Circular Bioeconomy in Finland

Kari Herlevi, 13th of October 2015
Finnish Innovation Fund Sitra
World Resources Forum
Oil related risks are increasing...

...BUT OUR FORESTS ARE FULL OF "CIRCULAR GREEN GOLD".

Peak oil?
Availability?
Future price?
Dependence on imports
Carbon asset risk

Graph data: EIA

...as are the risks related to many other resources...

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<thead>
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<tbody>
<tr>
<td>Iron ore</td>
<td>75</td>
<td>61</td>
<td>206</td>
<td>High</td>
<td>High</td>
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<td>High</td>
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<tr>
<td>Coking coal</td>
<td>&lt;50</td>
<td>151</td>
<td>104</td>
<td>Medium Low</td>
<td>High</td>
<td>High</td>
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<tr>
<td>Copper</td>
<td>39</td>
<td>144</td>
<td>104</td>
<td>Medium Low</td>
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<td>Medium</td>
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<tr>
<td>Gold</td>
<td>20</td>
<td>104</td>
<td>104</td>
<td>Low</td>
<td>Medium Low</td>
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<tr>
<td>Bauxite/Al²</td>
<td>133</td>
<td>48</td>
<td>72</td>
<td>Medium Low</td>
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<td>Medium</td>
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<tr>
<td>Zinc</td>
<td>21</td>
<td>30</td>
<td>28</td>
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<td>Nickel</td>
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<td>43</td>
<td>29</td>
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<tr>
<td>Silver</td>
<td>23</td>
<td>30</td>
<td>20</td>
<td>Low</td>
<td>Medium</td>
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<tr>
<td>Platinum GM²</td>
<td>174</td>
<td>14</td>
<td>14</td>
<td>Low</td>
<td>Medium</td>
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<tr>
<td>Lead</td>
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<td>77</td>
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<td>Medium Low</td>
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<tr>
<td>Tin</td>
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<td>34</td>
<td>7</td>
<td>Low</td>
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<td>Low</td>
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<tr>
<td>Rare earth</td>
<td>846</td>
<td>11²</td>
<td>11²</td>
<td>High Medium</td>
<td>High</td>
<td>High</td>
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<tr>
<td>Phosphate</td>
<td>406</td>
<td>21</td>
<td>21</td>
<td>High Low</td>
<td>High</td>
<td>High</td>
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<tr>
<td>Potash</td>
<td>263</td>
<td>18</td>
<td>18</td>
<td>High Medium</td>
<td>High</td>
<td>High</td>
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</tbody>
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Circular Economy potential in Finland

2-3 billion euro potential annually, by 2030
(Sitra, McKinsey, Gaia Consulting)
### Some Circular Economy opportunities for Finland

**Sources:** McKinsey, Gaia Consulting

<table>
<thead>
<tr>
<th>Industry</th>
<th>Key Opportunity</th>
<th>Annual Value (EUR millions by 2030)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest, pulp and paper industries</td>
<td>Minimising food waste</td>
<td>165</td>
</tr>
<tr>
<td>Machinery &amp; equipment industry</td>
<td>Sharing and second hand market</td>
<td>230</td>
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<tr>
<td>Construction sector</td>
<td>Construction sector</td>
<td>450</td>
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<tr>
<td>Nutrient circulation</td>
<td>Total</td>
<td>310</td>
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</table>

**Total:** ~1.8 mrnd. €
Paradigm shift – from consumption of nutrients to a nutrient economy

Waste

Raw material

Primary production operators as initiators of change

Consumers create market demand

Uses nutrients

Recovers nutrients

Waste management facility

Nutrient producer

Nutrient seller

Nutrient producer

Wastewater treatment facility

Party leasing nutrients

Jobs, business operations, national economy, vitality of rural areas, new services, healthy environment
Fertilising service concept is a key to the adoption of recycled nutrients

The economic net value for Finland:
EUR 70 million/year

- Added value of the new business model for the service provider: EUR 9 million/year
- Farmer's cost savings: EUR 3 million/year
- Household income: EUR 11 million/year
- Additional turnover for suppliers of recycled nutrient technology, machinery and measuring devices: EUR 28 million/year
- Additional tax revenues of municipalities and the state: EUR 15 million/year

Source and graphics: Gaia Consulting
Sybimar’s closed circulation concept combines energy and food production

**Idea:** Closed circulation concept produces energy, fish and vegetables, and can be tailored according to local, prevailing conditions.

Source: Sybimar.fi
Remarkable potential in the utilization of pulp and paper industry’s side streams: 230 million €/year by 2030

- **Functional Products**
  - EUR 210-220 million

- **Process Waste Streams**
  - EUR 10-20 million

- **Drop-in Products**
  - (value not estimated)

Source: McKinsey
Forest-based biofuels by UPM

UPM is a global company in forest industry.

Idea: Wood (forest residues) based biodiesel which generates up to 80% less CO$_2$-emissions compared to fossil fuels.

Refining and production at commercial scale, 100,000 tonnes per year, began in Finland in 2015.

Source: Upmbiofuels.com
Metsä Fibre’s next-generation bioproduct mill

Metsä Fibre, a company in forest industry, will invest EUR 1.2 billion on bioproduct mill.

**Idea:** In addition to 1.3 million tonnes of pulp production per year, the mill will produce many other bioproducts, such as tall oil, turpentine, and bioenergy. All raw-materials and side streams will be 100% utilized.

Source: Metsä Group - Bioproductmill.com
Biodegradable marking and lubricants by Jarmat


**Idea:** Fully biodegradable and harmless wood marking color and lubricant products produced from the side streams of forest and food industry.

Jarmat’s products provide better performance than mineral oils.
Idea: Production line for new wood building elements (*LVL panels*) which can be used, for example, as load-bearing beams.

The company already offers CLT products for walls, roofs and ceilings.

The production of LVL panels (*laminated veneer lumber*) will start in Q2/2016

A house of CLT (*cross laminated timber*)

Sources: Stora Enso, Woodproducts.fi
5 + 1 key facts about Sitra

1. A gift from Parliament to the 50-year-old Finland

2. An independent foresight agency: futurologist, researcher, visionary, developer, experimentalist, partner, trainer, networker

3. Funded by returns on endowment capital and capital investments

4. Vision of Finland as a successful pioneer in sustainable well-being

5. Vision includes three themes, 6 focus areas and dozens of projects

+ 1 Building our future together
Building a successful Finland for tomorrow

sitra.fi/ekologia/kiertotalous

Facebook.com/SitraFund

@SitraFund
Overall estimation of annual economic added value through more efficient nutrient circulation in Finland, 2013*

<table>
<thead>
<tr>
<th>Category</th>
<th>Value (M€/y)</th>
<th>Source and graphics: Gaia Consulting</th>
</tr>
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<tbody>
<tr>
<td>Fertiliser leasing</td>
<td>70</td>
<td></td>
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<tr>
<td>Broad beans as a replacement for imported soybeans</td>
<td>50</td>
<td></td>
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<tr>
<td>Feed from low-value fish</td>
<td>40</td>
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<tr>
<td>Biogasification as a driver of nutrient cycling</td>
<td>150</td>
<td></td>
</tr>
<tr>
<td>Benefits from the reduced eutrophication of the Baltic Sea</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>Total EUR 510 million</td>
<td>310</td>
<td></td>
</tr>
</tbody>
</table>

*Based on selected examples and demonstrates annual net change on 2030.
Do we wear forest-based textiles in the future?

Photo: Knowpap.com

Textiles from paper mills?

Photo: Treehugger.com. Marimekko’s birch fiber based Allu dress was introduced in 2014.