C.A.R.M.E.N.®

Wood heating plants – opportunities and limits for municipalities

Sebastian Kilburg

C.A.R.M.E.N. e.V.

Central **A**gricultural **R**aw Material **M**arketing and d**E**velopment **N**etwork

Coordination office for renewable resources

- **founded 1992**
- **65 members**
- **20 employees**
- **Consulting, public relations and project management with regard to energetical and industrial use of RR**
- **Project assessment and project evaluation for the bavarian ministry of agriculture and forestry**
- **approx. 200 big bioenergy-projects**
- **in-depth information: www.carmen-ev.de**

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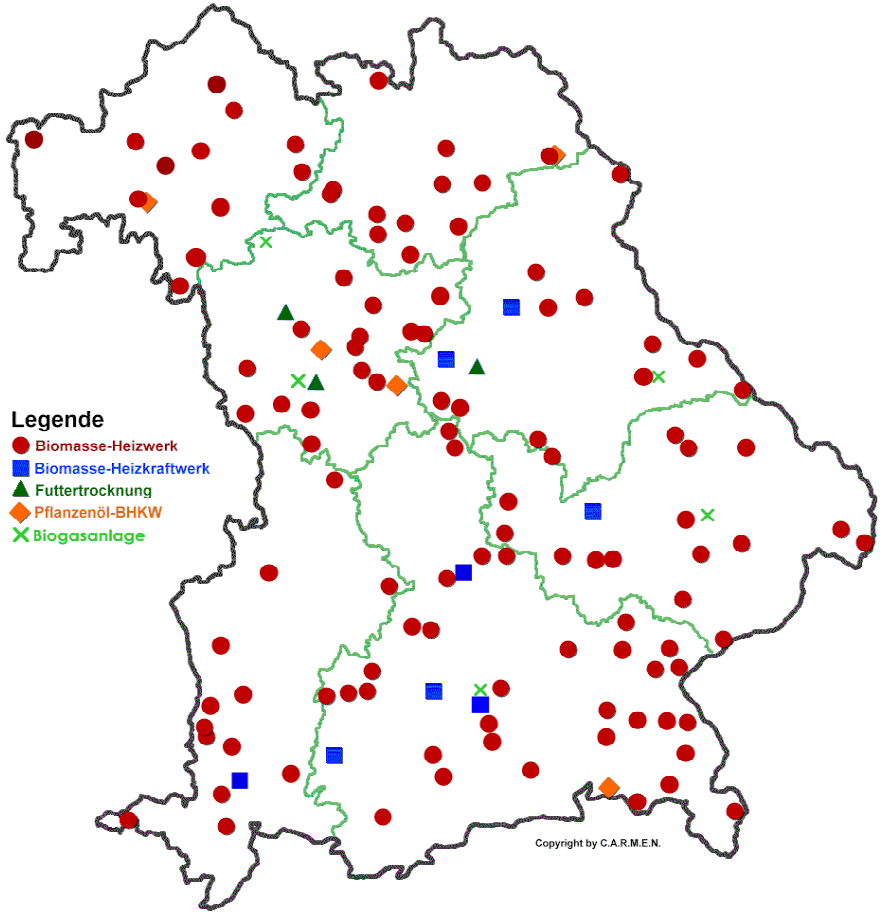
Bioenergy-projects

- 177 heat plants
  200 kW to 10 MW
- 9 wood-CHPs
  40 kW_{el} to 13 MW_{el}
- 7 vegetable oil-CHPs
  16 kW_{el} to 190 kW_{el}
- 5 biogas-CHPs
  15 kW_{el} to 225 kW_{el}
- 2.994 small wood boilers



Solid biofuels

(Split-)Logs

Wood-chips

Wood-pellets

Prices

Residues

- forestry residues: 20 €/MWh
- straw: 15 €/MWh
- industrial wood residues: 12 €/MWh
- material from LSC: < 8 €/MWh

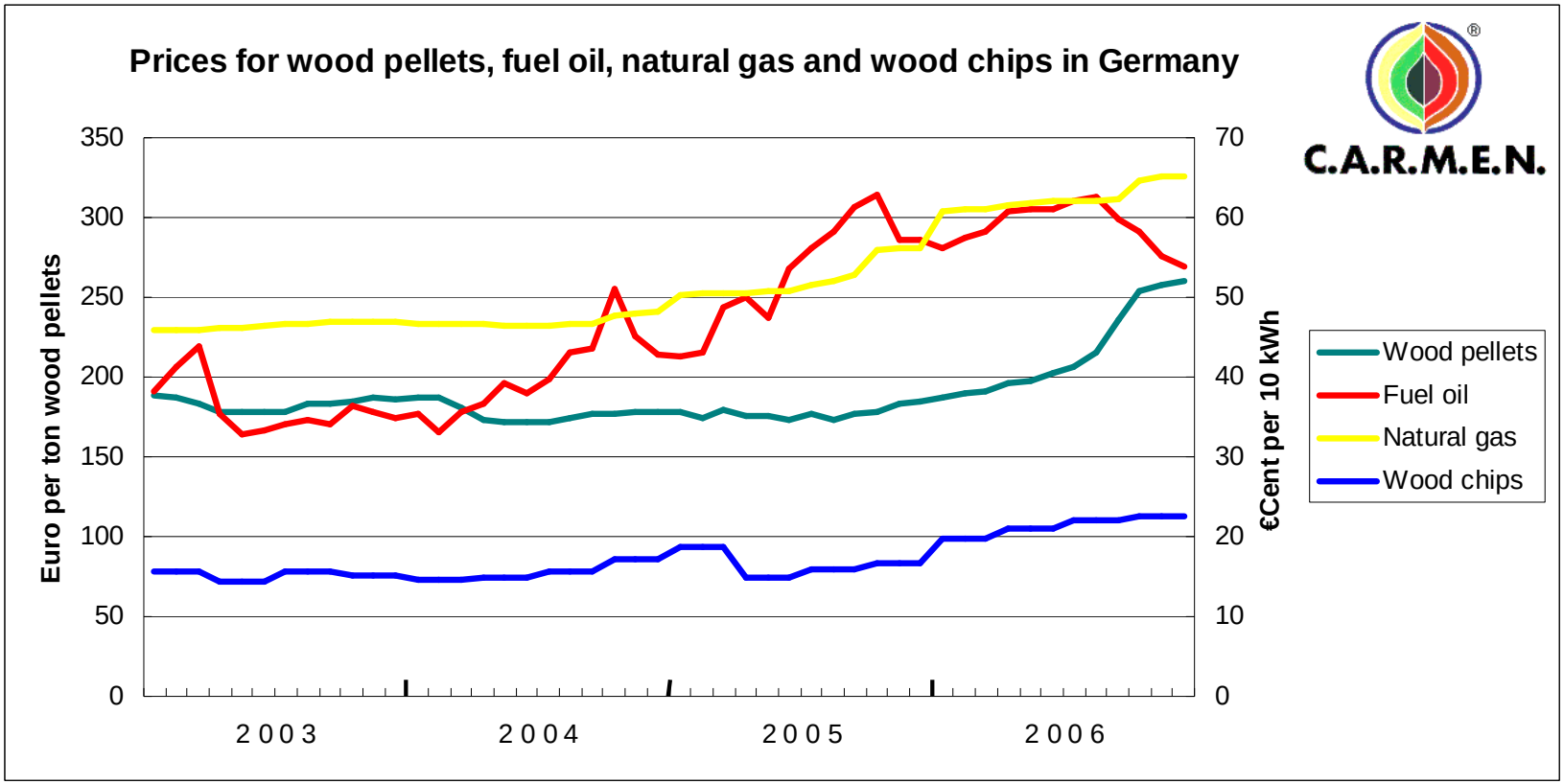
Energy plants

- short rotation poplar: 30 €/MWh

Wood pellets

- small consumers 45 €/MWh
- middle-size consumers 40 €/MWh
- large-scale consumers 35 €/MWh

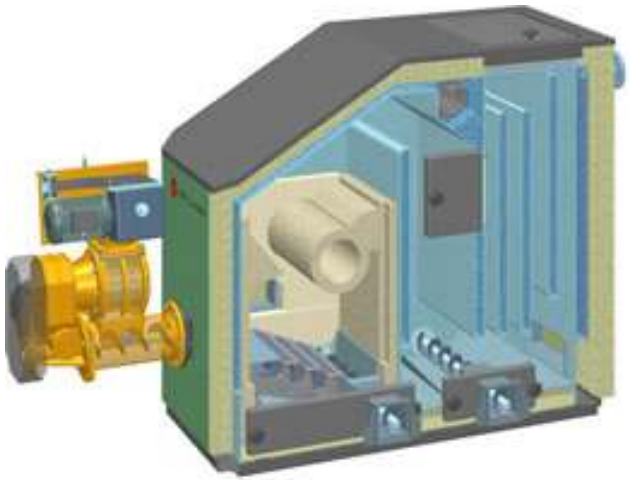
Prices


Prices for wood pellets, fuel oil, natural gas and wood chips in Germany
Euro per ton wood pellets
€Cent per 10 kWh
350
300
250
200
150
100
50
0
70
60
50
40
30
20
10
0
2003
2004
2005
2006
Wood pellets
Fuel oil
Natural gas
Wood chips

Technology

Wood chip boilers

- new developments since the early eighties
- high efficiency and low emissions
- considerable market growth since the early nineties
- main advantage: low fuel price
- main obstacle: high investment



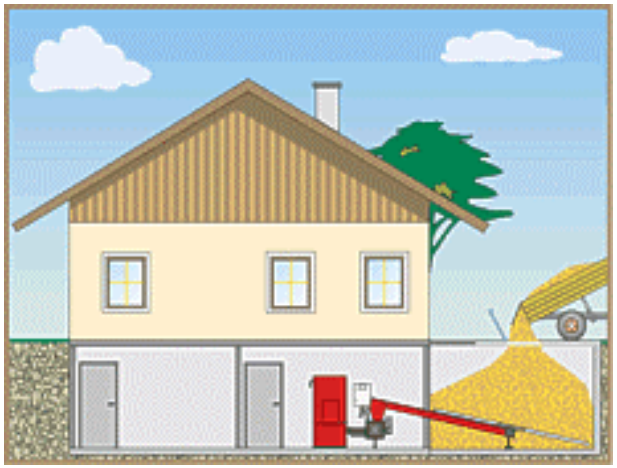
Source: HDG Bavaria

Technology – fuel handling

Crane

Wheel loader

Technology - storage



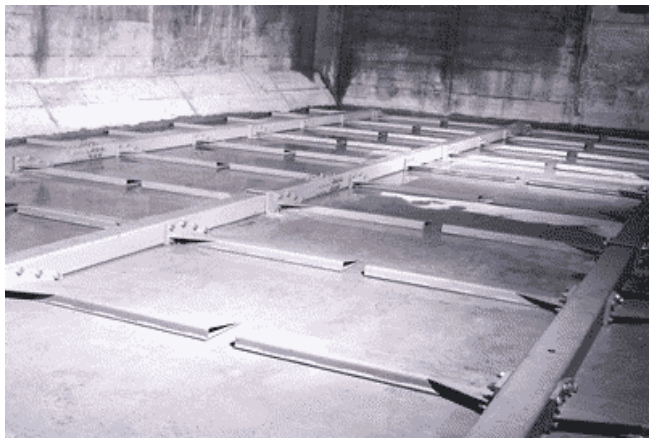
Underground fuel bunker

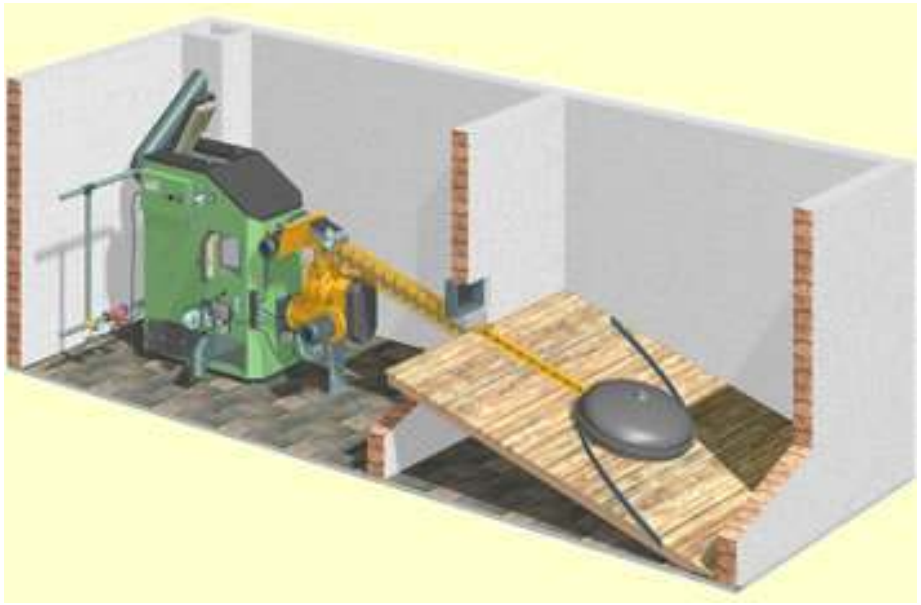
Technology - storage

Container

Source: Schmid AG

Technology - conveyors





Source: HDG Bavaria, Schmid AG

Economics

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	Unit	Wood chips	Wood pellets	Fuel oil
Investment	€	100.000	80.000	40.000
Grants	€	0	0	0
capitalbound costs (capital costs, maintenance)	€/a	12.296	9.837	4.519
consumptionbound costs (fuel, electricity)	€/a	7.680	11.520	17.550
operating costs (personnel, service)	€/a	1.948	1.588	480
other costs (insurance etc.)	€/a	500	400	200
Total costs per year	€/a	22.424	23.345	22.749
Total costs per MWh	€/MWh	62	65	63

Thermal output 200 kW; op. hours (full load) 1.500; energy demand 300 MWh/a; calc. Interest rate 4%; wood chips 65 €/t; wood pellets 150 €/t; fuel oil 0,50 €/l

Economics

Experiences (medium scale)

- manifold planning mistakes (e.g. size of building/storage, expected heat demand/heat losses)
- difficult customers: low heat demand, long term realisation
- need of quality control → quality management "QM Chauffages au bois" developed in D, A and CH

  → see Annex

Recommendations (medium scale)

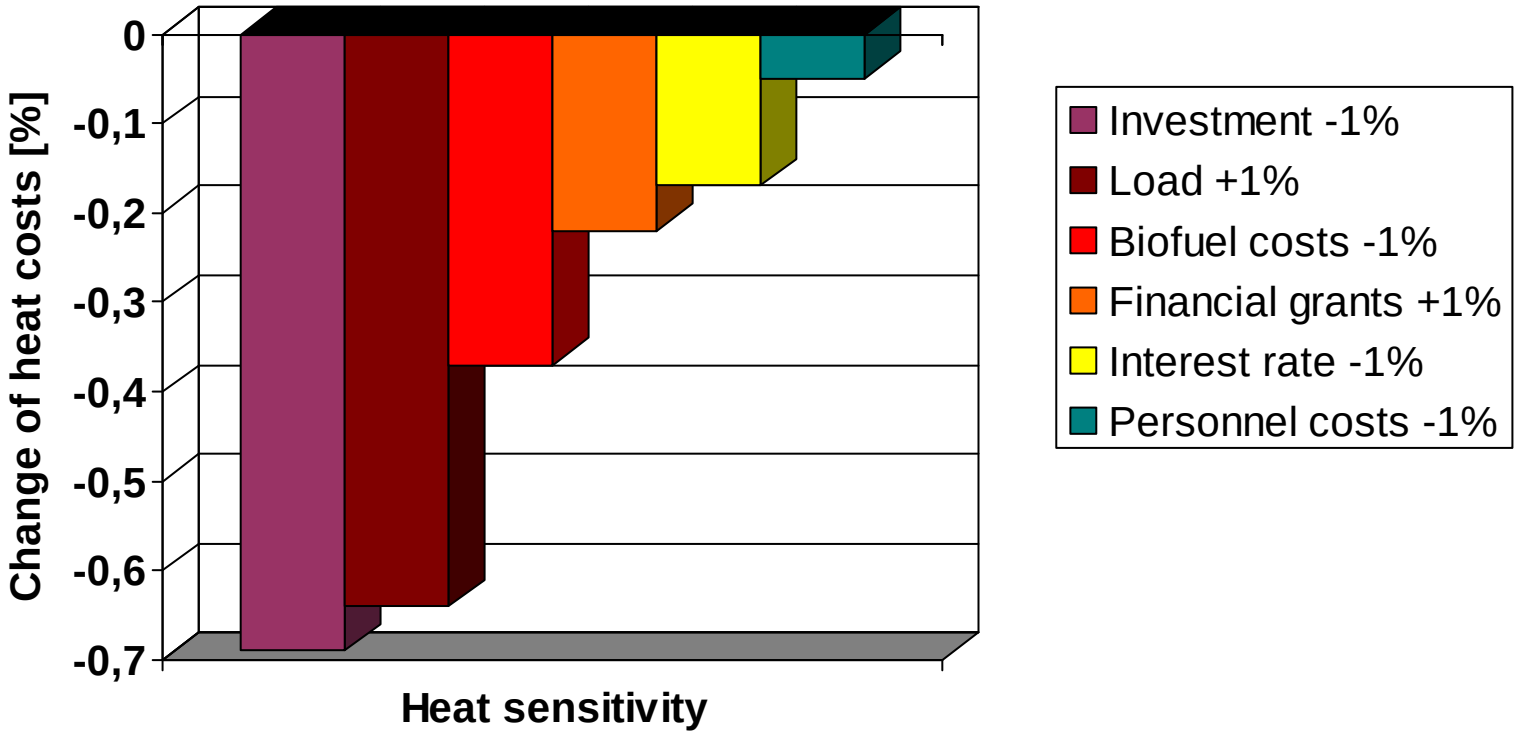
- at least 2.500 h full load for the biomass boiler
- more than 80 % heat production from biomass
- specific investment below 7,5 times the heat price
- minimal proportion of heat demand to pipe length: 1,5 MWh/m/a

Economics

Sensitivity analysis

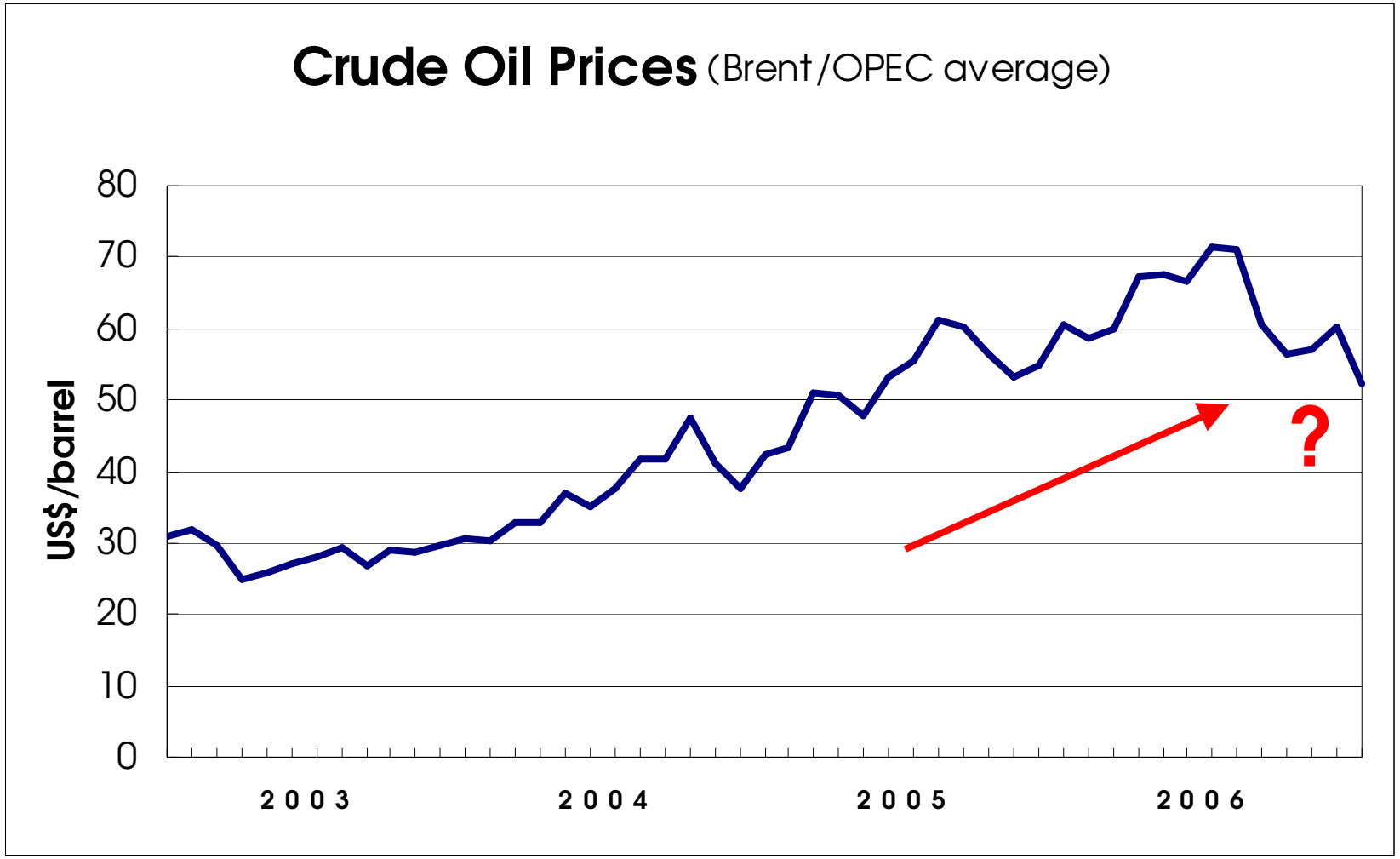
Change of heat costs in dependence of different parameters

Example: Heat plant, 5 MW, 1,4 MW BM, 7.100 MWh heat production, 96 % biofuel, 4 % fuel oil, 1,96 Mio. € Invest

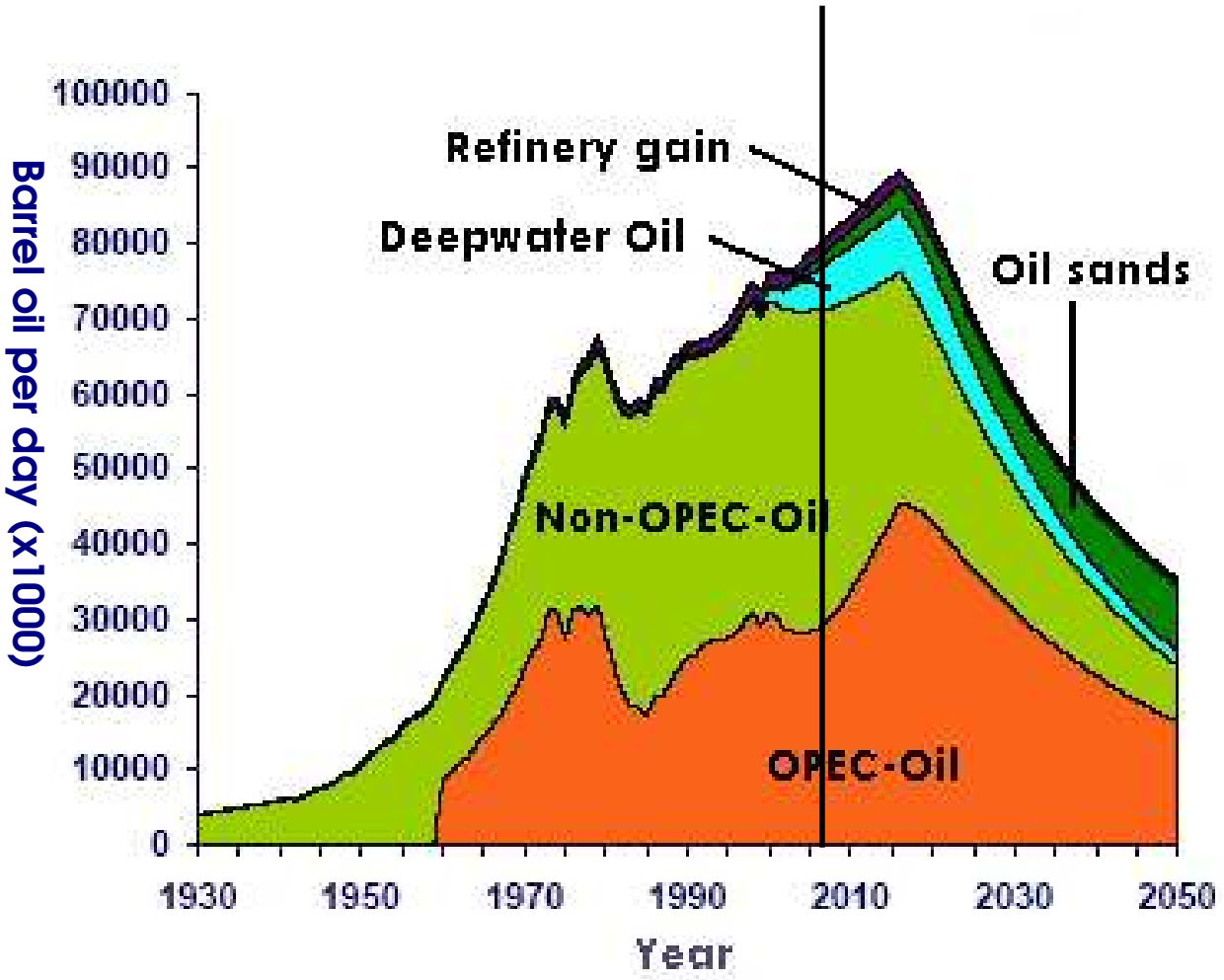


Economics

Development ?



Development ?



Source: Douglas-Westwood Ltd.

Join Wood-Energy Now!

Thanks for your attention!

Any questions?

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Annex: QM Development

Experiences in Austria, Germany and Switzerland

- significant differences between planning and actual state of WHP
- insufficient quality of several wood heating plants
- weak points in the sectors
  - calculation of energy demand
  - design of heat generation
  - selection of biomass fuels
  - economics
  - documentation and optimisation

Resulting actions

- QS Holzheizung in Switzerland from 2000 to 2003 (connected to a financial grant scheme)
- Revision and optimisation with experts from Austria, Germany and Switzerland in 2004

→ QM Chauffages au bois®

Annex: QM Workflow and methods

Workflow

- quality planning at the outset of the project (i.a. target values for heat losses, DHD and specific investment)
- quality checkup and quality guidance during the project development (three times until system start)
- quality examination after realisation of the project

Methods

- checklists for every milestone
- written assessment and recommendations for improvement by the Q-Manager at MS 2 to 5
- acceptance has to be signed by the awarding authority and the supervising engineer

Annex: QM Tools and prices

Supporting tools

- QM-guideline
- planning hand book
- standard solutions for the set-up of the heat plant
- standard tender for wood boiler systems

Prices in Germany

scaled by the total heat demand of the customers

- up to 1.000 MWh 3.000 €
- > 1.000 MWh up to 3.000 MWh 6.500 €
- > 3.000 MWh 10.000 €

Annex: QM Experiences

Link-up with financial grant scheme in Bavaria

- MS 1 and 2 necessary for application
- payments connected with MS 3 and 4
- start of the scheme in August 2004

QM-Projects

- 47 wood heating plants in Bavaria up to MS 5
- yearly heat demand between 520 and 7.390 MWh (in the average 2.450 MWh)
- grid-length between 20 and 2.300 meter (in the average 460 meter)
- predominantly supply of public buildings

Annex: QM Experiences

Detected and corrected deficiencies

- rough calculation of heat demand resulting in excessive values
- deficient fuel definition and no coordination with firing unit
- oversized wood-boiler in two-fuel-plants
- oversized wood storage
- undersized temperature spread (flow/return) resulting in oversized pipe diameters

Acceptance

- awarding authority: in the start: fear of more duties, higher planning costs and delay
  during the project development: positive ratings
- planning authority: very different; often better from inexperienced planners due to the offered help
- publicity: good due to reduced fears of faulty appliances (emissions!) and to efficient use of public funds

Annex: QM Conclusion

Results of QM

- prompt control and information about differences between nominal and actual value
- planning process meets always the state of the art (partly through standards)
- high quality in economics, technology and emissions by using the experiences from more than 1.000 wood heating plants in Central Europe