Rainer Schlepphorst (Lignovis GmbH, Hamburg):

“Optimization of the SRC value chain - findings from 200 ha SRC plantations under the 'OPTFUEL' R&D project”
Content

• The Optfuel Project
• SRC
• Results of yield inventories
• GHG emissions
• Best practice for SRC
• Key findings
The OPTFUEL Project

- **OPTFUEL** = Optimized Fuels for Sustainable Transport

- A research & demonstration project within the 7th Framework programme funded by the European Union (grant agreement 218890)

- OPTFUEL aims at the demonstration of the production chain of synthetic fuels from biomass (BtL) and the potential of pollutants emissions reduction in vehicle applications.

- **Consortium:** Volkswagen AG, Lignovis GmbH, Ford Research Centre GmbH, Renault SA, Certh, IFP Energies nouvelles, CONCAWE, Invensys Systems GmbH, SYNCOM F&E Beratung GmbH, Indian Institute of Technology, Delhi

- Budget: 12.8 Mio €, funding 7.1 Mio €, Duration: 48 months, Start: 01/2009, Coordinator: Volkswagen AG

- [http://www.optfuel.eu/](http://www.optfuel.eu/)
Lignovis GmbH to continue WP 1

- Lignovis GmbH is the successor of the biomass department of CHOREN Industries GmbH (insolvent since summer 2011)

- Lignovis GmbH continued and finalized WP 1 from Nov 2011 to Dez 2012

- Most of WP 1 objectives remained and short rotation coppice (SRC) activities were intensified

- Due to CHOREN’s insolvency the focus of WP 1 shifted from biomass supply strategy for “large scale BTL plant” to “large/ mid scale bioenergy project” in Europe

- Sourcing, supply and logistic concepts for different large/midscale biomass projects are similar, irrespective of the technology applied.
SRC activities of WP 1 (Feedstock and logistic)

• Improvement of the willingness of farmers in 5 target regions to grow src by development and implementation of a long term attractive corporation model between producers and consumers and off-takers of the feedstock.

• Identification of efficient planting-, treatment-, and harvesting technologies for commercial src projects by testing them in a practical scale.

• Testing of different tree species and clones in terms of their yield development and sensitiveness to pests and diseases by using an relatively high richness of variance species and clones on all sites.

• Support of src relevant scientific activities by corporation with universities (e.g. allocation of src demonstration plots for scientific research).

• Experimental implementation of ecological improved src and an ecological and economical assessment of itself, in dialog with a nature conservation organization (NABU).
• 230 ha SRC plantation established between 2009 and 2011 (with more than 30 different willow and poplar varieties, domestic species and eucalyptus trials)

• Prosperous regrowth of fields after first harvests in 2010 (Schwedt) and 2011 (Freiberg)

• Apparent variances in growth and resilience of different varieties on respective sites

• Diversification of operator structure after CHOREN’s insolvency: Lignovis continued operation in Freiberg, Vattenfall integrated some fields near Schwedt region in their portfolio and all other fields are now managed by the respective farmers

• Lignovis is granted access to all fields to continue successful monitoring under OPTFUEL
# Tree categories, species/clones and treatment

<table>
<thead>
<tr>
<th>Category</th>
<th>Clone/Species</th>
<th>Rotation (years)</th>
<th>Spacing [m]</th>
<th>Density (trees per ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alder</td>
<td>A. <em>incana</em>, A. <em>glutinosa</em></td>
<td>3 - 4</td>
<td>2.1 x 0.48</td>
<td>10.000</td>
</tr>
<tr>
<td>Black locust</td>
<td>-</td>
<td>3 - 4</td>
<td>2.1 x 0.48</td>
<td>10.000</td>
</tr>
<tr>
<td>Poplar</td>
<td>AF 2, AF 6, AF 8, Androscoggin, Grimminge, Hybride 275, Jacometti 78 B, Koltay, Kopecky, Kornik, Matrix, Max, Monviso, Muur, Oudenberg, Pannonia, Rochester, Vesten</td>
<td>3 - 4</td>
<td>2.1 x 0.48 resp. 0.75/1.8 x 0.58</td>
<td>10.000 resp. 13.500</td>
</tr>
<tr>
<td>Poplar</td>
<td>AF 2, Grimminge, Hybride 275, Jacometti 78 B, Kopecky, Kornik, Matrix, Max, Monviso, Muur, Rochester</td>
<td>5 - 8</td>
<td>2.4 x 1.0</td>
<td>4.166</td>
</tr>
<tr>
<td>Willow</td>
<td>1013, 1047, 1054, Bedai, Inger, Klara, Sarvar, Sven, Tora, Tordis</td>
<td>3 - 4</td>
<td>2.1 x 0.48 resp. 0.75/1.8 x 0.58</td>
<td>10.000 resp. 13.500</td>
</tr>
<tr>
<td>Others</td>
<td>A. <em>pseudoplatanus</em>, B. <em>pendula</em>, S. <em>aucuparia</em></td>
<td>-</td>
<td>3 x 0.5</td>
<td>6.667</td>
</tr>
</tbody>
</table>
SRC plantations Freiberg region

Harvested plantation after 6 months (in front, 3,5 year old plantation in the back)

Pest infestation: Red poplar leaf beetle in regrown poplar plantation after harvest

2,5 year old poplar plantation shading ground vegetation

Biodiversity in SRC plantation Freiberg
Harvesting activities in Freiberg region (winter 2011/12)

- Harvest on 5 ha poplar & willow plantations (est. 2009) with New Holland field chipper

- Logistic chain: field chipper → tractor with trailer → intermediate storage → walking floor truck → customer

- Optimization potential concerning harvesting cost, intermediate storage and handling

- Higher feasibility (concerning economics and coordination) for small plots and broad customer range of field chipper line compared to whole stem harvest (lower water content after natural drying was not decompensated appropriately)

- Marketing of harvested wood chips to 3 heat & power plants, 1 pellet plant and 1 fiberboard producer in max. 100 km distance
Harvesting activities in Freiberg region (winter 2011/12)

Harvest with New Holland field chipper near Freiberg, February 2012

Unloading tractor trailer at intermediate storage

Handling at intermediate storage

Harvested plantation after 3 months, May 2012
SRC plantations Schwedt region

Planting of poplar (Max) with a four-row step-planter, April 2009

4 month old willow (Tordis) on a sandy soil, August 2010

3.5 year old poplar plantation (AF 2) with chicken fowler, June 2012

Leaf rost (Melampsora larici-populina) on a leaf of AF 2, Oktober 2010
Harvesting activities in Schwedt region (winter 2010/11)

- Harvesting of poplar (Max, double row) with the NB Stemster, January 2011
- Unloading the NB Stemster, January 2011
- Forwarding the unloaded rods to a headland of the field, June 2011
- Stapeling of rods at a headland of the field, to enable chipping, June 2011
3,5 year old plantation with test trial, where pre-emergent herbicide was not applied.
Results of yield inventories, overview

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Freiberg II</td>
<td>3</td>
<td>1&lt;sup&gt;st&lt;/sup&gt;</td>
<td>based on harvest in February 2012:</td>
<td>7,3 bdt/ha/a (poplar &amp; willow)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freiberg II</td>
<td>4</td>
<td>1&lt;sup&gt;st&lt;/sup&gt;</td>
<td>harvested volumes in January 2013:</td>
<td>8 bdt/ha/a (poplar &amp; willow)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freiberg II</td>
<td>1</td>
<td>2&lt;sup&gt;nd&lt;/sup&gt;</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>6,4</td>
<td>7,9</td>
<td>10,0</td>
</tr>
<tr>
<td>Kröpelin I</td>
<td>4</td>
<td>1&lt;sup&gt;st&lt;/sup&gt;</td>
<td>5,5</td>
<td>7,4</td>
<td>8,4</td>
<td>-</td>
<td>9,9</td>
<td>-</td>
</tr>
<tr>
<td>Kröpelin II</td>
<td>4</td>
<td>1&lt;sup&gt;st&lt;/sup&gt;</td>
<td>-</td>
<td>4,6</td>
<td>-</td>
<td>5,1</td>
<td>7,1</td>
<td>8,7</td>
</tr>
<tr>
<td>Kröpelin III</td>
<td>4</td>
<td>1&lt;sup&gt;st&lt;/sup&gt;</td>
<td>2,3</td>
<td>5,8</td>
<td>7,1</td>
<td>6,0</td>
<td>6,7</td>
<td>7,4</td>
</tr>
<tr>
<td>Freiberg VI</td>
<td>3</td>
<td>1&lt;sup&gt;st&lt;/sup&gt;</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>6,2</td>
<td>7,7</td>
<td>8,5</td>
</tr>
<tr>
<td>Freiberg IIX</td>
<td>3</td>
<td>1&lt;sup&gt;st&lt;/sup&gt;</td>
<td>2,5</td>
<td>4,1</td>
<td>5,8</td>
<td>5,0</td>
<td>6,5</td>
<td>7,6</td>
</tr>
<tr>
<td>Kröpelin IV</td>
<td>3</td>
<td>1&lt;sup&gt;st&lt;/sup&gt;</td>
<td>4,5</td>
<td>4,9</td>
<td>6,2</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Schwedt II</td>
<td>3</td>
<td>1&lt;sup&gt;st&lt;/sup&gt;</td>
<td>-</td>
<td>5,2</td>
<td>-</td>
<td>4,1</td>
<td>5,3</td>
<td>5,9</td>
</tr>
<tr>
<td>Schwedt II</td>
<td>2</td>
<td>2&lt;sup&gt;nd&lt;/sup&gt;</td>
<td>-</td>
<td>7,1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Schwedt III</td>
<td>3</td>
<td>1&lt;sup&gt;st&lt;/sup&gt;</td>
<td>3,8</td>
<td>5,3</td>
<td>6,3</td>
<td>7,4</td>
<td>8,2</td>
<td>9,2</td>
</tr>
<tr>
<td>Schwedt III (long rotation)</td>
<td>3</td>
<td>1&lt;sup&gt;st&lt;/sup&gt;</td>
<td>1,7</td>
<td>3,3</td>
<td>4,4</td>
<td>-</td>
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</tr>
</tbody>
</table>
**Site Seifersdorf 2 (1. and 2. rotation, short rotation, 10.00 trees per ha)**

<table>
<thead>
<tr>
<th>Clone / Plot / Age of shoots [years]</th>
<th>Willow</th>
<th>Poplar</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 west</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 northeast</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 northwest</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 southeast</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 southwest</td>
<td></td>
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<tr>
<td>4 east</td>
<td></td>
<td></td>
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<tr>
<td>4 west</td>
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<td></td>
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<tr>
<td>4 east</td>
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<td></td>
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<tr>
<td>4 west</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 east</td>
<td></td>
<td></td>
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<tr>
<td>1 east</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monviso</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 east</td>
<td></td>
<td></td>
</tr>
<tr>
<td>east</td>
<td></td>
<td></td>
</tr>
<tr>
<td>west</td>
<td></td>
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</tr>
</tbody>
</table>

- **range of annual yields from 3 to 10 bdt/ha/year in the first rotation**
- **willow seems better in the first rotation, poplar is expected to be higher from 2nd rotation on**

*Yield inventory via tree measurements on plots (diameter in height of 1 m) and calculation with biomass functions.*
Influence of weed control, Schwedt region

Site Blumberg 1, Clone Tordis (2. rotation, 2. year, short rotation, 13,500 trees per ha)

Plot 1 + 2: conventional chemical treatment (mix of pre-emerge herbicides)
Plot 3: no treatment

Yield inventory via tree measurements on plots (diameter in height of 1 m) and calculation with biomass functions.
Comparison with native species, Schwedt region

*Site Blumberg 4 (1. rotation, 2. year, height increment)*

<table>
<thead>
<tr>
<th>Species/Clone</th>
<th>Average height [cm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. pseudoplatanus</td>
<td>0</td>
</tr>
<tr>
<td>A. glutinosa</td>
<td>50</td>
</tr>
<tr>
<td>A. incana</td>
<td>100</td>
</tr>
<tr>
<td>B. pendula</td>
<td>150</td>
</tr>
<tr>
<td>AF2</td>
<td>200</td>
</tr>
<tr>
<td>Max Populus spec.</td>
<td>250</td>
</tr>
<tr>
<td>Hybride 275</td>
<td>300</td>
</tr>
<tr>
<td>4248 Salix spec.</td>
<td>350</td>
</tr>
<tr>
<td>S. aucuparia</td>
<td>400</td>
</tr>
</tbody>
</table>

Schlepphorst, Lignovis GmbH
GHG emissions of SRC

Composition of GHG emissions of commercial SRC production

- **N₂O emissions from managed soils**: 47.3%
- **Harvest and handling**: 39.1%
- **Plantation Management**: 6.2%
- **Site preparation**: 2.5%
- **Plantation Establishment**: 1.8%
- **Recultivation**: 1.6%
- **Planting material allocation**: 1.4%

Greenhouse gas emissions from different energy crops

[g CO₂eq per MJ feedstock]

- **SRC wood chips**: 1.8
- **maize silage**: 8.9
- **gras silage**: 11.1
- **canola seeds**: 23.2

GHG emissions of SRC based on Lignovis calculation, GHG emissions of other energy crops based on data from GEMIS database version 4.7 (cultivation of energy crops in Germany 2010 without LUC)
Best practice for SRC operations in Central Europe

- Use of **diverse (site specific) species and varieties assortment** to enhance resilience against fungi, pests and diseases of plantation as a whole.

- Focus **on proven poplar and willow varieties (e.g. Max, Hybride 275, Matrix, Tordis)** due to cost efficient establishment, management and high growth rates (locust, alder and other species may be favored on specific sites).

- Consider preferred harvesting and management technique when setting up plantation layout.

- Guarantee **effective weed management within the first 6 months** after establishment which holds the biggest impact on successful plantation development (pre-emergent herbicides at the right time & circumstances, mechanical and chemical weed control at the emergence of new weed).

- Aim for a “**critical mass**” of SRC plantations in one region (>100 ha) to lower costs for special services (harvesting & plantation management).
Key findings for SRC operations in Central Europe

- SRC suitable on marginal land, but higher quality soils provide higher growth and better economic performance

- Increasing interest of farmers, but still barriers due to bias, nesciences and uncertainties of legal state and political support
  - need for landmark projects, information campaigns and legal security & support

- SRC offers higher biodiversity (Flora & Fauna) compared to conventional agriculture and diversifies agricultural systems
  - integration in national and EU-wide strategies for development of the agriculture and energy sector
End of Presentation

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