WP 4 Energy Supply

Part-financed by the European Union
(European Regional Development Fund
and European Neighbourhood and
Partnership Instrument)

Energy Efficient and Integrated
Urban Development Action

URB Energy

Energy efficiency in energy supply infrastructure - the ALFA project

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BEWOG – Belziger Wohnungsgesellschaft mbH /
Belzig Housing Association

Wed 16 Sep 2009 – WP4 Workshop Jelgava

Background information from State of Brandenburg

Background information from the city of Belzig

The ALFA project

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Goals of Energy Strategy 2020 Brandenburg

- Reduce final energy consumption by 13% (39.8PJ) by 2020 compared to 2004 (i.e. 1% per year) *
- Increase share of RES to 20% (20PJ) by 2020
- Reduce CO_2 emissions by 40% (36.4m t) by 2020 compared to 1990 *
- Secure lignite conversion using Carbon Capture Storage (CCS)
- Support research, development and technologies "made in Brandenburg" *

* addressed by ALFA

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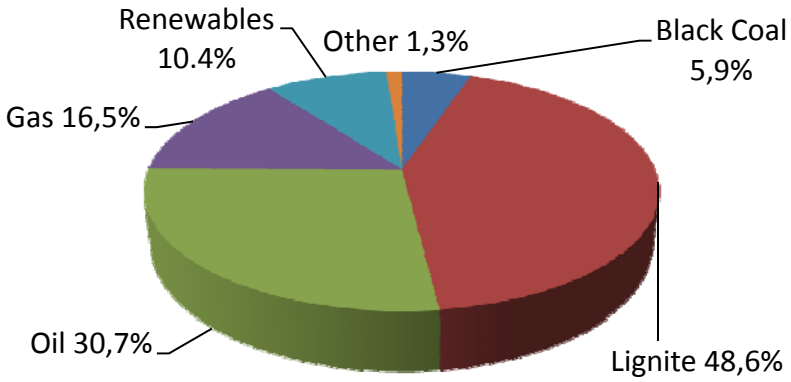
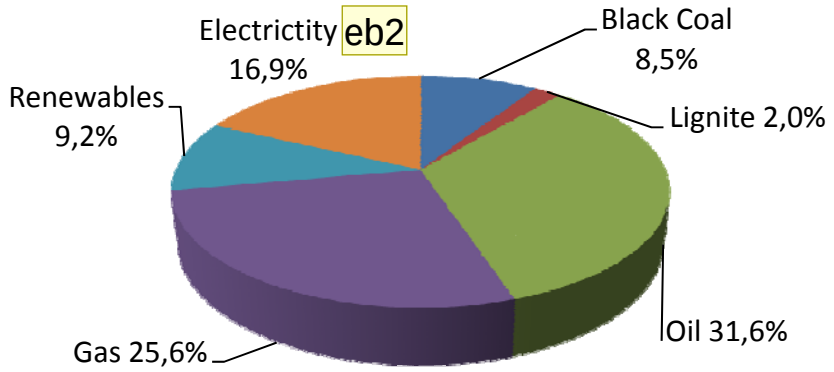
Primary / Final energy consumption in Brandenburg

eb4



Primary Energy Consumption (2006)

eb2



Final Energy Consumption (2006)

→ heavy use of lignite resources results in the fact that Brandenburg…

… is an energy exporter (Berlin: energy importer)
… has a high CO_2 consumption rate per capita 2007:23.7t / 1990: ~35t (compared to Germany: 9.7t/a; Berlin: 5.9t/a)

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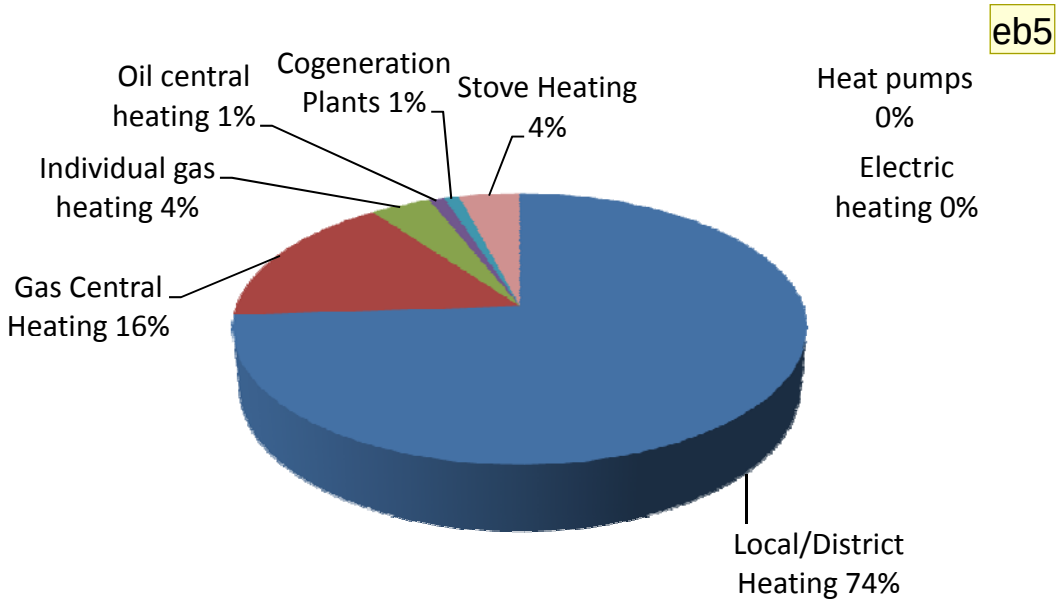
Folie 4

eb2 Electricity (formatting won't let me change it)
eball; 14.09.2009

eb4 alle die kommas mussen durch punkte ersetzt werden, ich kann es nicht ändern wegen Formattierung
eball; 14.09.2009

Heating systems in Brandenburg



→ around 75% are supplied by district heating

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Folie 5

eb5 Es wäre besser, die alle gross zu machen. Ich kann nicht wegen Formattierungen

eball; 14.09.2009

Belzig

- 12,000 inhabitants, 9,000 of which live in the town centre
- BEWOG - largest housing association with 1,250 apartments + 2 small housing cooperatives with 500 apartments (= 1,750 apartments) housing 4,000 people
- The remaining 5,000 live in private housing or rent from private landlords
- Private landlords have mostly converted their heating to oil and gas

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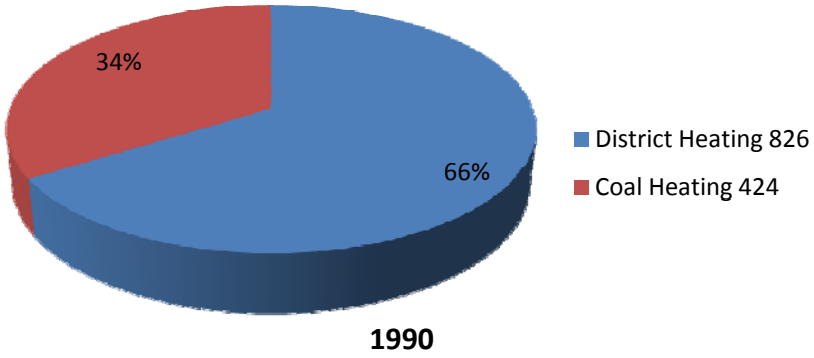
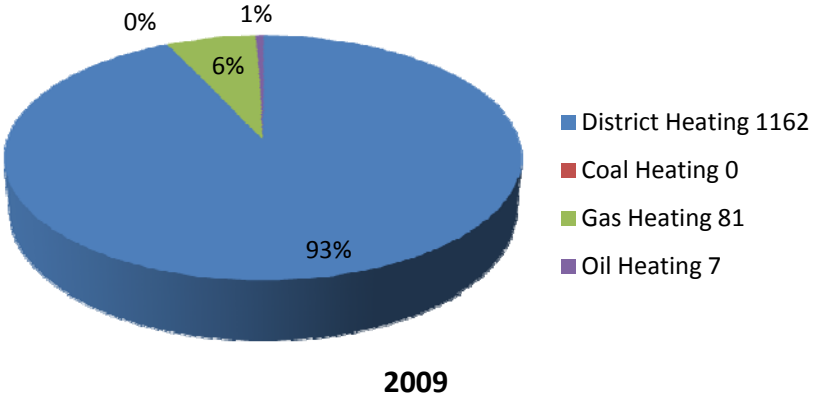
Belzig - Heat supply for BEWOG's 1,250 apartments





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The ALFA project – Alliance for plant efficiency

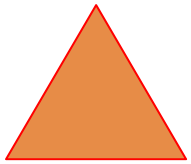
Low investment measures for high energy and economic efficiency

Cost efficiency

Rent incl. heating & service charge (Bruttowarmmiete)

Profitability

Energy Costs



Energy Consumption

Energy efficiency

Security of supply

Environmental protection

CO_2 Emissions

Climate efficiency

Climate protection

Regulatory law

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Objectives

- Energy saving and reduction of operating costs through optimised adjustment of heating systems, pumps, controling systems and valves
- Use of instruments for analysis
- Use of low investment measures in terms of technology
- Development and implementation of training programmes
- Documentation and evaluation
- Project results made public

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Why plant efficiency?

- **Comprehensively refurbished buildings:**

  → Tap efficiency

- **Partly refurbished buildings:**

  → Tap energy and overhead cost savings

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Why plant efficiency?

Comparison of investments per saved ton of CO_2

- **Life expectancy of investments: 20 years**
- **Gas price: 0.065 EUR/kWh**
- **CO_2 emission for gas: 0.211kg/kWh**

	Investment	Energy saving	CO_2 savings	Investment per ton CO_2 (>20yrs)
	€/m^2	kWh (m^2a)	Kg /(m^2a)	€/(t CO_2)
Fully refurbished, Proportion: energy saving measures	200	140	30	333
Optimisation of plant	**10**	20	4	50

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Building Data 1
Construction details

Year of construction (building)	1974/ 1975
Start of operation (heating system)	1974
Prefabricated building type	WBS 70
Number of apartments	30 + 40
Connected load of heating system	510 KW
Living space	4.702 m^2
Number of storeys	5
Energy supply	District heating

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Building Data 2

First refurbishment 1993 / energy saving measures

Retrofitting of thermal insulation	
Retrofitting of new windows	U-value, U_{Glas} = 1,6 W/(m²K)
Insulation of cellar ceiling	Insulation = 4 cm
Insulation of outer walls	Insulation = 8 cm
Insulation of roof	Insulation = 10 -12 cm
Retrofitting of new entrance doors	

Costs of refurbisment: 950,000 €

→ these measures have led to an energy saving of 50% !

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Building Data 3

Energy consumption and costs 2007

Energy consumption 2007	424.07 MWh/a Specific consumption 90.2 KWh/ m2 p.a.
Consumption of heating system	62,3 % Specific consumption 57.2 KWh/ m2 p.a.
Consumption of water heating	37,7 % Specific consumption 34.10 KWh/ m2 p.a.
Connected load of old heating system	510 KW
Costs (capacity and labour) Related service costs (basic price) Energy price (energy supply)	49,008 €/p.a. net equals to 115.6 €/KW p.a. 10.43 €/m² living space p.a. 15,515 €/p.a. 33,493 €/p.a.

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Deficits identified for transfer station (district heating)

- Existing heating system is out of date. Connected load (510 KW) is too high
- Pumps are dependent on initial pressure from supplier and unregulated. Individual houses are not adjustable

✓ Calculations showed that connected load of 321 KW is sufficient (→ related service price can be reduced by 37%)

✓ Possible energy saving amounts to 40% electrical energy

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Deficits identified for heating system

– Hydraulic calibration of regulation valves and thermostat valves is poor	✓ Energy saving potential: 5% heat energy
– Insufficient insulation of pipes in the basement	✓ Energy saving potential: 5% heat energy
– No insulation of ascending pipes in apartments	✓ Energy saving potential: 4% heat energy

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Deficits identified for water heating

- Water heating is not separated from ordinary heating system
- No storage of hot water, constant flow, circulation not adjusted
- Outdated pumps, no load dependence
- Oversized control system
- Poor distribution and insulation in certain areas

✓ Energy saving potential: 9% heat energy

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Envisaged measures for energy saving

- Hydraulic separation of both objects
- Installation of new transfer station with central water heater and buffering 2x500 litre
- Control unit for adaptation of flow temperature
- Hydraulic calibration of heating systems through installation of differential pressure regulating valves and adjustable thermostats
- Renewal of insulation for heating and hot water pipes
- Subsequent insulation of ascending pipes in apartments

→ if all measures are implemented, an energy reduction of 25-30% is possible!

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Costs

• New transfer station (district heating)	12,200 €	2.59 €/m²
• Hydraulic calibration of heating system	15,750 €	3.35 €/m²
• Hydraulic calibration of water heating	3,100 €	0.66 €/m²
• Insulation of heating pipes in basement	5,880 €	1.25 €/m²
• Insulation of ascending pipes	8,860 €	1.88 €/m²
• Insulation of circulating pipes for hot water	1,890 €	0.40 €/m²
Total	**47,680 €**	**10.14 €/m²**

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Summary of costs

Total costs	**47,680 €**
Refurbishment costs for transfer station which are covered by public utilities as owner	**-12,200 €**
Remaining costs for BEWOG	**35,480 €**
thereof	
Hydraulic calibration of heating system and hot water	19,050 €
Insulation of pipes	16,430 €
Costs for energy supply and energy saving	
Energy cost (2007)	**33,493 €**
25% energy saving equals to	**8,373 €**
Payback period	**4 years**

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Old transfer station

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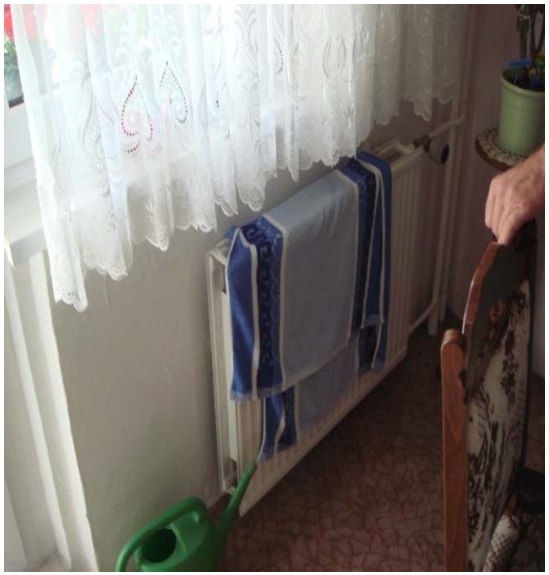
Old transfer station



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New transfer station

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Conclusions

- ✓ Belzig's ALFA pilot project can be applied by most housing associations in Berlin & Brandenburg and contributes to its energy efficiency policies
- ✓ Focus on low cost investments with high energy saving potentials and short payback periods
- ✓ Informing caretakers/facility managers on measures implemented to ensure that the new settings are maintained (incl. trainings)
- ✓ Residents/homeowners need to be informed at an early stage
- ✓ One cornerstone of energy efficient sustainable urban development: huge impact if applied in all buildings

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Thank you !

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