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RHC Renewable
Heating & Cooling

European Technology Platform

Small-scale Biomass Heating in an Urban Environment

Workshop on Smart Cities:
Integrating Renewable Heating & Cooling

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Brussels, 9 February 2011

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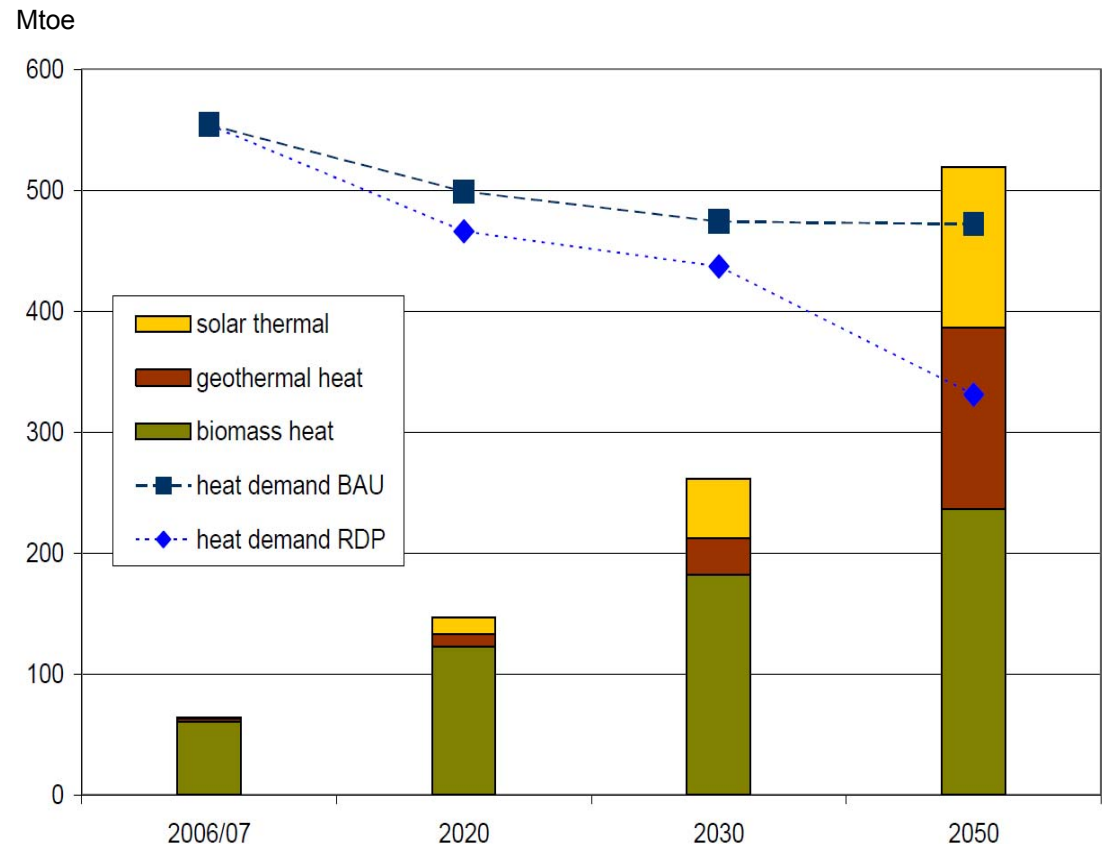
Content

- Framework Conditions
 - Renewable heat
 - Small scale biomass heating
- Role of small scale biomass heating in urban environments
- Special requirements
- Biomass solutions
- R&D needs
- Conclusions



Framework conditions – Renewable heat

- **Bioenergy** – most relevant renewable energy source
- **Bioheat** – most relevant application of bioenergy
- **Residential heating** – most relevant bioheat application
- **Residential heating** – biggest absolute potential to contribute to 20/20/20 goals



Source: Sanner, Burkhard; Bilbao 2010



Framework conditions – Small scale biomass heating

- Biomass for household energy $\sim 200 \text{ Mm}^3 = 35 \text{ Mtoe}$ (excl. DH)
 - Target for 2020: $> 400 \text{ Mm}^3 = 70 \text{ Mtoe}$
 - 86% of household energy consumption used for heat
 - Biomass covers 97% of renewable heat market
- Market: small scale combustion systems:

Appliance	Stock	Sales
Fireplaces	30 Mio.	1.7 Mio.
Stoves	25 Mio.	1.3 Mio.
Cookers	7.5 Mio.	0.5 Mio.
Boilers	8 Mio.	0.3 Mio.

Sources: *European Biomass Statistics, AEBIOM 2010, Reference year: 2007*
Working Paper, Bio Intelligence Service, 2009

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Roles of small-scale biomass heating in urban environments

- Central heating system for single dwellings
 - If no district heating is available
 - Replacement of fossil fuel heating systems
 - New buildings
- Object heating system
 - Central heating system for residential and office buildings
- Additional heating / Well-being / Aesthetic aspects (“lifestyle”)
- Decentralised electricity production (Micro-CHP)



Special heating system requirements in urban environments

- Ultra-low emissions (air quality issues, e.g. PM)
- Compact units (limited space)
- Low heat output (energy standard of buildings, EPBD)
- User convenience
 - Automatic operation
 - Fuel availability (“home delivery service”)
- Well-being effects (flame optics, radiation heat)
- High operating reliability (if used as main heating system)



Small scale biomass heating solutions on the market or under development...

■ Compact central heating solutions:

„PelletUnit“ (7-15 kW)
in modern leather design



www.eta.co.at

„Therm“ (2-7 kW)
for wall mounting



www.guntamatic.com

Innovative solutions for logwood stoves

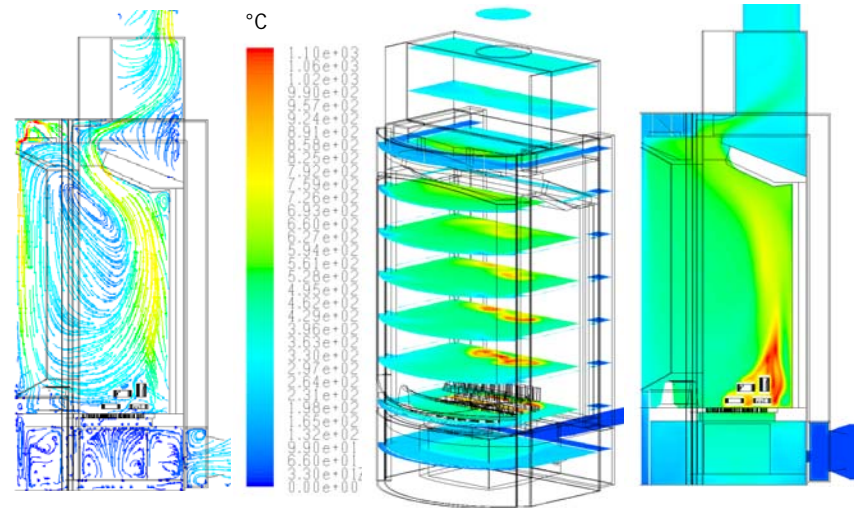
- Simulation based design (CFD)
- Automatic airflow control system
- Automatic briquette stove
- Integration of secondary technologies

www.rika.at



www.hapero.com

Source:
Bioenergy2020+
Austroflamm



www.hark.de

www.dr-pley.com



www.spartherm.com

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Ultra-low emissions / Low heat output

Calimax Twist (1.8 – 6 kW)

www.calimax.com

Pellet boiler for the living room

Water/Room : 80/20

Emissions:

CO: 3mg/MJ

PM: 7mg/MJ

HC: 1mg/MJ

Efficiency:

$\eta = 95\%$



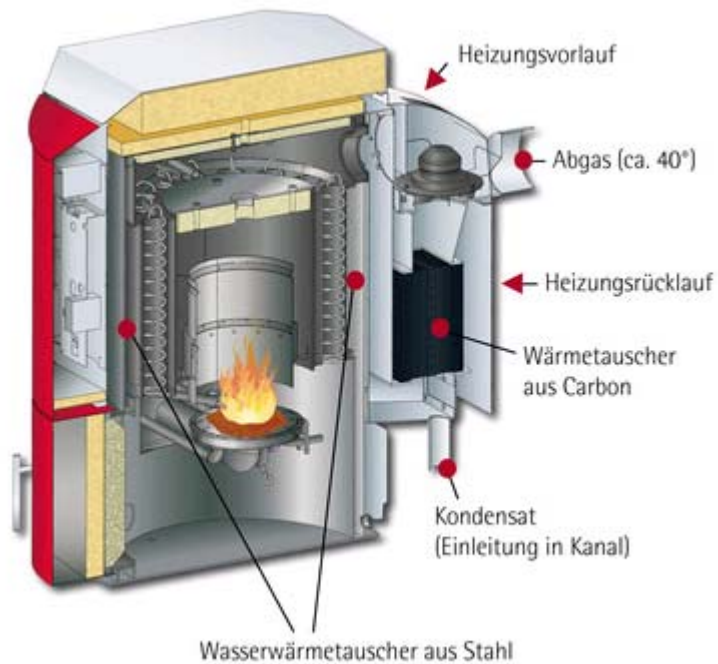
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Ultra high efficiency

- Condensing pellet boiler
- Efficiency > 100%

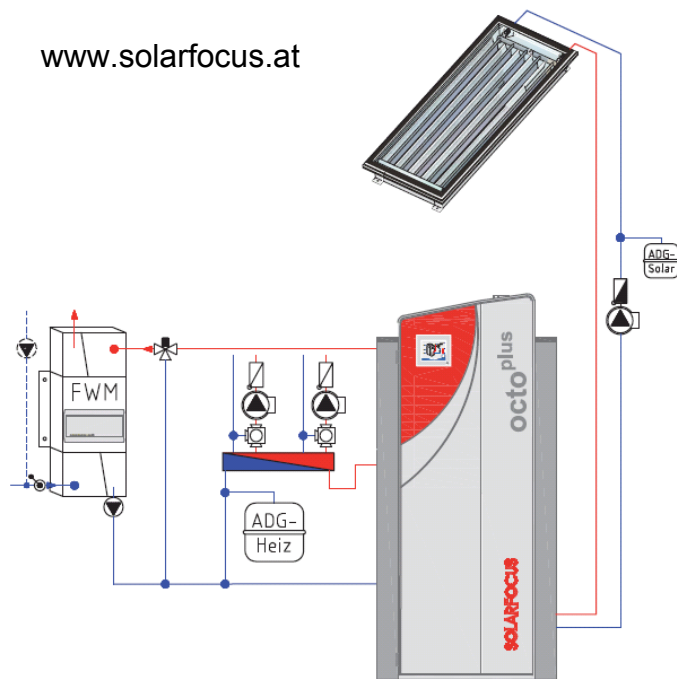
www.pelletsheizung.at



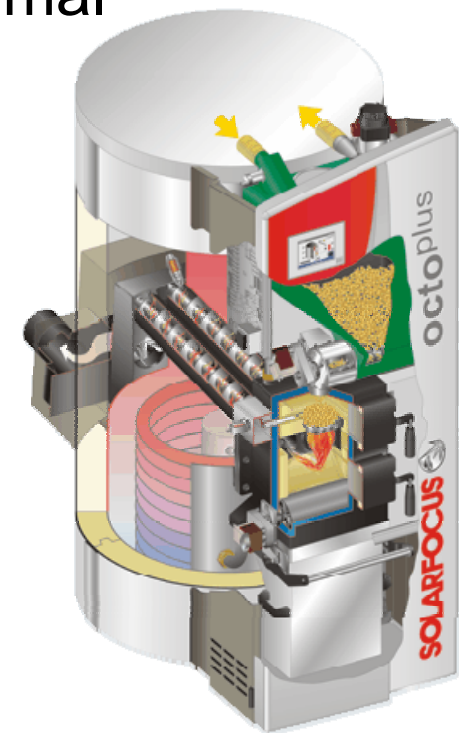
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Compact integrated solutions

- Pellets boiler + Thermal storage combination
- Optimised for combination with solar thermal



www.pelletsheizung.at



www.solarfocus.at

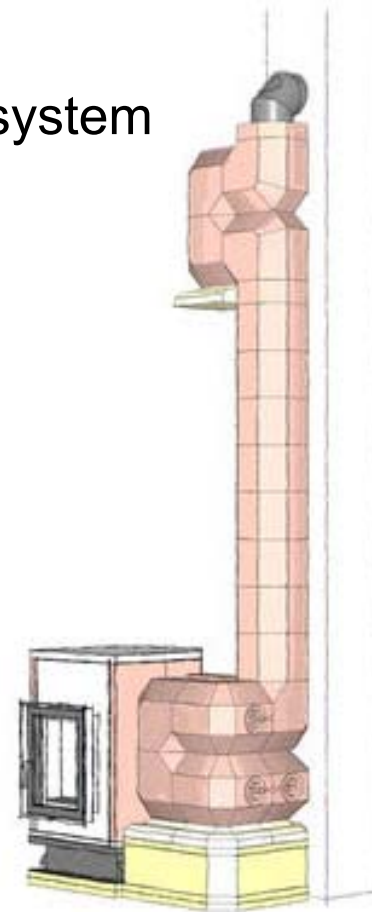
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Low heat output / well being / radiation heat

- Ceramic inserts
- Modular ceramic heat storage system
- Tile casing (hypocaust)
- Heat output: 2 – 6 kW (8-12h)



www.ortner-cc.at



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Aesthetic aspects (lifestyle) / well being

Modular tile stove system as

- main heating
- additional heating
- design element

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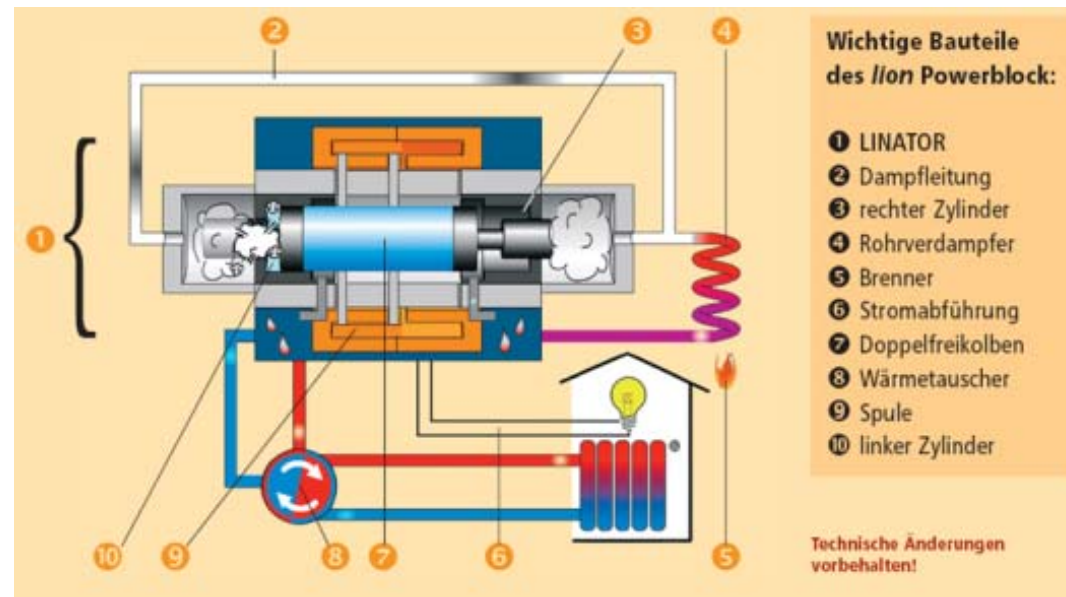


Micro-CHP: Steam Piston Engine (Demonstrator)



Source: Button Energy

Generator:	Steam piston engine with integrated linear-generator
Fuel:	Woodpellets
Heat / Electric power	5-16 kW / 0.3-2kW
Electric Efficiency:	11 %
Total Efficiency:	> 90 %





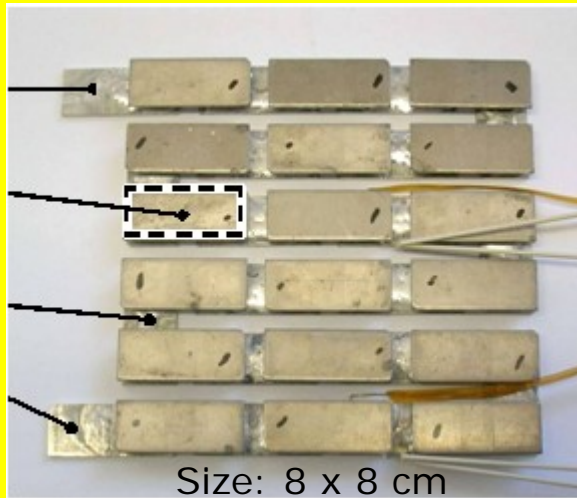
Micro-CHP: Thermoelectrics (Prototype)

Pellet stove/boiler equipped with TEG

Heat output: 10 kW

Nominal electric power: 200 - 400 W

Thermoelectric Module



Thermogenerator



Micro-CHP Prototype





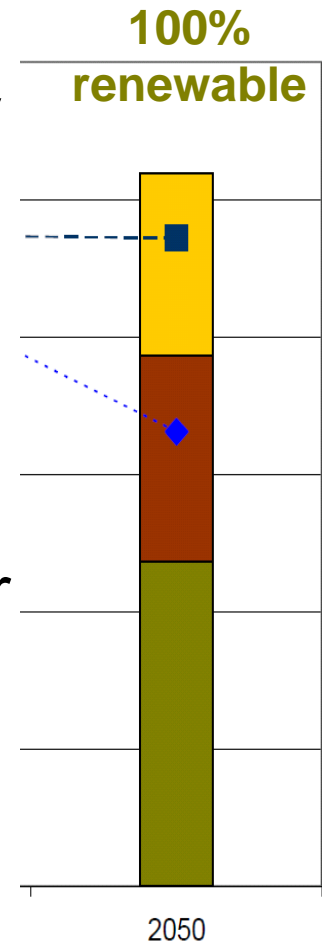
Research and development needs...

- Increase **annual efficiency** of heating systems >85-90%
- **Zero-emission** technology (i.p. logwood)
 - Supported by standards and legislation (e.g. Ecodesign Directive: Emission thresholds and Eco-Labeling of EUP)
- **Lowest load** systems (part load < 1 kW)
- **Combination** of all HVAC technologies in one system
- **Micro-CHP** technology
 - Technology development / Increase of reliability
- New **thermal storage** solutions (e.g. PCM)



Conclusions

- Small-scale biomass heating is the leading technology for achieving Europe's 2020 Energy goals
- Several applications in urban environments
 - Main heating system
 - Additional heating / Well-being
 - Decentralised electricity production
- Innovative solutions already enter the market or are under development
- **Further R&D and supporting legal and funding framework are necessary to make renewable industries' vision become reality!**





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Thank you for your attention!



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