The bio-based economy in Northeast Netherlands

Final report presentation

Amsterdam, 2013
This phase inventories economic potential, local strengths, innovation demand and the available knowledge in BBE in Northeast Netherlands.

Project objectives and approach

Objectives

- Determine intersection between innovation demand and available knowledge in the BBE.
- Determine the complementarity to and the role of universities in the BBE.
- Determine the most important elements for possible cooperation.

Phase 1 (current focus)

1. Assess the economic potential of the BBE for the Northeast Netherlands region.
2. Focus regional BBE chains on local strengths.
3. Inventory innovation demand and available knowledge in the region.

Phase 2 (out of scope)

- Set up business plan with business leaders and other stakeholders.
- Develop consortium by selecting and connecting partners and by growing the base.

GO / NO GO
Industry, research institutes and government in the region are heavily represented in this study

Research participants and sources

**ONLINE QUESTIONNAIRE AND INTERVIEWS**

- **INDUSTRY**
- **RESEARCH INSTITUTES**
- **GOVERNMENT**

**DESK RESEARCH**

- **DATABASES AND MONITORS**
  - CBS – Statline
  - BBE magazine
  - BvDEP, Reach, Amadeus
  - Biobased chemicals – IEA

- **STUDIES AND RESEARCH FROM ORGANIZATIONS**
  - IEA
  - Wageningen University
  - SER, SER Noord
  - PGG/BBP
  - Rathenau
  - NOM

- **VISIONS AND AGENDAS**
  - ‘BBE in Noordoost NL – Chemie ontmoet Agro’
  - ‘BBE in de energietransitie – Overheid’
  - ‘Punt op de horizon – Topsector Chemie’
  - ‘Agrifood en BBE Noord-Nederland – NOM’
  - ‘Green Deal KvK NO-NL’

- Online questionnaire of 150+ companies active in the BBE in the region
- Online questionnaire of 60+ university and college departments in the region
- More than 35 interviews with companies, professors/lecturers and public stakeholders
In the sectors energy and fuels, chemicals and materials, and agrifood, Northeast Netherlands holds a strong national position

Economic strengths of major BBE sectors, Northeast Netherlands, 2011

Contribution to GRP\(^1\) relative to national sector [Index 100 = sector contribution in the rest of Netherlands]

Source: CBS; LISA

\(^1\) GRP – Gross Regional Product, extrapolated from CBS data and complemented with LISA data
The power of these sectors is also demonstrated by the numerous companies active in the region.

Selection of companies by size and per sector, Northeast Netherlands

Source: Roland Berger analysis
Developing the value chain between agriculture and chemicals will realize the economic potential of the region

Focus on sectors with most economic potential

<table>
<thead>
<tr>
<th>SECTOR</th>
<th>ECONOMY &quot;AT RISK&quot; (AV1) [EUR bn]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>0.6</td>
</tr>
<tr>
<td>Pharma</td>
<td>0.0</td>
</tr>
<tr>
<td>Nutrition and food</td>
<td>0.0</td>
</tr>
<tr>
<td>Chemicals and materials</td>
<td>1.1</td>
</tr>
<tr>
<td>Transport fuels</td>
<td>0.1</td>
</tr>
<tr>
<td>Heat and electricity</td>
<td>0.1</td>
</tr>
</tbody>
</table>

1) Added value

Focus on Agri-Chemistry Chains

Source: Desk research; Roland Berger analysis
Northeast Netherlands is a major source of biomass, particularly potatoes, sugar beets, grass and wood.

Biomass availability in the Netherlands by (farm) acreage

**High-starch potatoes**
- Netherlands total: 48,000 ha
- NE Netherlands total: 47,000 ha

**Grassland**
- Netherlands total: 1,016,000 ha
- NE Netherlands total: 632,000 ha

**Sugar beets**
- Netherlands total: 82,000 ha
- NE Netherlands total: 30,000 ha

**Wood (forests)**
- Netherlands total: 344,000 ha
- NE Netherlands total: 180,000 ha

1) Shading indicates feedstock acreage; a dark blue province indicates lots of acreage, a white province indicates none.

Source: CBS; LEI; Roland Berger analysis
Four chains fit well with the biomass, knowledge and business activity in Northeast Netherlands

1) AD = Anaerobic digestion; 2) FT synth. = Fischer-Tropsch synthesis; 3) HTU = hydro-thermal upgrading; 4) DME = dimethoxyethane

Source: Interviews; Desk research; Roland Berger analysis
The region is already home to a large number of companies in each chain – This offers a basis for further BBE development

Illustration of business activity by chain, Northeast Netherlands

**Grass chain**

<table>
<thead>
<tr>
<th>KEY SECTOR</th>
<th>SELECTION OF COMPANIES</th>
<th>COLLABORATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGRICULTURE AND DAIRY SECTOR</td>
<td></td>
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<tr>
<td>FOOD/FEED INDUSTRY</td>
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<tr>
<td>PAPER AND FIBER INDUSTRY</td>
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<tr>
<td>GAS INDUSTRY</td>
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**Carbohydrate chain**

<table>
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<td>FOOD/FEED INDUSTRY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHEMICAL INDUSTRY</td>
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</tbody>
</table>

**Wood chain**

<table>
<thead>
<tr>
<th>KEY SECTOR</th>
<th>SELECTION OF COMPANIES</th>
<th>COLLABORATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>FORESTRY</td>
<td></td>
<td></td>
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<tr>
<td>ENERGY AND FUELS</td>
<td></td>
<td></td>
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<tr>
<td>PAPER AND FIBER INDUSTRY</td>
<td></td>
<td></td>
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<tr>
<td>BUILDING AND CONSTRUCTION</td>
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</table>

**Waste streams**

<table>
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<th>KEY SECTOR</th>
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<tbody>
<tr>
<td>AGRO-FOOD</td>
<td></td>
<td></td>
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<tr>
<td>WASTE (WATER) DISPOSAL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PAPER AND CHEMICAL INDUSTRY</td>
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<td></td>
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<tr>
<td>GAS INDUSTRY</td>
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</table>

Source: Desk research; Roland Berger analysis
Each area of Northeast Netherlands has a specific offering and position within the future BBE cluster

Distribution of business activity by chain, Northeast Netherlands

**Grass chain**
- Current pilot plant in Friesland with support from the North Netherlands region
- Huge potential for grasslands in Gelderland and Overijssel

**Carbohydrate chain**
- Strong cluster currently around North Netherlands
- Expansion of application into chemicals and materials means the cluster can expand towards Delfzijl and Drenthe (Emmtec)

**Wood chain**
- Clusters around Delfzijl (e.g. Woodspirit – BioMCN) and around Enschede (e.g. BTG)
- Expansion of application into chemicals and materials means the cluster can expand towards Drenthe (Emmtec)

**Waste streams**
- Potential for valorization of waste streams spans the entire region

Source: Desk research; Roland Berger analysis
By choosing this clustering of chains, Northeast Netherlands' BBE proposition sets it apart from other Dutch regions

BBE clusters in the Netherlands

**PROFILE**

<table>
<thead>
<tr>
<th>Region</th>
<th>Biomass</th>
<th>Conversion</th>
<th>Applications</th>
<th>Academic links</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. ZUID-VLEUGEL</strong></td>
<td>Import and use of horticultural waste streams (Westland)</td>
<td>Focus on fermentation (BE-Basic and BPF) around Delft</td>
<td>Use of biobased feedstock in heavy chemicals</td>
<td>Strong ties with TU Delft; connection with Biobased Delta</td>
</tr>
<tr>
<td><strong>2. BIOBASED DELTA</strong></td>
<td>Use of local agro products (e.g. sugar beets)</td>
<td>Broad focus on product and process development</td>
<td>e.g. perf. materials, agrochemicals, green coatings</td>
<td>TU Delft, University of Gent, WUR</td>
</tr>
<tr>
<td><strong>3. SOUTH HOLLAND</strong></td>
<td>Via Chemelot Institute focus on later steps in value chain</td>
<td>Process development and technology upscaling</td>
<td>Biomedical materials and biobased building blocks</td>
<td>University of Maastricht, TU Eindhoven</td>
</tr>
<tr>
<td>(Limburg)</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Differentiating characteristics of Northeast Netherlands

Source: Desk research; Roland Berger analysis
The innovation demand and the knowledge supply in each chain were compared via an online questionnaire and interviews.

Innovation demand and knowledge supply

**Innovation demand from companies**

150 companies with biobased activities in the region were invited to complete an online questionnaire, and a selection was invited for interviews.

**Knowledge supply from universities/colleges**

More than 60 departments from universities and colleges were invited to complete an online questionnaire about their research. A selection was invited for interviews.

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1) More than 35 interviews were conducted with companies, research institutes and public stakeholders.

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**Source:** Online questionnaire; Interviews
The complementary expertise from the two universities can support innovation across the chain, a good match for the demand

Division of expertise and matching innovation demand and knowledge supply

**INNOVATION DEMAND**

1) Formulated as actions; 2) Generalized division; 3) Leading roles based on the amount of research activity (measure for amount of researchers involved)

<table>
<thead>
<tr>
<th><strong>Bio-&amp;chemocatalytic</strong></th>
<th><strong>Thermal</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>UNIVERSITEIT TWENTE.</strong></td>
<td><strong>UNIVERSITEIT TWENTE.</strong></td>
</tr>
</tbody>
</table>

**EXPERTISE**

- Development of applications with **high added value** for chemicals and materials
- Development of applications with **high added value** for agrifood
- Advancement of applications with **lower added value** such as energy and fuels

**KNOWLEDGE SUPPLY**

- The **University of Twente** plays a leading role in research into **thermal conversion**, **synthetic fibers** and **energy applications**
- The **University of Groningen** plays a leading role in research into **bio- & chemocatalytic conversion** (including **carbohydrates**) and the development of applications in **chemicals and materials**

- Organization of the **entire chain** (biomass to application) and division of returns and risks
- Creation of **laws and regulations** that are **clear**, which **permit** the desired innovations and **stimulate** the sector where necessary

1) Formulated as actions; 2) Generalized division; 3) Leading role is based on the amount of research activity (measure for amount of researchers involved)
Together, businesses and universities can develop high-value applications and advance existing techniques

Summary of technical innovation demands to develop the BBE

**TECHNICAL INNOVATION DEMAND**

1. Development of applications with **high added value** for chemicals and materials
   - The University of Twente plays a leading role in research into thermal conversion and synthetic fibers
   - The University of Groningen plays a leading role in biological conversion for the development of applications with high added value

2. Development of applications with **high added value** for agro-food
   - The University of Groningen plays a leading role in research into carbohydrate conversion
   - *Further involvement of the University of Wageningen seems appropriate given its focus*

3. Advancement of applications with **lower added value** such as energy and fuels
   - The University of Twente plays a leading role in research into energy and fuel applications
   - The University of Groningen plays a leading role in research into energy generation in the grass chain

Source: Questionnaire; Interviews
The non-technical innovation demand from companies mainly encompasses chain development and regulation.

Other major innovation demands to develop the BBE:

<table>
<thead>
<tr>
<th>Priority of non-technical innovation demands [% of companies]</th>
<th>Major innovation demands</th>
<th>Knowledge supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chain development</td>
<td>How should the entire chain from biomass to application be organized, and are returns and risks divided?</td>
<td><strong>University of Groningen</strong></td>
</tr>
<tr>
<td>Laws and regulations</td>
<td>How can laws and regulations be created that are clear, that permit the desired innovations and which stimulate the sector where necessary?</td>
<td></td>
</tr>
<tr>
<td>Logistics</td>
<td>How can biomass supply costs be controlled? These are often a limiting cost item for business cases</td>
<td><strong>University of Twente</strong></td>
</tr>
<tr>
<td>Ethics (e.g. food, fuel)</td>
<td>Around primary biomass, food production can be hindered – Are there alternatives?</td>
<td></td>
</tr>
</tbody>
</table>

1) Comprises more than 15 research groups

Source: Questionnaire; Interviews
The region's strengths in the selected chains form the foundation for the successful development of the region's BBE

Regional strengths for further BBE development

ACCESS TO BIOMASS
• Northeast Netherlands has large quantities of its own biomass available for the economic development of the chains
• The region has good logistics and access points for biomass supply/import
• Solid initiatives have been undertaken in the region to actively promote the development of the chains
• Developed initiatives are broadly supported by all stakeholders in the chains, including regional government

STRONG BUSINESS ACTIVITY
• Northeast Netherlands has a relatively large economic sector in the selected chains
• Companies actively seek and are involved in biobased innovation in the chains
• Research institutions are accessible to companies and are active in valorization

ACTIVE CLUSTER
• Northeast Netherlands has an active and first-rate knowledge base involved in the further development of the chains

EXCELLENT KNOWLEDGE
A public-private partnership can remove the remaining bottlenecks in the regional BBE’s current development

Bottlenecks in the further development of the biobased economy

<table>
<thead>
<tr>
<th>Bottleneck</th>
<th>Description</th>
<th>Public-private partnership</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Lack of shared vision</strong></td>
<td>Companies indicate that neither chain partners nor social partners share a vision</td>
<td></td>
</tr>
<tr>
<td><strong>2. Lack of transparency in the chains</strong></td>
<td>53% of companies name chain development as an innovation demand. With no business case worked out for the entire chain, it is a risk to start to grow</td>
<td><strong>CHAIN COORDINATION</strong></td>
</tr>
<tr>
<td><strong>3. Lack of resources</strong></td>
<td>56% of companies have insufficient means or capacity in their R&amp;D departments – The fragmentation of subsidies has hampered the building of critical mass</td>
<td><strong>COMMUNITY COORDINATION</strong></td>
</tr>
<tr>
<td></td>
<td>51% of companies indicate that laws and regulations hold back innovation</td>
<td><strong>COMPANIES</strong></td>
</tr>
<tr>
<td><strong>4. Lack of profile as BBE region</strong></td>
<td>Companies indicate that current BBE initiatives are a &quot;hodgepodge&quot; – The region has too low of a profile, which stands in the way of forming a successful cluster</td>
<td><strong>RESEARCH INSTITUTIONS</strong></td>
</tr>
</tbody>
</table>

Source: Online questionnaire; Interviews; Roland Berger analysis