NEW BIOMASS AND WASTE TO ENERGY CHP IN VILNIUS - THE LAST STEP TO GET OUT FROM THE GAS DEPENDENCE IN DH SECTOR OF LITHUANIA

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AGENDA

I. STATE OF PLAY OF ENERGY SECTOR IN LITHUANIA

II. NEW BIOMASS AND WASTE TO ENERGY CHP IN VILNIUS

III. FUEL SUPPLY AND INFLUENCE TO THE MARKET
STATE OF PLAY OF ENERGY SECTOR IN LITHUANIA
ENERGY OUTLOOK (electricity sector)

Electricity supply balance

- One of the biggest importer of electricity among EU countries (~ 70% from the country’s demand)

- CHP plants are being closed due to non competitive fossil fuels and have been already depreciated

- RES in local electricity production ~20% from countries demand
ENERGY OUTLOOK (district heating)

**Fuel balance** in district heat production (cogeneration power plants and heat only boilers)

- Ineffective use or no use of cogeneration based heat production in district heating
- Biomass sector is still in the transition from a few players into the biomass exchange based market
- The majority of the heat production capacities’ are designed to use white wood chips

Source: LDHA (2015 preliminary)
ENERGY OUTLOOK (district heating)

District heat production ~ 8.3 TWh
Vilnius city ~ 2.6 TWh (~31%)

Government target up to 2021

Source: LDHA (preliminary data for 2015)
ENERGY OUTLOOK (waste management)

- Ineffective waste management - 60% of waste containing energy value is still landfilled

- Lack of WtE capacities to incinerate RDF/SRF locally produced by MBTs (mechanical biological treatment plants)

- EC ambitions for recycling (65 %, 2030) push to optimize WtE capacities in the conservative manner

*Source: Eurostat (2013)*
- Lithuania ranks 6th among most energy dependent EU members
- Lithuanian socio-economic environment is favourable for implementing projects reducing the country’s energy dependence
It *strategy* should help to **reduce energy imports and dependency**, to **cut costs for households and businesses**, and to deliver the EU's **greenhouse gas emission reduction** goal and meet its commitment under the climate agreement reached at the COP21 climate conference in Paris.

*The strategy aims are* maximizing the **efficiency and sustainability** of heating and cooling systems.
CO-GENERATION - A TOOL FOR ENERGY EFFICIENCY AND SUSTAINABILITY

- It has ~ 40% higher primary energy utilization rate compared to separate conventional energy (electricity and heat) production
- Country’s energy dependency can be significantly reduced by the use of local municipal waste (RDF/SRF) and renewable fuel
Agenda
1. Introduction
2. Market overview
3. CHPs project
4. Financial forecast

NEW BIOMASS AND WASTE TO ENERGY CHP IN VILNIUS
### Vilnius city

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
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<tbody>
<tr>
<td>Population</td>
<td>540,000</td>
</tr>
<tr>
<td>District heating</td>
<td>90%</td>
</tr>
<tr>
<td>Annual district heat demand</td>
<td>2.6 TWh</td>
</tr>
<tr>
<td>Annual RDF/SRF potential in the region for energy</td>
<td>~145,000 tons</td>
</tr>
<tr>
<td>Waste landfilled</td>
<td>~85%</td>
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**LOCATION OF THE NEW BIOMASS AND WtE CHP**
OBJECTIVES OF THE PROJECT

- Implementation of CHP projects will contribute to pursue the objectives and tasks of the National Energy Independence Strategy – the natural gas as a fuel for heat and electricity production will be replaced with biomass and waste resulting in enhancement of Lithuanian energy independence from fossil type fuel (import of the natural gas).

- The Government of the Republic of Lithuania acknowledged that CHP projects have national economic significance to the Republic of Lithuania.
OWNERSHIP OF THE PROJECT

Ministry of Energy
Ministry of Finance
Ministry of Environment

EU funding
<164mEUR

Ministry of Finance
100% - control

Lietuvos energija
100% - control

UAB Vilniaus kogeneracinė jėgainė
SPV

Vilnius high efficiency CHP installation

<table>
<thead>
<tr>
<th>MWe</th>
<th>MWt</th>
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<tbody>
<tr>
<td>~88</td>
<td>~227</td>
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CAPEX ~325 mEur

BioCHP unit

<table>
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<tr>
<th>MWe</th>
<th>MWt</th>
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<tr>
<td>~70</td>
<td>~174</td>
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WtE CHP unit

<table>
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<tr>
<th>MWe</th>
<th>MWt</th>
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<tbody>
<tr>
<td>~18</td>
<td>~53</td>
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Ministry of Finance
100% - control

EU funding
<164mEUR
VILNIUS CHP PROJECT TIMELINE

Partner selection
Preparatory works
Construction work
Securing of financing

2015
Selection, negotiation
Environmental Impact Assessment
Territory planning (height allowance)
State Aid/ EU Funding
Financing structure

2016
EPC tender

2017
EPC contractor(s) work(s)

2018
First fire
Selection, negotiation

Works at the site
Commissioning
Completion
Final completion
CHP INTEGRATION INTO VILNIUS DH SYSTEM

Current situation
RES ~ 40-45%

After implementation of the project
RES+RDF(SRF) ~ 75-80%
EXPECTED RESULTS OF VILNIUS CHP PROJECT

<table>
<thead>
<tr>
<th>Vilnius high efficiency CHP installation</th>
<th>Electricity production, GWh (share of LT demand)</th>
<th>400 (~3.7%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>District heat production, GWh (share of Vilnius demand)</td>
<td>1.240 (~50%)</td>
</tr>
<tr>
<td></td>
<td>CO$_2$ reduction, tones/year</td>
<td>~ 230,000</td>
</tr>
<tr>
<td></td>
<td>Primary energy savings</td>
<td>~40 %</td>
</tr>
<tr>
<td></td>
<td>Overall efficiency of the units</td>
<td>≥ 101 %</td>
</tr>
</tbody>
</table>
Vilnius city has chosen a land plot for the New CHP by approving general city plan and heating sector special plan.

- Well developed infrastructure for connection to engineering infrastructure – natural gas, electricity and district heating;
- Well developed transport infrastructure. It located next to highway between Vilnius and Kaunas, also there is railway branch;
- Site is not located in protected territory or NATURA 2000 territory boundaries, does not contain any cultural heritage;
- Blends in the current Vilnius layout, concentrating energy infrastructure at the same place.

The site is Jočionių str. 13, located on the southwest part of Vilnius, 8 kilometers away from city center.
LAND PLOT STRUCTURE

MBT

Energy production area

Biofuel handling area
PROGRESS OF THE PROJECT

- Completed Environmental Impact Assessment
- Completed Topographical surveying
- Completed Geological surveying
- Completed concept project of connections to existing infrastructure
- EPC tender still in progress (initial offers received, finishing negotiations, contract – mid 2006)
- Finishing negotiations with bank
FUEL SUPPLY AND INFLUENCE TO THE MARKET
PRIMARY ENERGY TO THE CHP PLANT

Municipal waste
RDF/SRF
up to 160,000 tons a year
(\sim41,000\ toe)

\sim30\%

Biomass
\sim450,000\ tons\ a\ year
(\sim97,000\ toe)

\sim70\%
Currently, the vast majority of municipal waste is disposed of in landfills 58% (2014)
Only about 8% of treated municipal solid waste was used for energy recovery in 2014
WtE CHP is the missing infrastructure link to treat refused derive fuel (RDF) from MBT
WASTE TO ENERGY CAPACITIES

Optimal solution of WtE capacities which suit waste management targets

Waste to Energy Capacities Chart

- Vilnius CHP capacity
- Kaunas CHP capacity
- Klaipeda CHP capacity
- RDF for incineration
BIOMASS PRODUCTS FOR VILNIUS CHP

- It is planned to use biomass of class P63 or P100 in accordance with EN 14961 standard

- Wood chips, bark and log wood will be delivered by roads and railway

- Furthermore, part of wood chips will be prepared on the site by chipping of wood logs

<table>
<thead>
<tr>
<th>Biomass</th>
<th>Instantaneous portion of fuel (mass basis)</th>
</tr>
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<tbody>
<tr>
<td>Biomass - wood chips</td>
<td>40-100%</td>
</tr>
<tr>
<td>Intermediate fuel, bark, willow and other energy crops, forestry residues.</td>
<td>30-60%</td>
</tr>
<tr>
<td>Straw</td>
<td>0-10%</td>
</tr>
</tbody>
</table>

A possibility to add in the fuel mixture **up to 60%** of the so called intermediate fuel - bark, forestry residues, energy crops, industrial wood chips (dry wood chips) and up to 10% of other low quality dusty biomass (straw).
Wood chips > 98% of the market;

Regulated energy producers are obligated by law to acquire certain part of biomass in Energy Exchange by the year 2014 - 10%; 2015 – 50%; 2016 – 100%.

Wood biomass consumption (district heating) by products' 2014

Biomass potential in Lithuania internal market follow type of biomass

<table>
<thead>
<tr>
<th>Biomass type</th>
<th>Potential in 2025 m³/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biomass from industrial waste</td>
<td>1,627,000</td>
</tr>
<tr>
<td>Firewood for energy</td>
<td>1,777,865</td>
</tr>
<tr>
<td>Logging waste</td>
<td>845,253</td>
</tr>
<tr>
<td>Secondary wood, not forest logging</td>
<td>1,700,000</td>
</tr>
<tr>
<td>Biomass from gray alder logging</td>
<td>650,000</td>
</tr>
<tr>
<td>Biomass from forest young stands</td>
<td>400,000</td>
</tr>
<tr>
<td>Biomass from short turnover plantations</td>
<td>983,580</td>
</tr>
<tr>
<td>Biomass potential from stump wood</td>
<td>644,601</td>
</tr>
<tr>
<td>TOTAL:</td>
<td>8,628,299</td>
</tr>
</tbody>
</table>

Source: Lithuania Energy Consultants Association
- About **4,5 TWh** of biomass was consumed in DH in 2015
- Annual biofuel potential is around **17 TWh** only in Lithuania (LEKA)
- Vilnius CHP is expected to increase biomass demand only by **~0,3 TWh** (~6% of biomass consumed in DH sector in 2015)
More than 235 members currently registered at the Biomass Exchange

Monthly max order from Vilnius BioCHP ~ 2.6 M EUR (if biofuel price 15EUR/MWh)
THANK YOU FOR YOUR ATTENTION