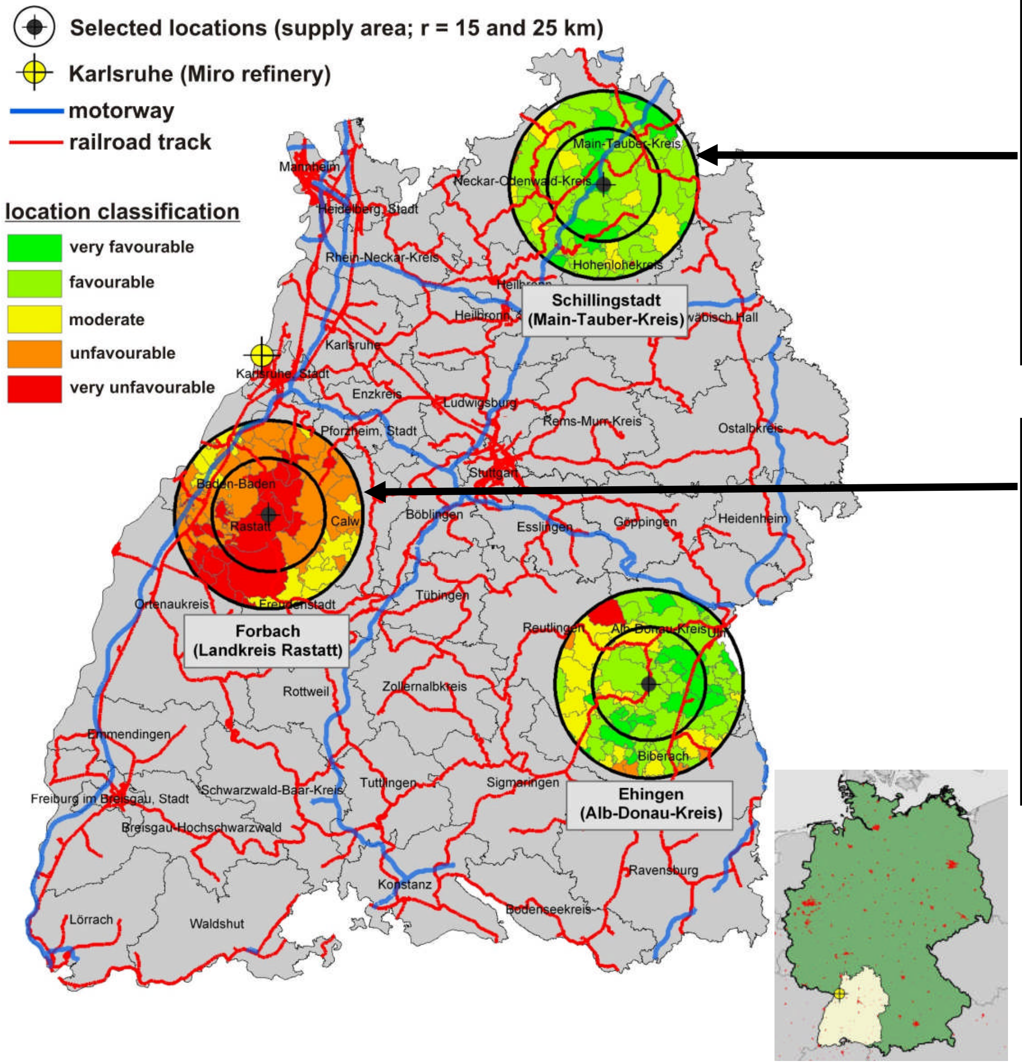
Wood chips: specific weight: 0.40 Mg/m³
(50% DM) energy density (H_u) ≈0.90 MWh/m³

Wood residues

Crude oil: specific weight: 0.8-0.9 Mg/m³;
energy density (H_u): 9-10 MWh/m³

ITAS LL/2008

Fig. 14: Supply with straw and wood residues – Location studies



Schillingstadt; with r = 25 km

- **Volume: 190,000 Mg DM** (thereof 71% straw)
- **Collecting costs:** 50 €/Mg DM for straw; 80 €/Mg DM for wood residues
- **Supply costs (free gate), in total: 80 €/Mg DM**

Forbach; with r = 25 km

- **Volume: 110,000 Mg DM** (thereof 10% straw)
- **Collecting costs:** 70 €/Mg DM for straw; 90 €/Mg DM for wood residues
- **Supply costs (free gate), in total: 100 €/Mg DM**

> **Only a few locations are suitable; these locations are mainly dominated by straw**

Source: Gunnar Kappler, Dissertation (2008, Uni Freiburg)

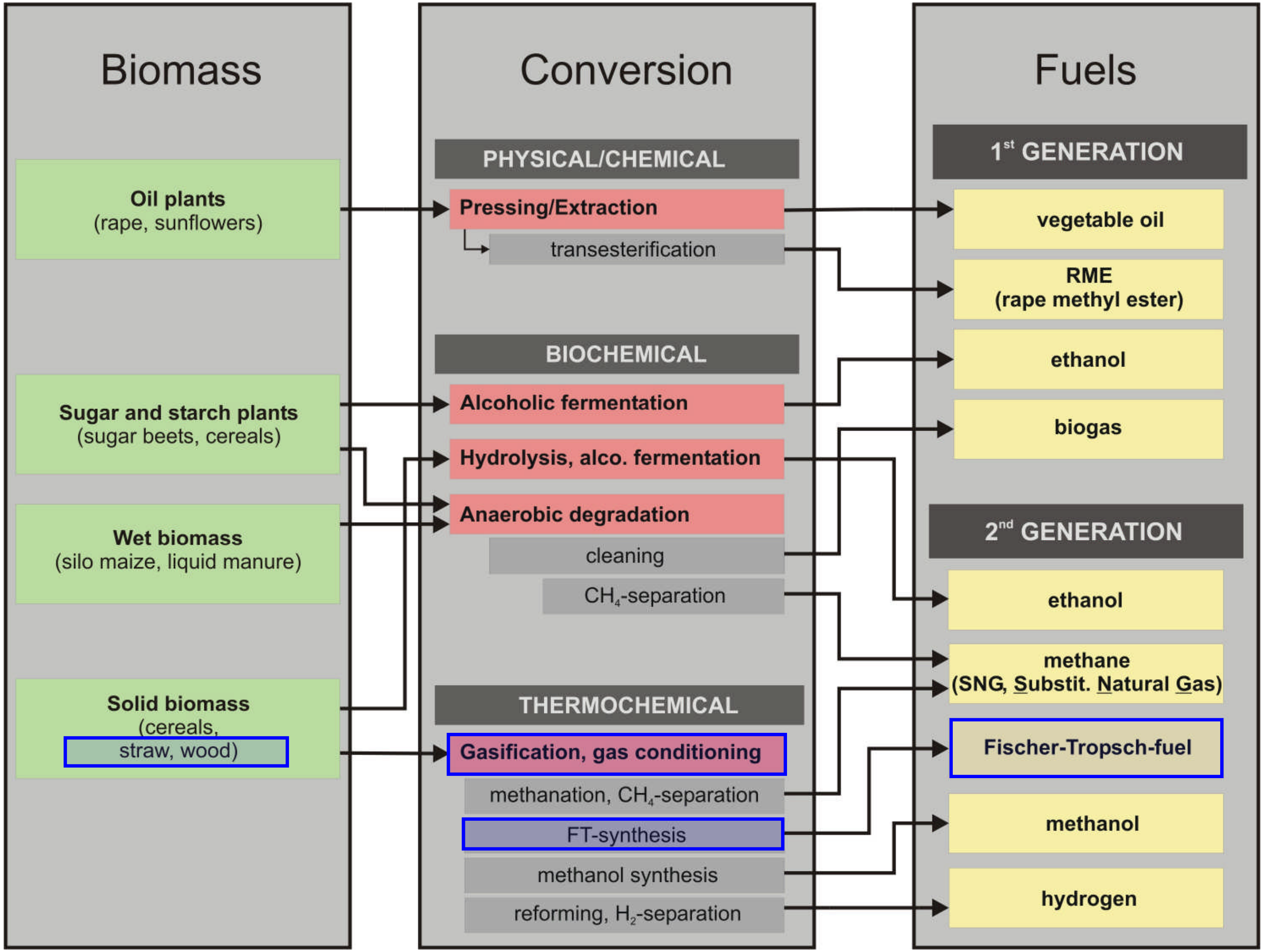
(3) Technologies for fuel production from biomass

Fig. 16: Search for alternatives: BtL is one option

BtL is one option!

Source: Bild der Wissenschaft 6/2007

Fig. 17: Routes for the production of fuels from biomass



(4) BtL-fuel from cereal straw and wood residues

(bioliq®-concept of the Forschungszentrum KA)

Fig. 19: Two-step bioliq®-concept (Biomass-to-Liquid, BtL) for fuel production from straw and wood residues

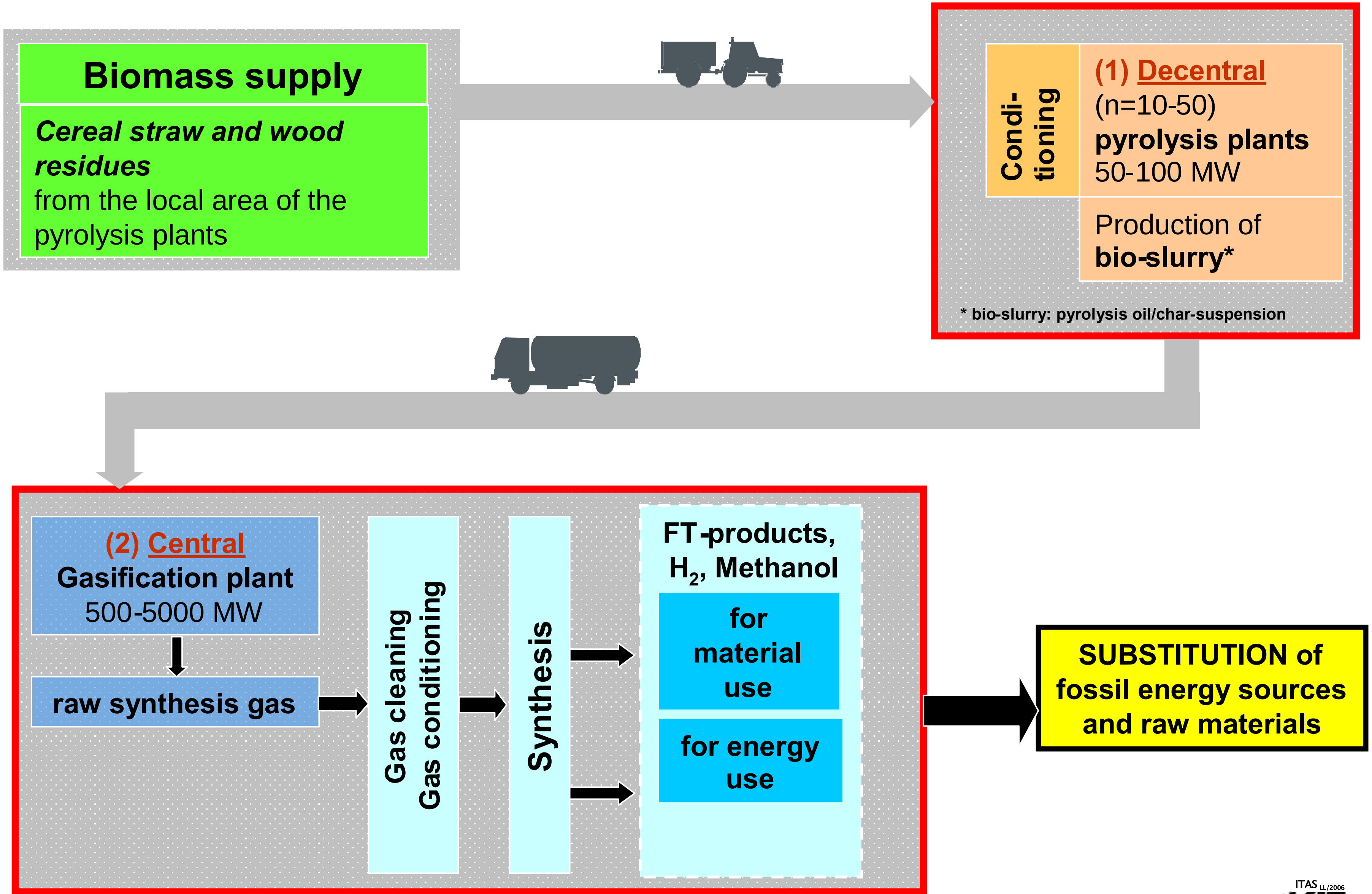
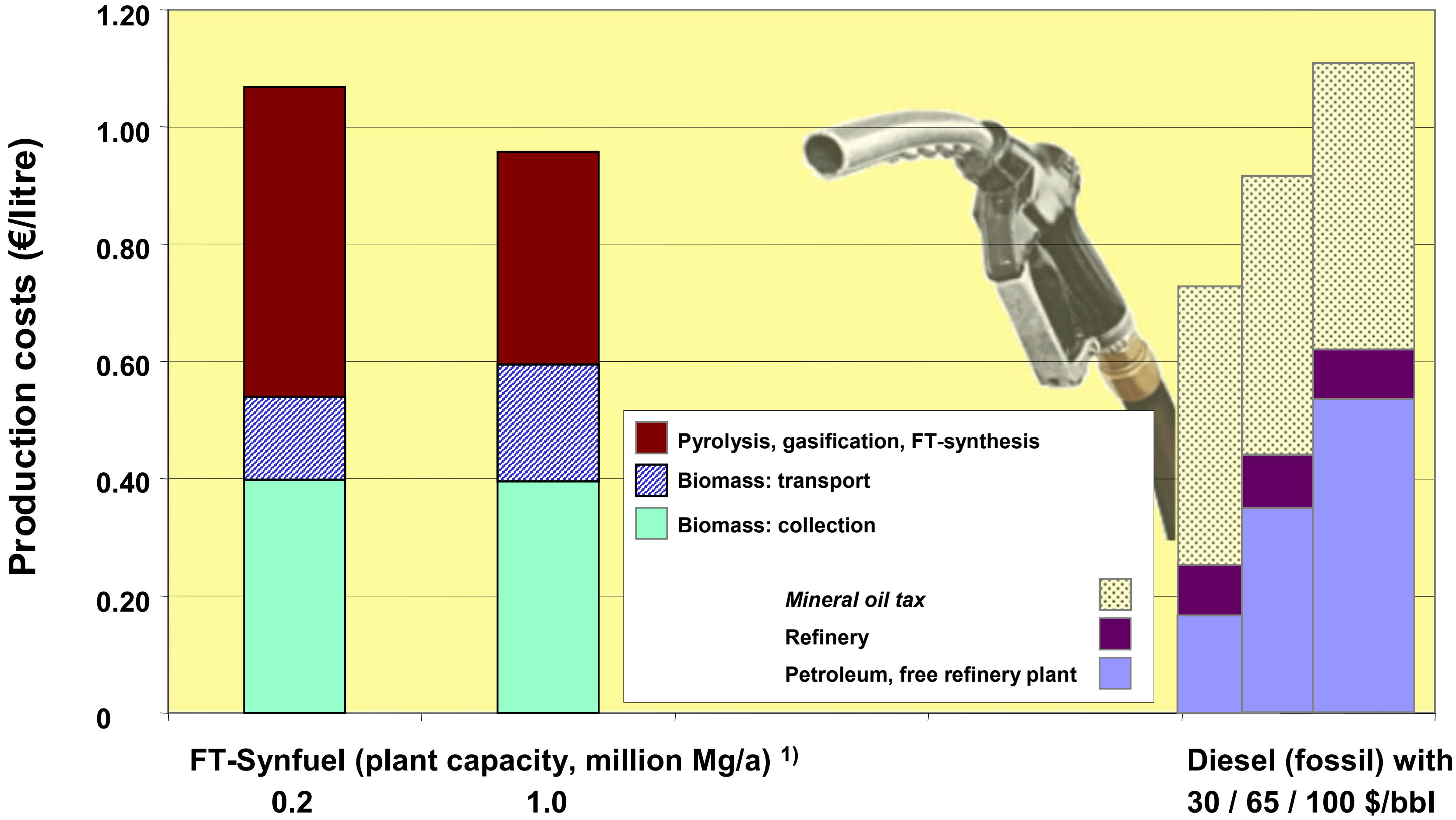


Fig. 20 : Production costs of FT-synfuel from straw and wood residues – a comparison with fossil diesel



1) FT-Synfuel from straw and wood residues, central plant; production costs quoted free plant, without tax; basis 2006

ITAS LL/2008

(5) Comparison of BtL-fuel with electricity or heat production

Fig. 22: Straw/wood – Diversity/competition regarding energy use

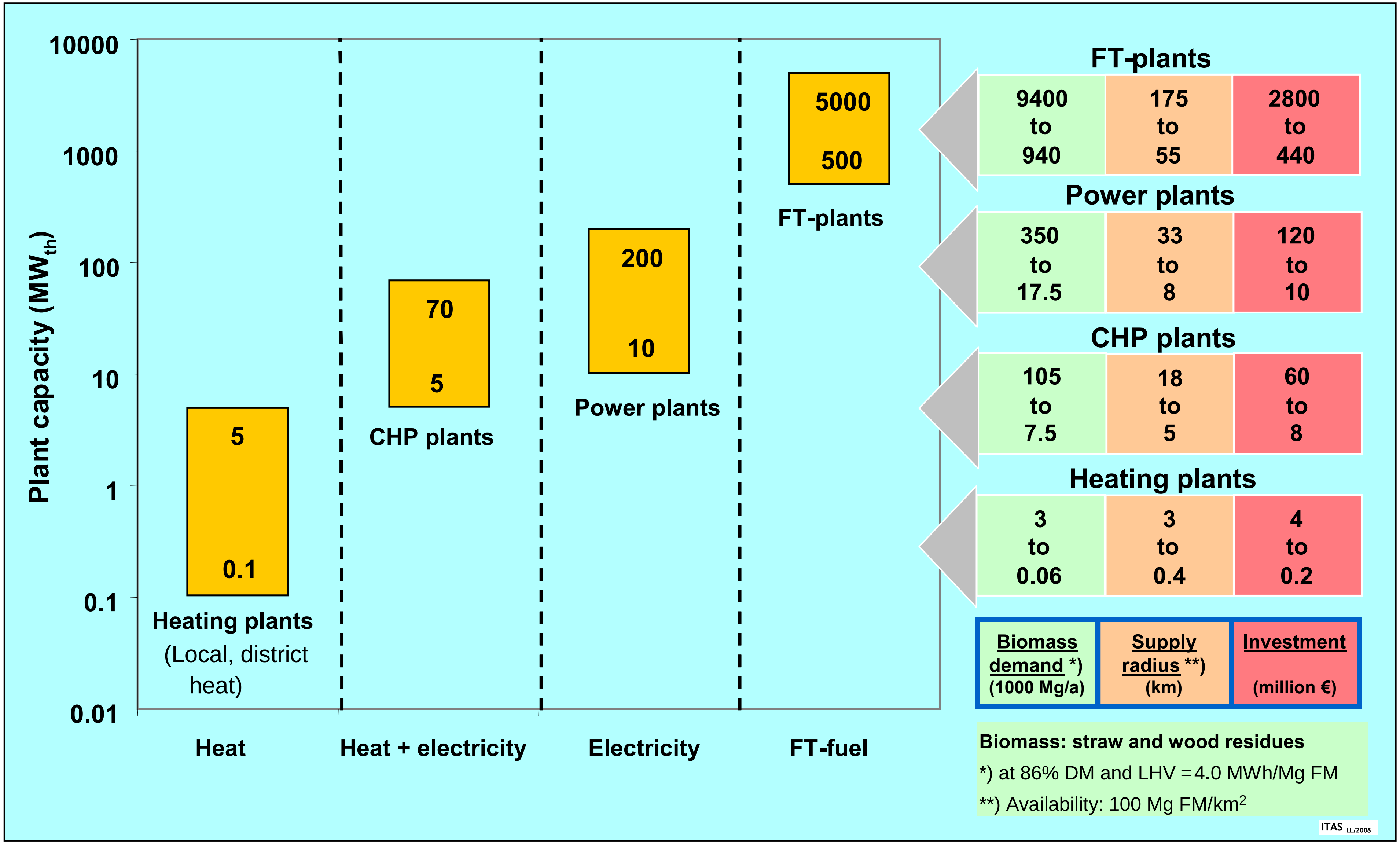
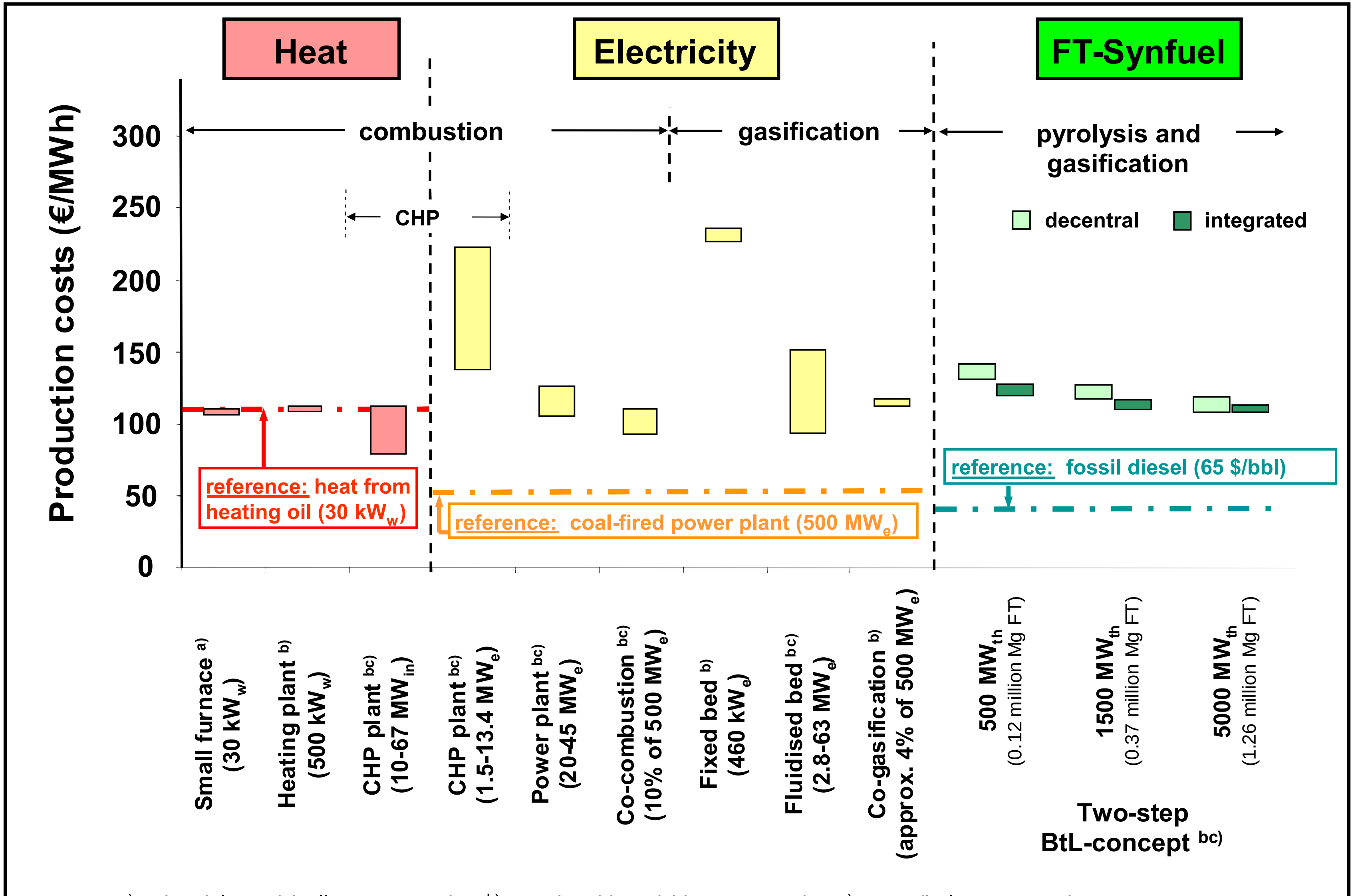


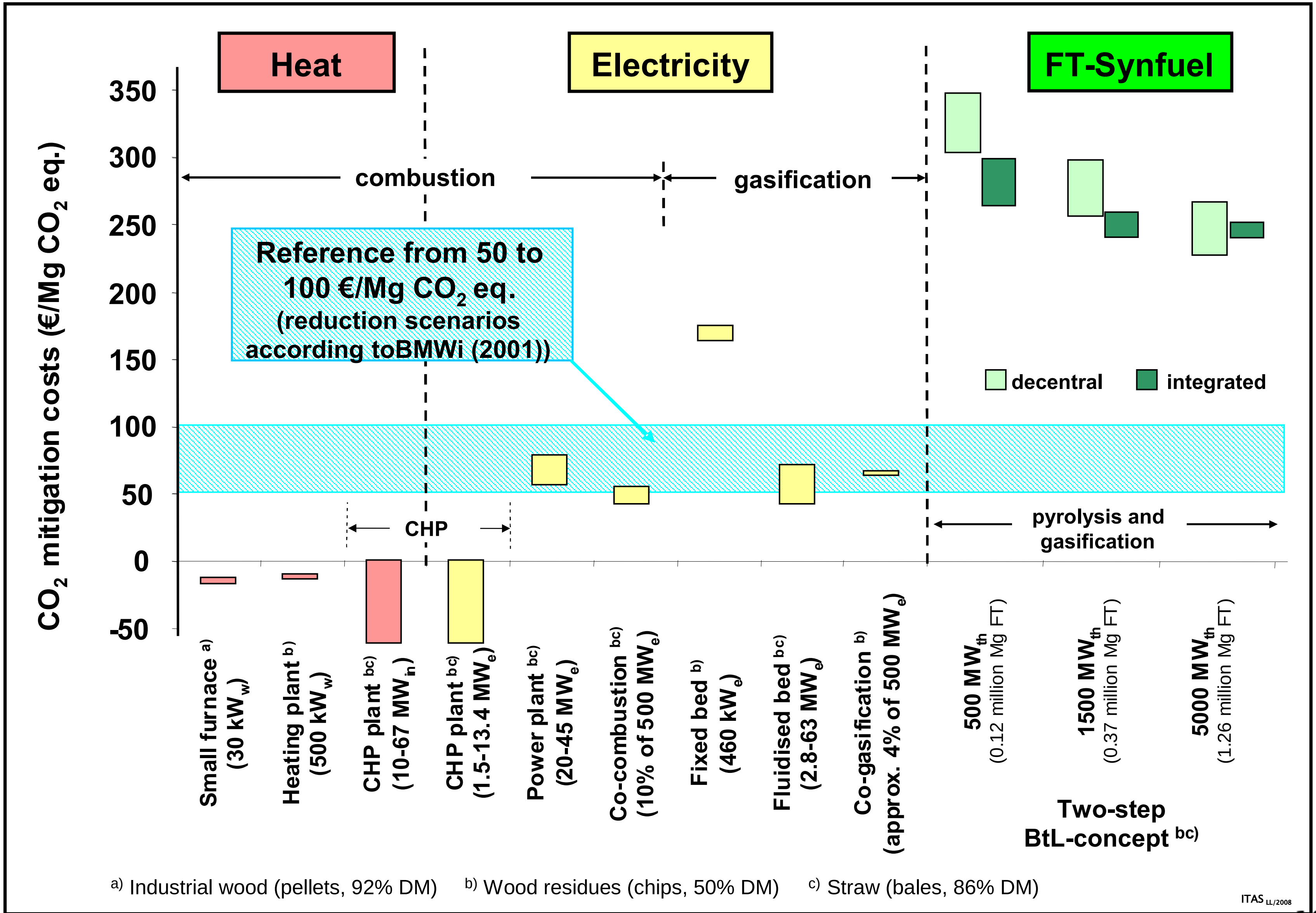
Fig. 23: Production costs of heat, electricity and FT-Synfuel from wood residues and cereal straw (basis 2006)



a) Industrial wood (pellets, 92% DM) b) Wood residues (chips, 50% DM) c) Straw (bales, 86% DM)

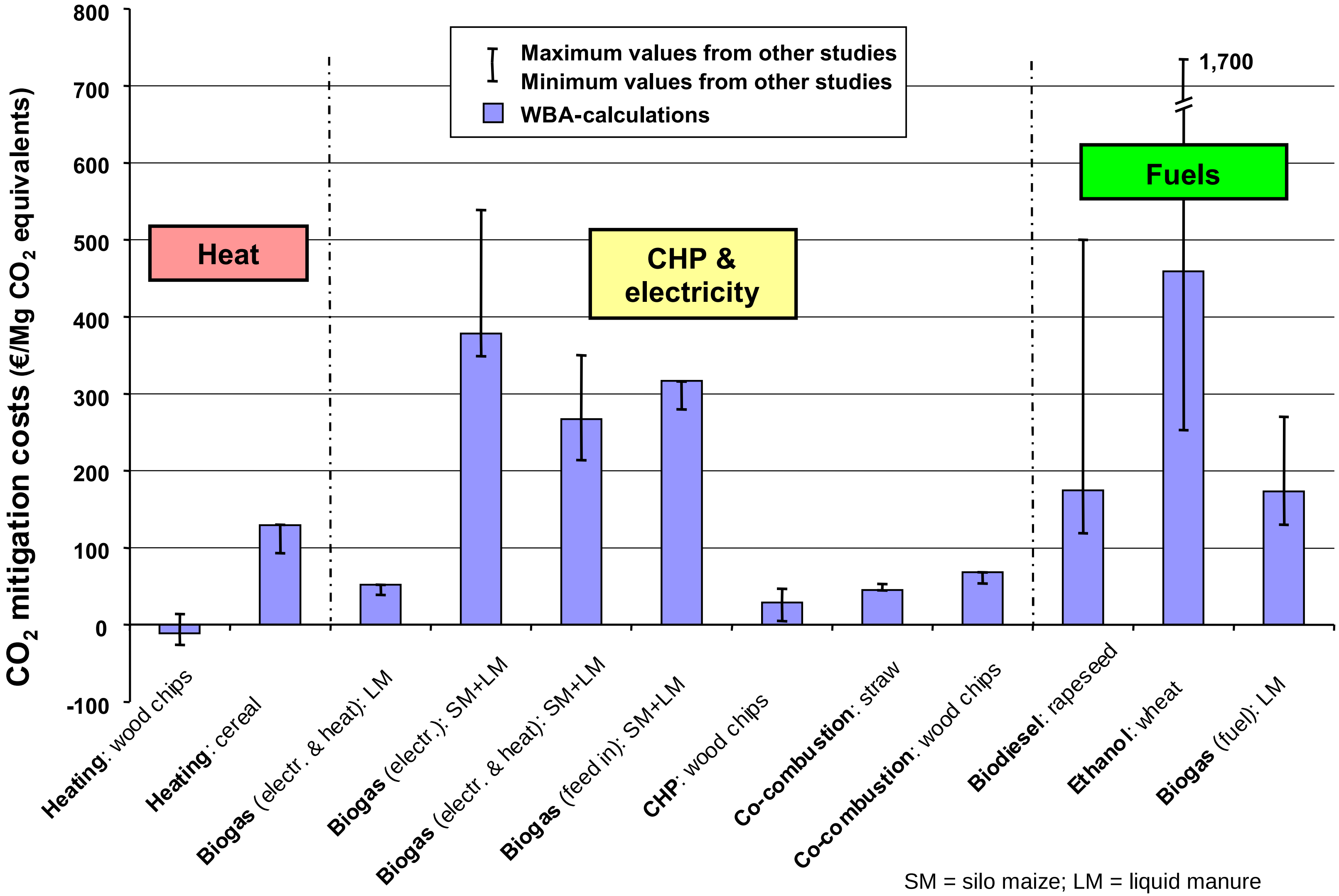
ITAS LL/2008

Fig. 24 : CO_2 mitigation costs producing heat, electricity and fuel from straw and wood residues (basis 2006)



a) Industrial wood (pellets, 92% DM) b) Wood residues (chips, 50% DM) c) Straw (bales, 86% DM)

Fig. 25: CO_2 mitigation costs – results from other studies (WBA 2008)



SM = silo maize; LM = liquid manure
Co-combustion in coal-fired power plant

Source: WBA (2008), modified

Fig. 26: Conclusions/Outlook

„Einsatz von Biomasse für BtL – ein kritischer Blick“

„Biomass Utilisation for BtL – A Critical Look“

- Increasing competition for biomass
- The potential of biomass as energy source is limited
- Biogenic waste and residues offer economic benefits
- Biomass for heat production is currently most competitive
- Highest CO_2 mitigation costs for biofuels
- Under precautionary aspects the promotion of BtL-technologies makes sense!

Fig. 27: Conclusion/Outlook for long-term perspective of biomass use

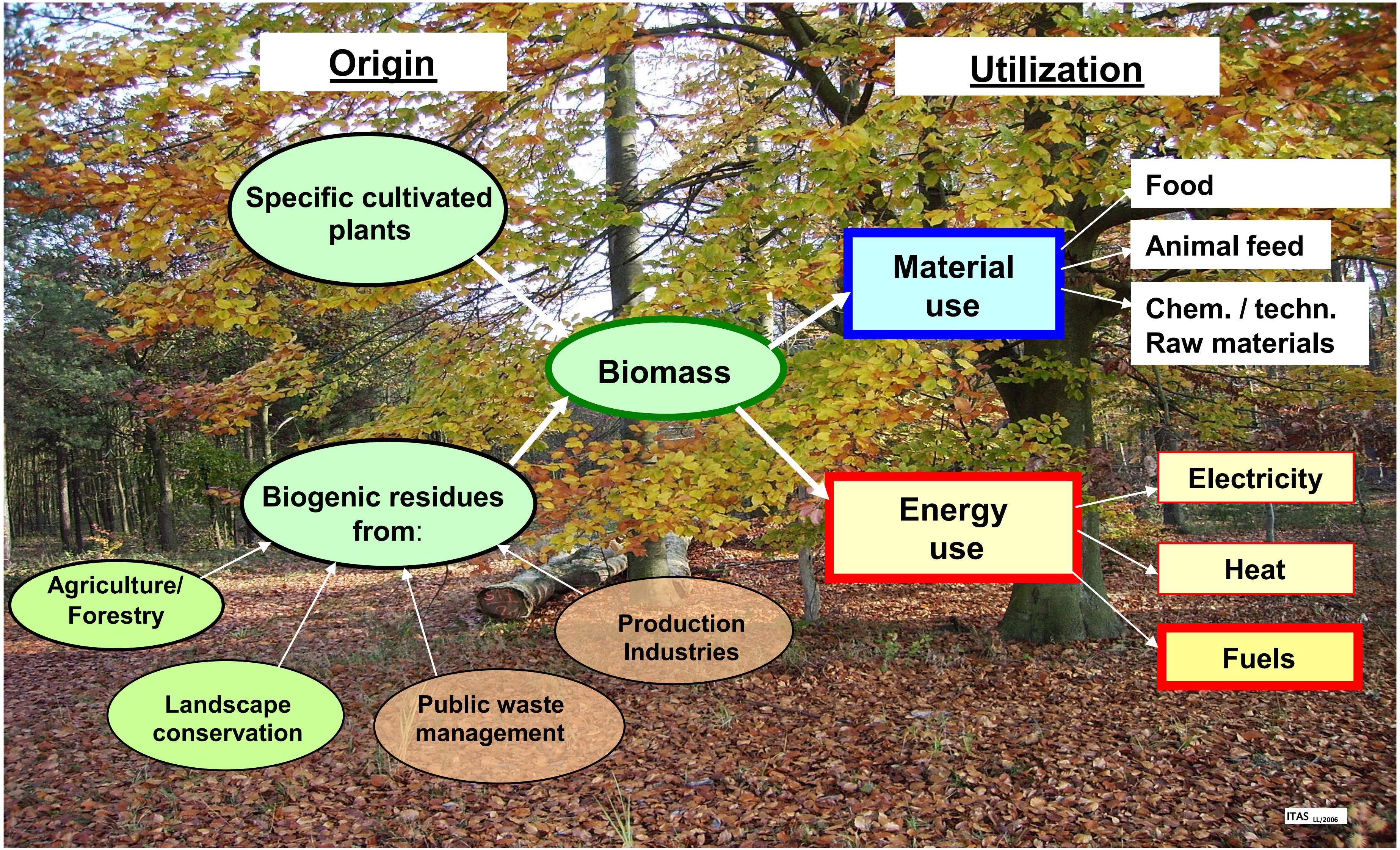


Fig. 28: Fuel from hard coal (biomass) – (not) a new subject in Germany?

Thank you for your attention!

ITAS
LL/2008

Source: Benzol-Verband, ARAL (Eds.), 1936, Bochum, 18pp.