

# BIOMASS – STRAW

## LUBAÑ (Poland)

*The use of straw as a fuel for heating is increasingly perceived as an alternative for local communities, allowing them to use surplus straw and limit emissions of harmful substances produced during the combustion of traditional fuels.*

### THE CITY

Lubań is situated in Dolnośląskie Voivodeship in southwestern Poland. It lies in the valley of the River Kwisza, on the edge of the Pogórze Izerskie (Izerskie Foothills). The town, which has 24,500 inhabitants, is located 22 km from the German border and 30 km from the Czech border.

#### Climatic data:

Average annual temperature: 7.4 °C



### CONTEXT

The analysis of the use of straw within 20 km of the town of Lubań showed that a significant quantity of this material was not used in the place where it is produced and is a burdensome waste product. The production of a straw surplus is a permanent phenomenon. The estimated quantity of straw available is from 10,000 to 12,000 tons of straw per year. This quantity could be used to produce up to 50% of the thermal energy required by the town of Lubań.

### EXPERIENCE OF LUBAÑ

The first stage of implementation of the programme for producing energy from biomass was the construction of a 1 MW straw-fired boiler plant. In the years 2000 and 2001, two further 3.5 MW boiler plants were constructed.

Preparations for introducing straw for energy production started in 1992 with the analysis of the straw market and straw-fired boilers. Due to the lack of affordable technologies for burning straw, the project could not be implemented until 1998. The implementation was divided into two stages:



**Stage 1**, finished in the first half of 1999, included:

- the purchase of know-how and the preparation of the technical documentation,
- the construction of a 1 MW straw-fired boiler with the necessary ancillary equipment,
- the purchase of a tractor, press, trailer and the construction of a straw warehouse.

Apart from the construction of the straw-fired boiler, stage 1 also included additional tasks:

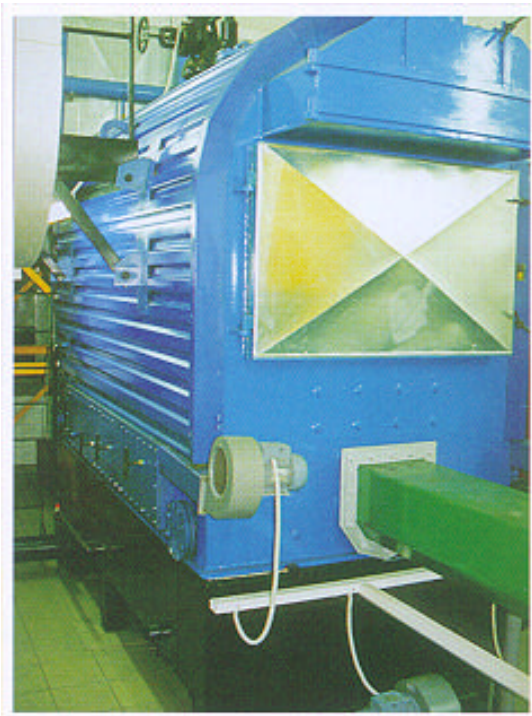
- the construction of 7 heating substations together with connections,
- the modernisation of 27 heating substations (the installation of outdoor temperature monitoring, highly efficient heat exchangers and heat meters)

**Stage 2**, finished in 2001, included:

- the construction of two 3.5 MW straw-fired boilers with the necessary ancillary equipment,
- the purchase of the equipment necessary to collect and transport the straw (two presses, two tractors, two loaders, two trailers, a rake),
- the construction of a 1060 m<sup>2</sup> straw warehouse,
- the construction of a 90 m<sup>2</sup> boiler room.

One 3.5 MW straw-fired boiler was put into operation in December 2000, the other in 2001.

The straw-fired boiler plant was constructed as an upgrade and extension of the existing coal-fired boiler plant. This solution has allowed the utilisation of existing technological infrastructure and the implementation of a safe multi-fuel heat production system. This system enables the full exploitation of the advantages of straw and the operation of straw-fired boilers which utilise 80% of the material available, while the existing coal-fired boilers serve as a flexible safeguard.



### Technology

The basic elements of the line which prepares and transports the straw, as well as the grate, was manufactured by the Zak<sup>3</sup>ady Urz<sup>1</sup>dze<sup>ñ</sup> Kot<sup>3</sup>owych "St<sup>1</sup>pork<sup>3</sup>ów" S.A., the pressurised part of the installation was manufactured by the firm "Wary<sup>ñ</sup>ski-Toru<sup>ñ</sup>" Sp. z o. o., the dust collection system was provided by EkolInstal Ko<sup>æ</sup>cian and the automation and control system was manufactured by Atech Sp. z o. o.

Table 1. Technical specification of the boilers and their fuel consumption

Boiler type	WCO-80/S	WCO-150/S	WCO-160/S
Nominal power	1	3.5	3.5
Country of manufacture	Denmark	Poland	Poland
Year of installation	1998	2000	2001
Annual fuel consumption	1305	3000	2996

The main factors influencing the choice made by the PEC Lubañ (the heating utility) regarding the boiler to be used was the tolerance of wet straw, the resistance to physical damage and the possibility of using the same device to burn other fuels, e.g. wood chips.

The nominal combustion efficiency of the straw-fired boiler plant is 84% (reaching 90% with very good quality straw).

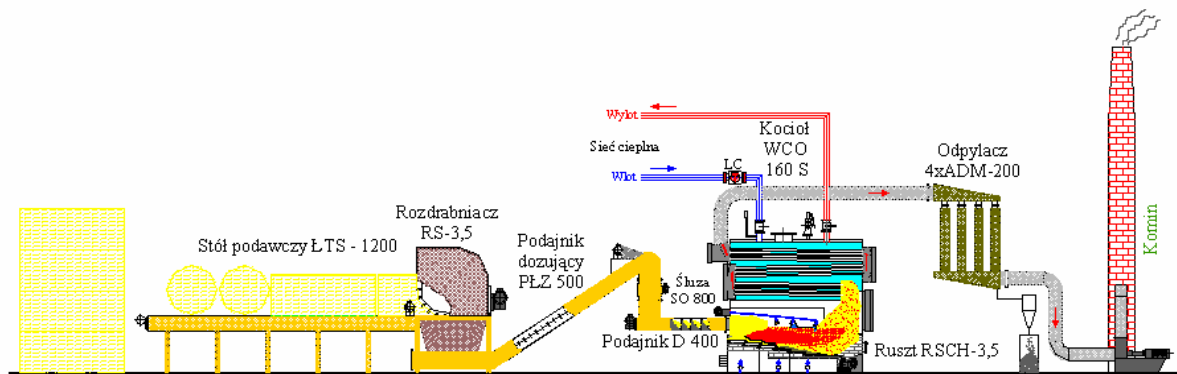


Fig. 1. Plan of a 3.5 MW straw-fired boiler plant.

Most of the straw is stored in heaps in the stacking yards of PEC Lubań. These are covered with plastic sheets to protect them from the rain. The rest is regularly delivered by the farmers. The straw contains about 3.5% ash and particulate matter. Research results have confirmed the suitability of the ash as a mineral fertiliser.

### Costs and financing

Construction of a straw-fired boiler plant is included as a priority in the strategy for supporting pro-environmental projects adopted by the EkoFundusz foundation and the WFOŃGW (Voivodeship Fund for Environmental Protection and Water Management) in Wroc<sup>3</sup>aw.

The costs of implementing the programme, amounting to EUR 1,608,275, were covered from three sources:

• EkoFundusz	EUR 688,625	subsidy	43 %
• WFOŃGW	EUR 311,875	loan	19 %
• PEC Lubań	EUR 607,775	own funds	38 %

### Economic and technical results of utilising straw as fuel

The operating costs for straw-fired boiler plant are not significantly different from the operating costs for boiler plant fuelled with coal dust. In the case of straw, the cost of fuel, including transportation costs, is around 20% lower. The costs of operation are comparable.

There is a significant difference in depreciation costs resulting from the fact that the coal-fired boilers were constructed much earlier. This difference is partly compensated for by higher maintenance costs and the exemption of straw combustion for energy purposes from environmental fees.

### Environmental aspects

The implementation of the Programme has a positive impact on the natural environment because renewable fuel is utilised. Apart from balancing the carbon dioxide emissions, straw combustion emits significantly smaller quantities of sulphur dioxide and particulate matter than coal combustion.

The adopted technological solutions utilising straw as a source of energy conform to the basic national guidelines concerning environmental protection and contribute towards limiting the emission of pollutants. The environmental effect of the Programme is shown in Table 2.

Table 2. Environmental effect (for the production of 21,000 MWh of heat/year from straw combustion)

Pollutant	Annual emissions		Environmental effects	
	Present state (Mg/year)	After modernisation (Mg/year)	Absolute value (Mg/year)	Relative value (%)
SO <sub>2</sub>	72.1	14.6	57.5	79.8
NO <sub>2</sub>	19.1	16.5	2.6	13.6
CO <sub>2</sub>	10 573.2	0.0	10 573.2	100.0
Particulate matter	68.0	4.9	63.1	92.8

## EVALUATION AND OUTLOOK

The experience of PEC Lubań (a private company which is 100% owned by the Municipality) covers the investment process and 3 years of operation of a straw-fired boiler plant. It testifies that in Polish conditions straw, or more generally locally produced biomass, constitutes an excellent basis to promote economic growth at the level of the Municipality.

A serious approach to energy planning by the local authorities at the level of the Municipality is a precondition for achieving a favourable result. It is not necessary that the Municipality itself should directly engage in the implementation of specific projects. It is enough that the proper conditions are created – transparent investment and tax policies conducive to economic growth.

The project implemented in Lubań shows that a broader view of local policy – encompassing more than the obligations placed upon the Municipality by the Energy Law – results in significant social and economic activity, which is not only linked to energy production. Almost naturally, this opens the way towards the creation of new jobs, the expansion of the agricultural market, increased use of uncultivated land and the disappearance of threats connected with the existence of such land.

## FURTHER INFORMATION

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This case study was prepared by Energie-Cités in cooperation with the Przedsiębiorstwo Energetyki Ciepłej Lubań Sp. z o. o. It received funding from the ALTENER programme of the DG for Energy and Transport of the European Commission.

