AGENDA

1. The PÖYRY Group
2. Key Challenges in Biomass Sourcing
3. Examples from other industries
4. Where is all the biomass?
5. Market competitiveness
6. International biomass logistics vs. local sourcing
THE PÖYRY GROUP - SECTORS & SERVICES

We deliver best-in-class management consulting and engineering services across our business groups.

<table>
<thead>
<tr>
<th>Management Consulting</th>
<th>Energy</th>
<th>Industry</th>
<th>Water &amp; Environment</th>
<th>Urban &amp; Mobility</th>
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</thead>
<tbody>
<tr>
<td>● Strategic advice</td>
<td>● Thermal power</td>
<td>● Pulp and Paper</td>
<td>● Water</td>
<td>● Roads</td>
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<tr>
<td>● Business development</td>
<td>● Hydro power</td>
<td>● Chemicals</td>
<td>● Wastewater</td>
<td>● Rail and urban public transport</td>
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<td>● Organizational optimization</td>
<td>● Nuclear energy</td>
<td>● Minerals processing</td>
<td>● Waste</td>
<td>● Tunnels</td>
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<td>● Bio-refining</td>
<td>● Desalination</td>
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<td>● Bio-converting (e.g., pellets)</td>
<td>● Environmental services</td>
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<td>● Renewable energy</td>
<td>● Real estate development</td>
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<td>● Transmission &amp; distribution</td>
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1) Owners & Lenders Engineering, Project Management, (Pre-) Feasibility EPC & EPCM Projects, …
## THE PÖYRY GROUP IN THE BIOENERGY SECTOR

We build our strategic advisory and M&A support on our deep knowledge in the biomass to energy sector; the competence is unique & profound

<table>
<thead>
<tr>
<th>Strategy development</th>
<th>Business operations and planning</th>
<th>Procurement strategies</th>
<th>Bioenergy market analysis</th>
<th>Technology assessment</th>
<th>Project services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bioenergy strategy formulation</td>
<td>Change management</td>
<td>Biomass sourcing strategy</td>
<td>Business development and modelling</td>
<td>Technology options evaluation</td>
<td>Project identification and concept development</td>
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<tr>
<td>Market penetration strategy</td>
<td>Analysis of selected business alternatives</td>
<td>Supply/market analysis</td>
<td>Performance improvement</td>
<td>Technology development benchmarking</td>
<td>Project pre-feasibility / feasibility assessments</td>
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<tr>
<td>Comprehensive market analysis</td>
<td>Partnership opportunities / Investor and downstream partner identification</td>
<td>Scenario analysis</td>
<td>Competitiveness benchmarking</td>
<td>Audits of novel technology</td>
<td>Financial viability analysis – ports, vessels</td>
</tr>
<tr>
<td>Bioenergy master plans</td>
<td>Procurement optimisation</td>
<td>Strategy formulation</td>
<td></td>
<td>Integration of bioenergy inv. to existing plants</td>
<td>Project due diligence / second opinion</td>
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<td></td>
<td>Implementation</td>
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<td>Technology partnership opportunities</td>
<td>Financial valuation of biomass plants – services to financiers</td>
</tr>
</tbody>
</table>

-
-
-
-
-
-
WHAT IS A BIOMASS SOURCING MANAGER DOING ALL DAY?

Making sure that the right feedstock volume of the right quality arrives at the facility at the right time at affordable cost.
KEY CHALLENGES IN BIOMASS SOURCING

- Identification of suitable biomass supply regions and sources
- Mobilisation of existing surplus volumes
- Development of new resources
- Bulky materials from dispersed origins
- Complex logistics
- Seasonality and cyclicity of supply flows
- Competition for raw material with other industries
- Competition for land and other resources
- Price uncertainty and risk of increasing biomass market prices
- Regulatory environment and financial incentive schemes
- Sustainability requirements and public perception
- etc.
BIOMASS ASSORTMENTS

Should the conversion technology decide over the feedstock to be used or vice versa?

<table>
<thead>
<tr>
<th>Pulpwood Logs</th>
<th>Chips / Sawdust</th>
<th>Bark</th>
<th>Harvesting Residues</th>
<th>Woody Energy Crops</th>
<th>Herbaceous Energy Crops</th>
<th>Agricultural Residues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous supply</td>
<td>+++</td>
<td>+</td>
<td>+</td>
<td>+++</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Low bulk density</td>
<td>+++</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Clean, homogenous fuel</td>
<td>+++</td>
<td>++</td>
<td>-</td>
<td>-</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td>Output per hectare</td>
<td>+ (+)</td>
<td>n/a</td>
<td>n/a</td>
<td>-</td>
<td>++</td>
<td>++</td>
</tr>
</tbody>
</table>
BIOMASS SOURCING IN THE FOREST INDUSTRY

The pulp industry can do it…

- Barra do Riacho pulp mill owned by Fibria Celulose – currently largest pulp mill in Latin America
- Annual wood consumption: ~10 million green tonnes
- Wood supply exclusively through trucks
- Directly located in plantation rich area
BIOMASS SOURCING IN THE ENERGY INDUSTRY
The energy industry can do it…

- Drax Power - largest single electricity generator in the UK with a capacity of ~4 GW
- Drax plan to convert three of their six units to biomass, resulting in a total biomass demand of about 8 million tonnes of pellets p.a. by 2015
- Wood chip equivalent: 16 million tonnes p.a.
- Biomass will be imported from various overseas supply regions

Implementation of Drax’s large scale biomass sourcing strategy is feasible and in full swing…but doesn’t come cheap!
WHERE IS THE BIOMASS?

On a macro level, the world is full of opportunities to source large quantities of biomass.

- Forest Resources
- Industry Residues
- Energy Crops
WHERE IS THE BIOMASS?

Local delivered cost for traditional wood assortments vary significantly between regions and influence strategic positioning.

Indicative pulpwood costs delivered to mill

USD/odt

Growth rates (odt/ha/year)

Finland
Canada
NW Russia
Portugal
US Southeast
Brazil
THE US SOUTHEAST AS FIBRE BASKET
Understanding current and future fibre flows is key for strategic positioning.
FOCUS ON US SOUTHEAST

Biomass markets are highly regional and transportation distance can be the devil.
COMPETITIVENESS OF BIOMASS CONSUMING INDUSTRIES

Possible market entry strategies
1. Find a niche in the biomass market and be friendly
2. Head on competition with existing consumers
3. Build own resource base / vertical integration
VERTICAL INTEGRATION

Pulp producers often show a high level of vertical integration, especially in Latin America and Asia Pacific

Vertical integrated companies with global forest land ownership or user rights
INTERNATIONAL BIOMASS LOGISTICS

Access to international biomass markets opens up a large resource basket and stable commoditised market might develop…

…but are price levels affordable for biofuel producers?
BIOMASS PRE-TREATMENT TECHNOLOGIES

Efficient densification technologies can present interesting options for large scale biomass conversion facilities.

Net calorific values (GJ/t as delivered)

Logs 8 – 12

Chips 10.2 – 13.8

Pellets 17.1 – 17.7

Pyrolysis Oil 16 – 19.2

Black Pellets 20.9 – 22.3
SUPPLYING LARGE SCALE PROJECTS WITH BIOMASS CAN BE DONE

- A robust long-term biomass sourcing strategy is key for the success of your project
- Proven supply chains for large scale biomass projects do exist
- The competitive power of existing players can be very strong
- Vertical integration can create peace of mind
- The learning curve ahead might be steep but provides lots of fun
THANK YOU!

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