



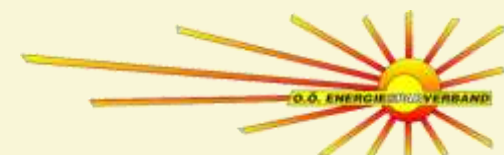
Clean heating, green jobs

Heating with biomass in Upper Austria

Christiane Egger

O.Ö. Energiesparverband
christiane.egger@esv.or.at

www.esv.or.at, www.oec.at, www.wsed.at



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Learning Objectives

At the end of this program, participants will be able to:

- *Discuss Austria's approach to change use of biomass technology*
- *Be exposed to tools used to revolutionize use of renewable biomass technology*
- *Have a general understanding of Vermont's current biomass landscape*

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The State of Upper Austria Oberösterreich

Capital:	Linz
Population:	1.38 million (similar to NH)
Area:	4.600 mi ² (similar to CT)
Gross inland cons.:	305 PJ; 33 % renewables
Economic activities:	industry, service sector, tourism, 25% of the Austrian industrial exports

Upper Austria
Linz



Energy Agency of the State of Upper Austria O.Ö. Energiesparverband

Organisation

- founded (in 1991) and mostly funded by the state government
- promotes **energy efficiency** and **renewable energy**
- provides **services** to private households, public bodies & businesses
- manages programmes on behalf of the state government
- supports development of legislation and policies



Services

- Energy advice (15,000 sessions/a)
- Building rating (> 93,000 buildings rated since 1993)
- Training programmes
- Management of state funding programmes
- Public awareness campaigns, events, publications
- Pilot projects
- Municipal energy strategies
- European cooperation
- **OEC network**



Renewable energy sources in Upper Austria

- Share of renewable energy: **34 % of total primary energy demand**
(15 % hydro, 15 % clean biomass, 4 % solar & other renewable)
- Share of renewable heating: **46 % of total heating demand**
- Share of renewable electricity: **78 %**
- Avoided CO₂ emissions: **7.4 million** tons per year
- Avoided imports of fossil fuels: **>1 billion US \$** per year

By 2030, all electricity and space heating will come from renewables!

- > reduction of heat demand by 39 %
- > reduction of electricity demand by 1 %/year
- > minus 65 % CO₂ emissions



Motivation for 100 % renewable targets

- **climate protection:**
 - increasing temperatures
 - more natural disasters
- **increasing costs:**
 - social problems ("energy poverty")
 - negative impact on the competitiveness of companies, especially price fluctuations
 - loss of purchasing power
- **import dependency** from geopolitically unstable regions
- **innovation and employment** ("green jobs")
- **economic perspectives for the farming/forestry sector**



Why biomass heating?

- Biomass is a **sustainable** and **carbon-neutral** fuel and especially **suitable for heating** of homes, businesses and public buildings.
 - Modern heating systems are **fully automated** with **ultra-low emissions**
 - The installation of a biomass heating system ensures **energy independence**, supports the local **forest economy** and is environmentally friendly
- The state of Upper Austria has pioneered biomass heating in the last two decades and achieved global leadership in small-scale systems.
- Biomass heating has created 4,500 jobs in the state.

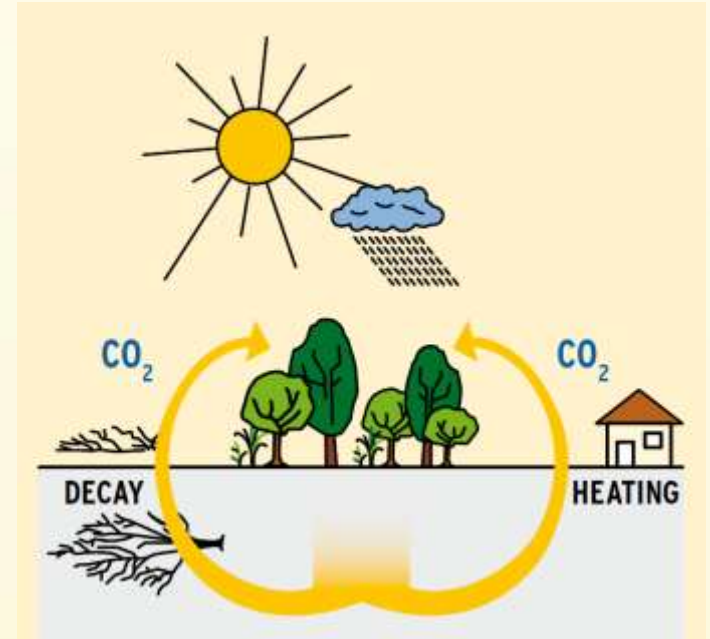


In Upper Austria, the most important ways to heat with biomass are:

- automatic **wood pellet heating systems**, mostly in single-family homes with **bulk delivery**
- automatic **wood chip heating systems** for commercial and public buildings
- low-emissions **firewood boilers**, mainly in rural areas
- biomass **district heating** systems
- large-scale **combined heat and power plants** supplied by biomass

Biomass heating: a "carbon neutral" fuel

- As trees grow, they absorb CO₂ and store it.
- The same quantity of CO₂ is released at the end of the lifetime (either tree decomposes or is burnt)
- In Austria, since more than 100 years, sustainable forestry is practiced.
- From the instate resources, we can more than double current biomass use (sustainably and not using land which is now used food production)





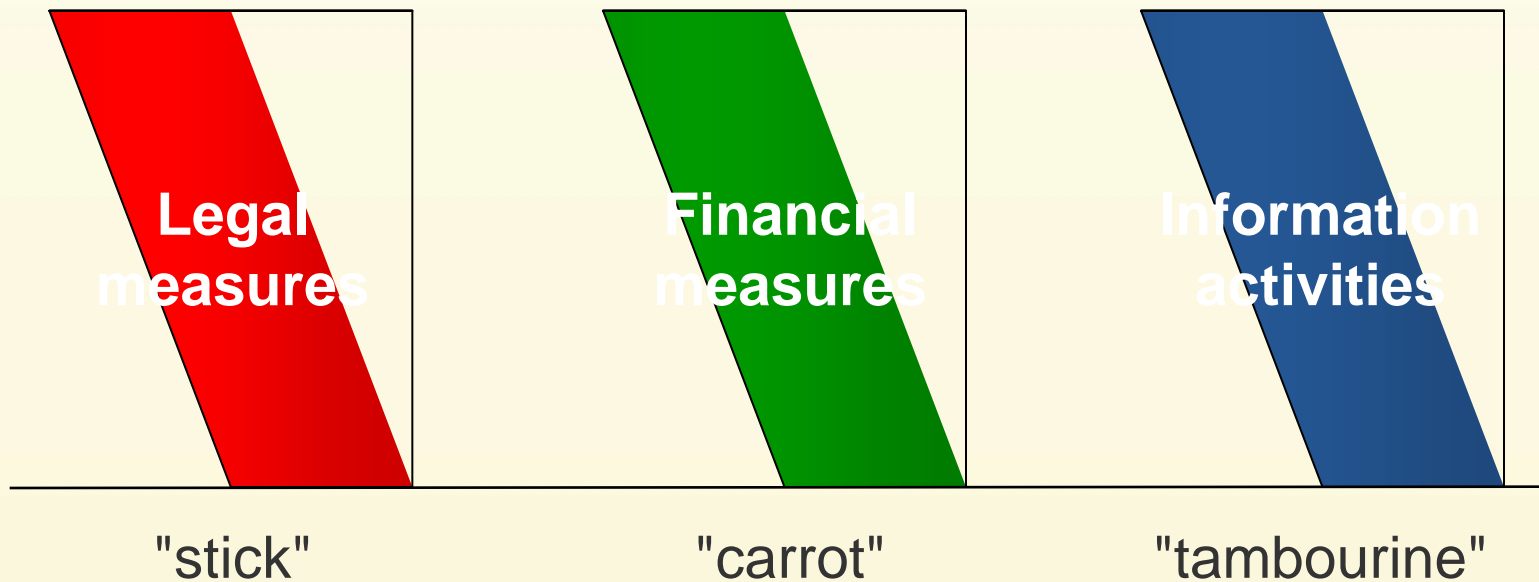
Carrot, stick and tambourine





Upper Austria's sustainable energy strategy

3 Pillars



Upper Austria's sustainable energy strategy – example biomass heating

"stick"

Legal measures

- Emission & efficiency standards
- Fuel requirements
- Renewable heating mandate
- Minimum requirements heating & cooling

"carrot"

Financial measures

- Investment grant programs
- Renewable heating as a program requirement
- Contracting program
- Regional R & D program, pilot projects

"tambourine"

Information & training

- Energy advice
- Training & education programs
- Publications, campaigns & competitions
- Local energy action plans
- Sustainable energy business network

stimulate demand

Policy Packages

support supply



Main policy instruments for biomass heating

- Driving the market through standards
- Renewable heating mandates
- Advice, information and awareness campaigns
- Education & training
- Supporting biomass heating manufacturers



Energy advice programme – Upper Austria

- programmes for private households, public bodies and companies managed by O.Ö. Energiesparverband
- 15,000 individual advice sessions, face-to-face
- supports energy and building-related investment decisions
- free for private households (up to 1.5 hrs.)
and public bodies, companies pay 25 % (150-400 US \$)
- typical issues: new construction of a home, renovation of a school, optimisation of an industrial process etc.



Training programmes across the value chain

Target groups for training:

- producers of equipment and materials
- installers and construction workers
- users of buildings and installations

New professional education:

- University degree "green energy engineers"
- "Green energy installers" (both since 2002)

Trainings offered by the Energy Academy of the
O.Ö. Energiesparverband

- 30 courses/year, 70 training days
- focus on low energy buildings & renewable heating





Heizen mit Pellets

heimisch und
klimafreundlich

www.pelletskampagne.info

Nützen Sie auch die
Förderaktion zum Kesseltausch!



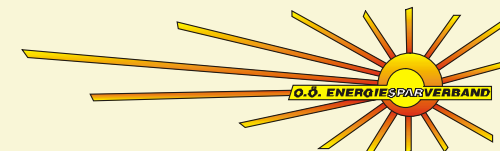


The Oekoenergie-Cluster Upper Austria (OEC)

- network of renewable energy & energy efficiency companies in Upper Austria
- 160 partner companies
- since 2000, managed by O.Oe. Energiesparverband
- www.oec-en.at
- main business fields:
 - biomass heating
 - solar heating
 - energy efficient buildings



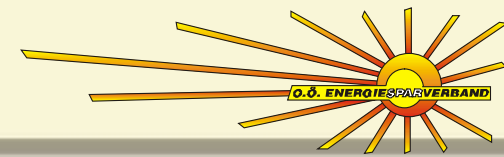
- **Turnover:** 2.3 billion US\$
- **Employees:** 6,260
- **Export share:** > 50 %



Solar thermal, Biomass, Efficient Buildings

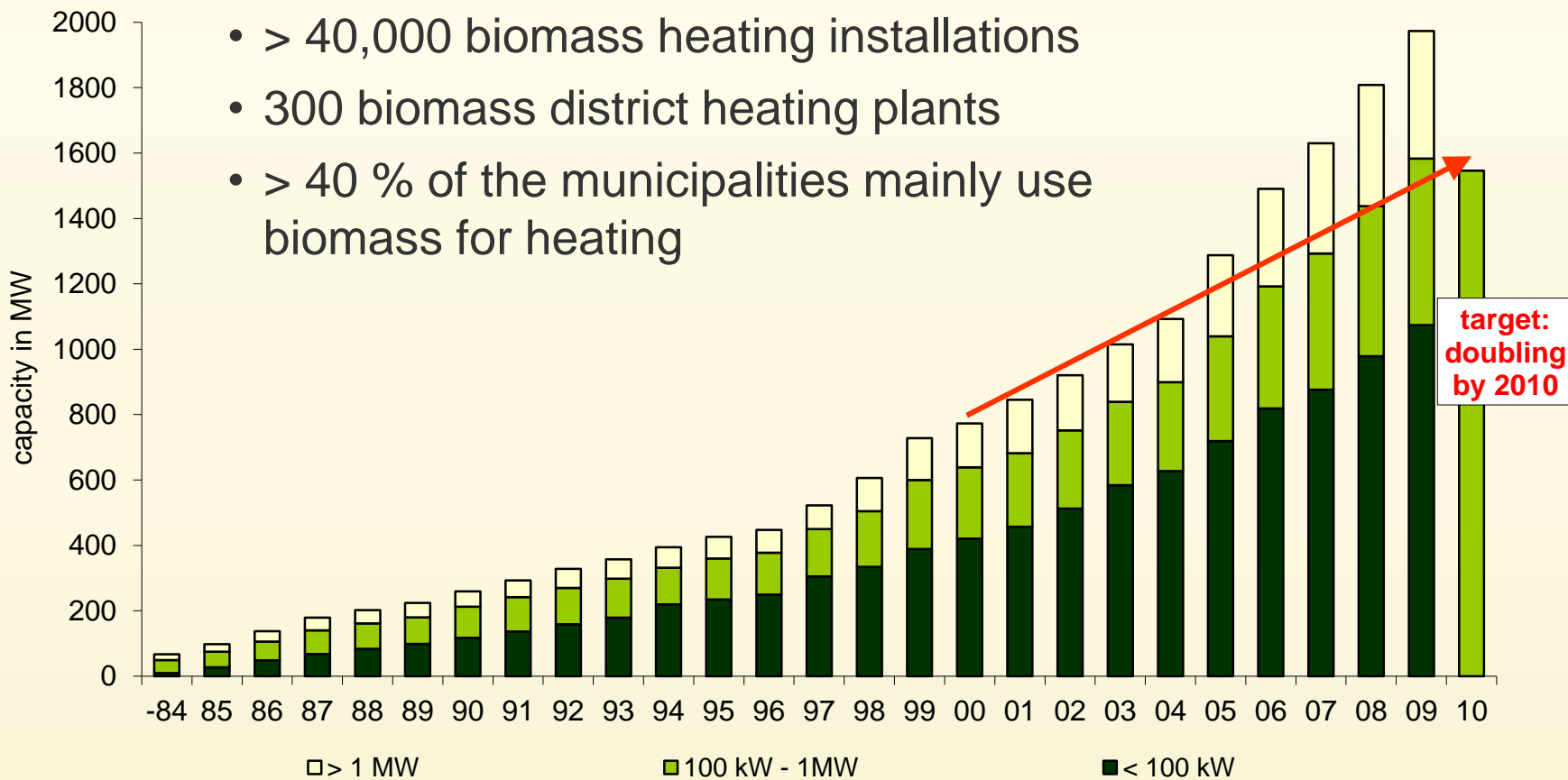


Biomass boiler producers – company headquarters in Upper Austria & OEC partners



Biomass heating in Upper Austria clean, efficient, fully automated

- 15 % of total energy consumption
- > 40,000 biomass heating installations
- 300 biomass district heating plants
- > 40 % of the municipalities mainly use biomass for heating





Employment and investments in biomass heating

Biomass boiler and stove industry in Upper Austria:

- annual revenue (from production, sales, installation): 530 million Euro
- employment (from production, sales, installation): 3,200 jobs

Total employment in biomass heating (including fuel production and distribution): 4,500 jobs

Annual investment in new biomass heating installations:

110 million Euro

Annual sales of biomass heating fuels, incl. CHP plants (2009):

90 million Euro



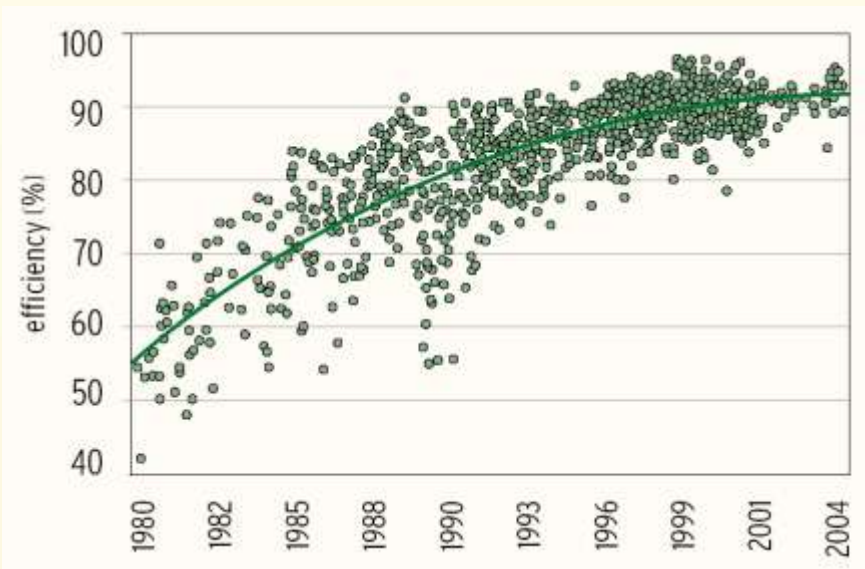
Biomass heating technologies

					
technology	automatic pellet heating	modern firewood boilers	automatic wood chip boilers	district heating with wood chip boilers	combined biomass heat & power stations
fuel	pellets	firewood	wood chips	wood chips	whole trees
					
typical installed capacity	5-15 kW	20-40 kW	50-150 kW	100 kW-3 MW	>1 MW _{el} > 10 MW _{th}
users, customers	single-family homes	farm buildings	public and commercial buildings	domestic, public and commercial buildings	domestic, public and commercial buildings
fuel supply	bulk delivery by a large number of fuel distributors	usually harvested from own forest	often by local farmers – forest owners	partly by the cooperative members, partly from sawmills	farmers & sawmills & other channels

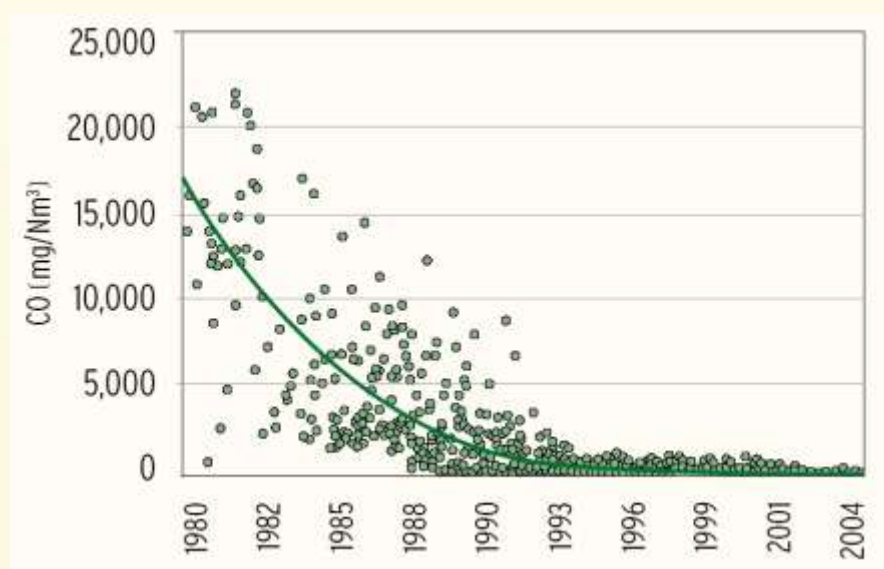


Emissions & efficiency

Results from more than 1000 boiler tests



Efficiency factor of tested biomass boilers



CO emissions of tested biomass boilers



Main elements of biomass central heating

Fuel

- standardization
- supply chain
- storage
- selection

Boiler

- sizing
- burner type
- efficiency & comfort
- fire safety

Ash

- amount
- removal

Emissions

- regulations

Distribution system

- from boiler to discharge system

Discharge system

- radiators
- floor/wall heating

Chimney

Accumulator tank



Features of modern biomass boilers

- convenient, fully automatic operation: automatic ignition and shutdown, fuel supply, ash removal, heat exchanger cleaning)
- low maintenance
- high fuel efficiency (80-90%)
- ultra-low emissions
- very high operation and fire safety standards
- high efficiency at part time operation (modulating operation)
- modern control devices (remote control)
- low fuel costs
- accumulator (storage tank), combination with solar thermal system



Biomass fuels





pellets



wood chips

Typical pellet / wood chips heating solutions

Characteristics	Pellet 	Wood chips 
building type	residential home	school building
capacity	5-15 kW	150 kW
system location	basement	basement
characteristic	fully automatic central heating system hydronic (water-based heat distribution)	
fuel delivery	bulk delivery by pressurized truck once/year	delivery by local farmers, 3-4 times/year
fuel demand	3-6 tons/year	50 tons/year
storage capacity	~ 50 ft ² ; min. annual pellet demand	40 x 40 ft ²
fuel supply	automatic pellet feed from storage to boiler	automatic wood chip supply from storage to boiler
ash removal	2-4 times/a	every 2 weeks

The supply chain

Pellets

saw mill



pellet pressing



delivery in bulk by
pressurised tank truck



transferred into storage
by filler pipe

Wood chips

forest



chipping



tractor trailer, truck

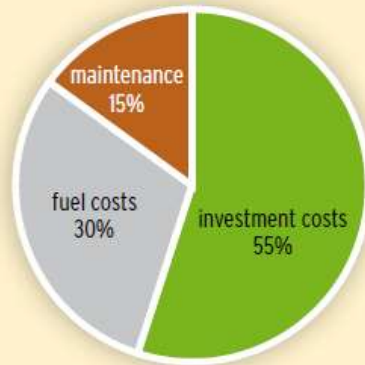


fed into storage by pipe or
poured off



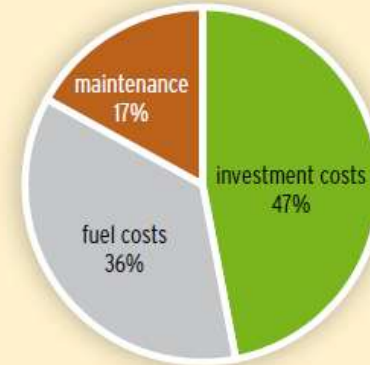
Life cycle cost split

Pellet home heating system



- **investment costs:**
15-20,000 US\$
- **fuel costs:**
800 US\$/a, 35 US\$ delivery fee
- **maintenance costs:**
350 - 500 US\$/a

Wood chip heating system (150 kW)



- **investment costs:**
60,000–75,000 US\$
- **fuel costs:**
4,400 US\$/a (local farmers)
- **maintenance costs:**
2,000 US\$/a

calculated for 20 years, 6% annual financing costs,
excluding investment grant



Wood pellet heating

- CO₂ neutral, standardised fuel
- very clean combustion due to two-stage combustion
- local fuel (Austria is a net exporter of wood & wood pellets)
- produced from a waste product (saw dust), in the future also directly from wood chips
- very user friendly:
 - bulk delivery
 - automatic operation
 - ash cleaning 3-4 times/year
 - comparatively low fuel costs
 - good combination with solar thermal & buffer storage

Home owners like it!





Pellet quality and standards

- Austrian pellet fuel standard since 1998 (ÖNORM M 7135) - a main reason for Austria's pioneering role!
- highly standardised fuel allows for high efficiency and low emission
- combustion technologies were developed based on and optimised for the standardised fuel
- warranty of the boilers only if standardised pellets are used
- European pellet fuel standard in the process of adoption

- Pellet fuel standards (EN 14961-2) sets technical fuel requirements, e.g.:
 - diameter: 6-8 mm/0.24-0.31 inch
 - calorific value: > 16.5 MJ/kg/72 MJ/lb, ash content: < 0.7 %
- standards for transport, storage, transport vehicles, training of staff

Wood pellet heating system feeding systems

transport auger



vacuum suction system



Wood pellet heating system feeding systems

transport auger



vacuum suction system



Wood pellet heating system container solution





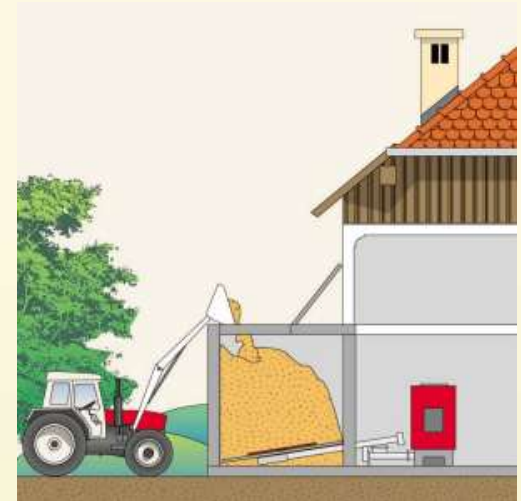
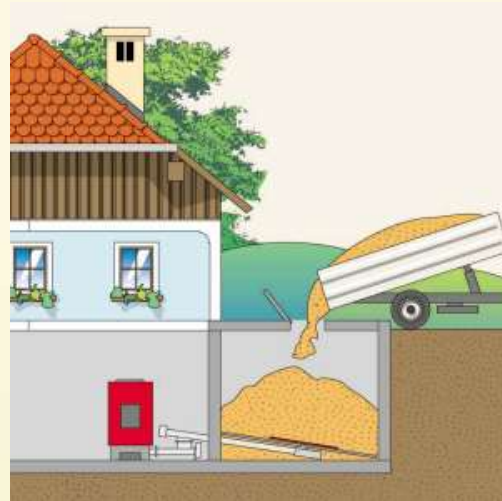
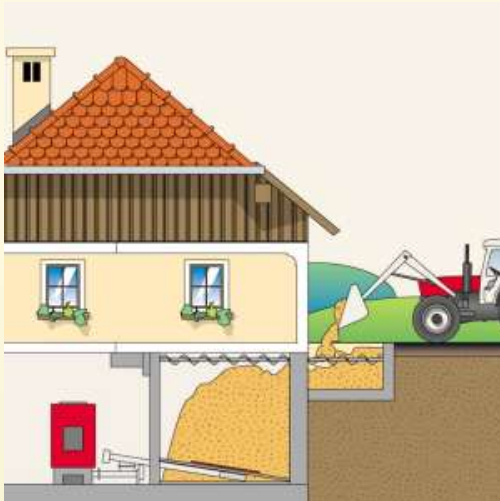
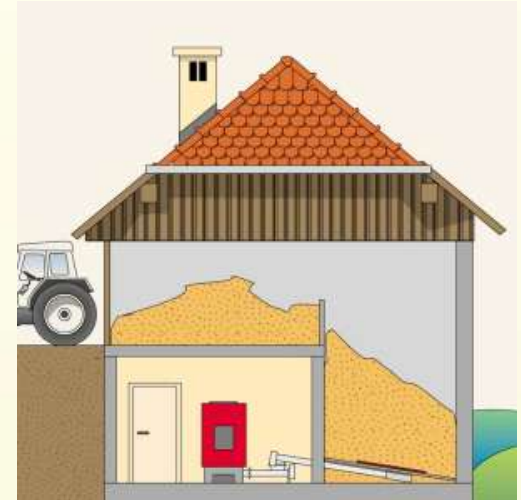
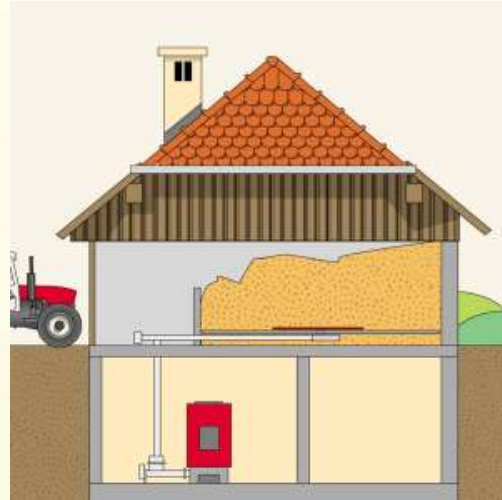
Wood chips quality and standards

- due its wide variety of sources, wood chip quality can vary widely
- important quality characteristics are bulk density (weight), size and moisture content
- moisture content classes W20 – W50:
< 20% (air-dried) – 40 (50)% (harvest-fresh)



Requirements for wood chips (Austrian standard ONORM M 7133)

heating value	4 kWh/kg for 25% water content
density	200–250 kg/m ³
moisture content	15–35%
size	G30 (size < 3 cm/1.2 inches) G50 (size < 5 cm/2 inches)

Wood chips – storage possibilities



Fuel selection - pellets or wood chips?

Criteria	Wood pellets? 	Wood chips? 
installed capacity	typically smaller heating systems (< 100 kW)	typically larger heating systems (> 100 kW)
space requirement	limited storage capacity	ample storage capacity
fuel delivery	frequent delivery is a sensitive issue (residential area, etc.)	frequent fuel delivery is not a problem
staff	no staff for operations and maintenance	staff for operations and maintenance
fuel	stable quality needed	different levels of quality acceptable
fuel supply	commercial fuel suppliers	option to "buy local" - availability of local fuel suppliers, local economic benefit from using wood chips
fuel costs	can be an attractive option if long-term supply contracts with favorable conditions can be negotiated	in general, cheaper than pellets

Recent product and technology innovation

Recent product innovations by partners of the OEC:

- pellet condensing boiler
- innovative pellet and firewood stoves
- very small-scale boilers for low energy buildings (from 2 kW)
- heating container solutions
- agro boilers meeting stringent efficiency standards

Financial support program:

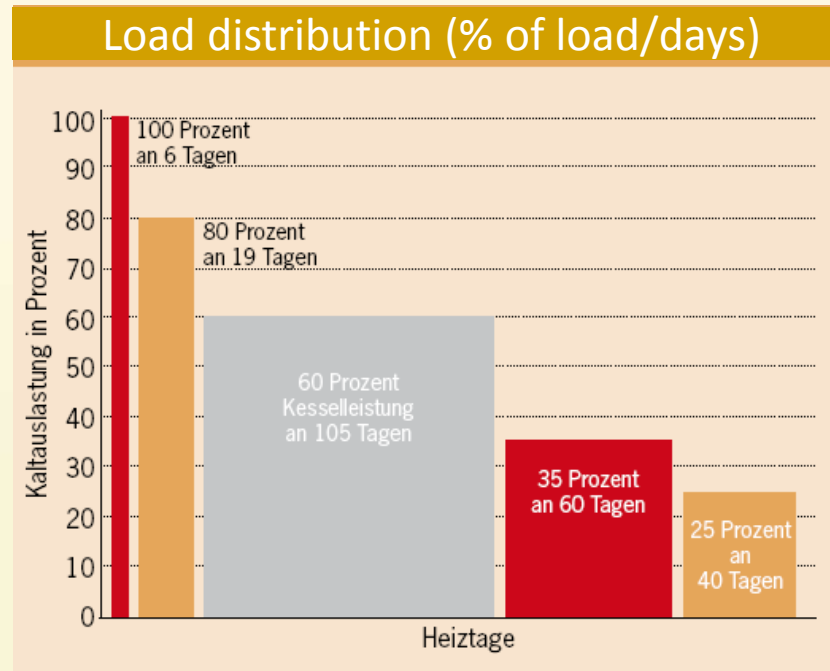
- state R&D program in Upper Austria (ETP), supports innovative projects
- so far 29 biomass R&D projects with over 1.8 million Euro supported



Accumulator tank (Heat storage)

Why & when?

- recommended for wood chip and pellet boilers required for firewood boilers
- great capacity fluctuations (part load operation)
- integration of different systems (esp. hot water production in summer)
- allow the boiler to operate at nominal load and to avoid frequent ignition and shut-down



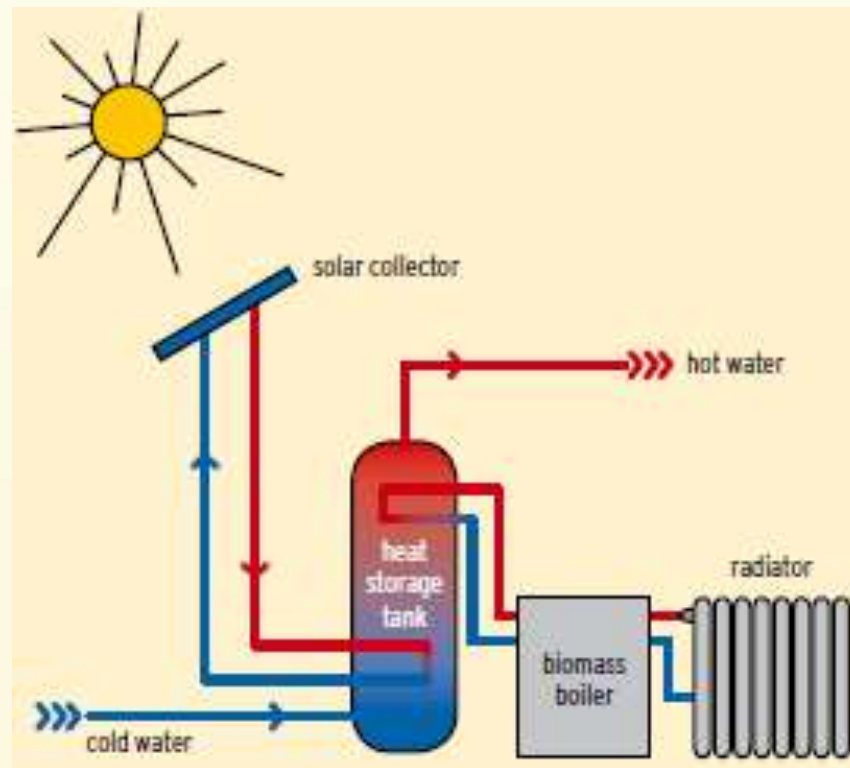


Multi-boiler cascade system

- consist of two or more (biomass) boilers
- when heating is required, one boiler will start up and operate at its most efficient level. When additional capacity is needed, additional boilers are brought online until all boilers in the cascade system are operating
- boilers work most efficiently at nominal power, the system always operates in its most efficient mode
- often not cost-effective to size the boiler for peak demand (larger buildings)
- offer increased operational safety
- can accommodate building extensions more cost-effectively
- existing fossil-fuel boilers can be included (back-up or peak demand)



Accumulator tank (Heat storage)

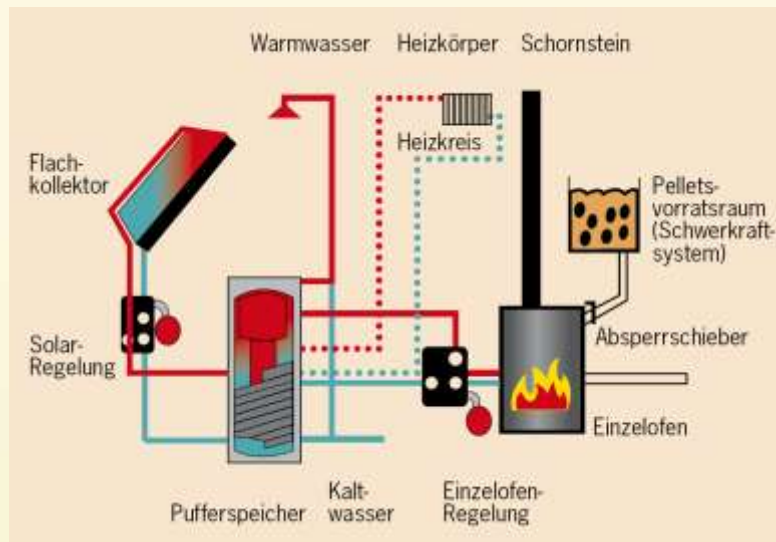


- The sizing of the tank is influenced by factors such as:
- the nominal capacity
 - the size of the boiler
 - the type of fuel used
 - the space available

Integration of solar thermal

Why & how?

- biomass boiler can be shut down in summer months (saves fuel, less part time operation, longer lifetime of the heating system)
- ideally the integration is taken into account when planning the system
- low temperature operation of the solar thermal collector (little temperature difference between outside air and collector temperature)





Success factors for biomass heating programs and action plans I

- "policy packages" (mix of regulatory, financial & training/awareness programmes)
- clearly defined quantitative targets
- communicating the benefits (not "just" climate protection)
- public acceptance only if forest management is sustainable
- fuel standardization & functioning fuel supply chains
- high efficiency equipment – low emissions & user convenience levels similar to oil & gas



Success factors for biomass heating programs and action plans II

- identify most promising markets (often new construction)
- demonstration programs & local biomass information campaigns & training - allow for a learning curve across the value chain
- market intelligence: understand progress & communicate success & take corrective action
- take a longer term perspective



Overcoming the chicken or the egg problem

Building up a local market for automatic pellet heating

The pellet supply chain

- pellets meeting strict fuel quality standards (production & handling)
- distributors for bulk delivery (fully-pressurized trucks & skills to handle pellets)

The equipment

- well-functioning pellet boilers, stringent emission standards
- high consumer convenience
- if not: pellet boiler are likely to remain a niche market
- technicians trained to install and service the equipment



The customers

- individual homes & larger buildings (to avoid overly-long payback for bulk delivery systems)

Information and awareness for market actors and stakeholders

- a new approach to heating needs information, awareness & training
- for potential pellet producers & distributors, heating companies, installers, public administration & permitting agencies & potential customers

Report
available at

www.oec-en.at



Biomass heating in Upper Austria Green energy, green jobs



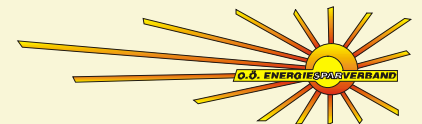
European Pellet Conference 2011

www.wsed.at

March 2 and 3, 2011

Wels / Austria

- Innovation & Technologies
- Products & Services
- Country reports
- Technical site-visits
- Energiesparmesse - trade show
(1,600 exhibitors, 100,000 visitors)





International Training Seminar

Biomass Heating Market development and technologies

Linz/Austria,
17 – 19 May 2011



The end of the oil-era?

