



Fortum progress in Bio2X plan in India and Europe

3rd EU-India Conference on Advanced Biofuels

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change

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Fortum today

Fortum is an energy and circular economy company offering solutions in electricity, heating and cooling, waste management and recycling.

Climate change, need for decarbonisation and resource efficiency are changing our industry in a profound way.

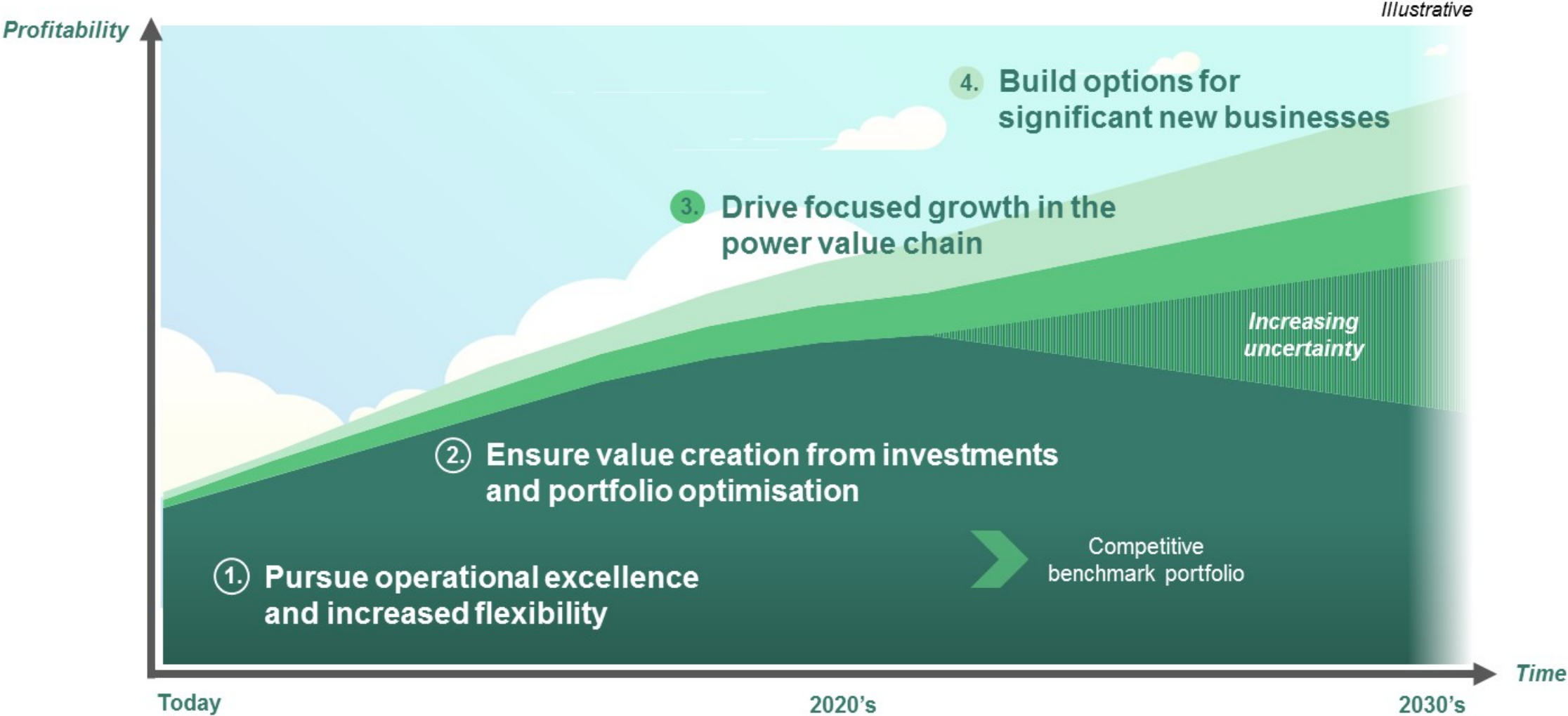
In **biomass** utilization, the focus needs to shift from energy use to higher value use.

In our **Bio2X** program we transform biomass into sustainable high-value end products.

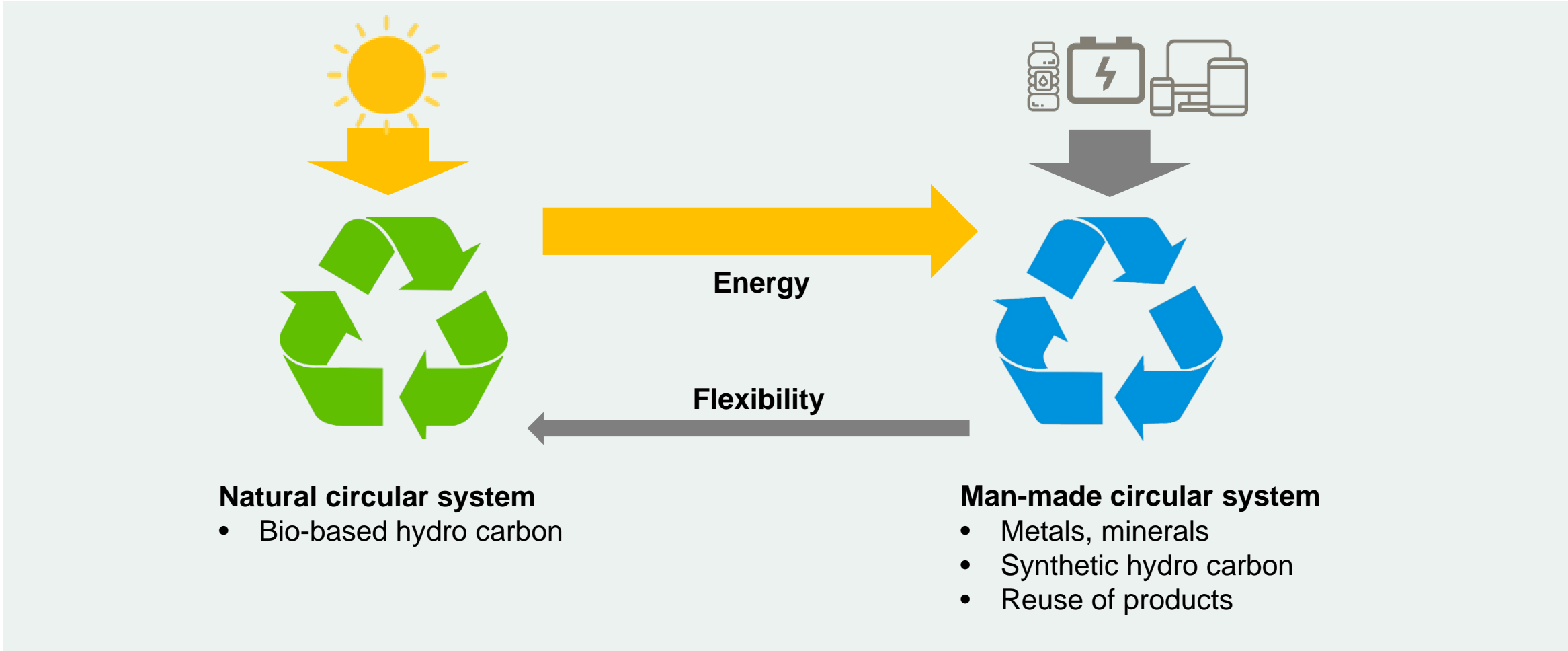
8,300
professionals
in the Nordics,
the Baltics,
Russia, Poland
and India

96% of our
electricity
production is CO₂
free in Europe,
57% in all
operations

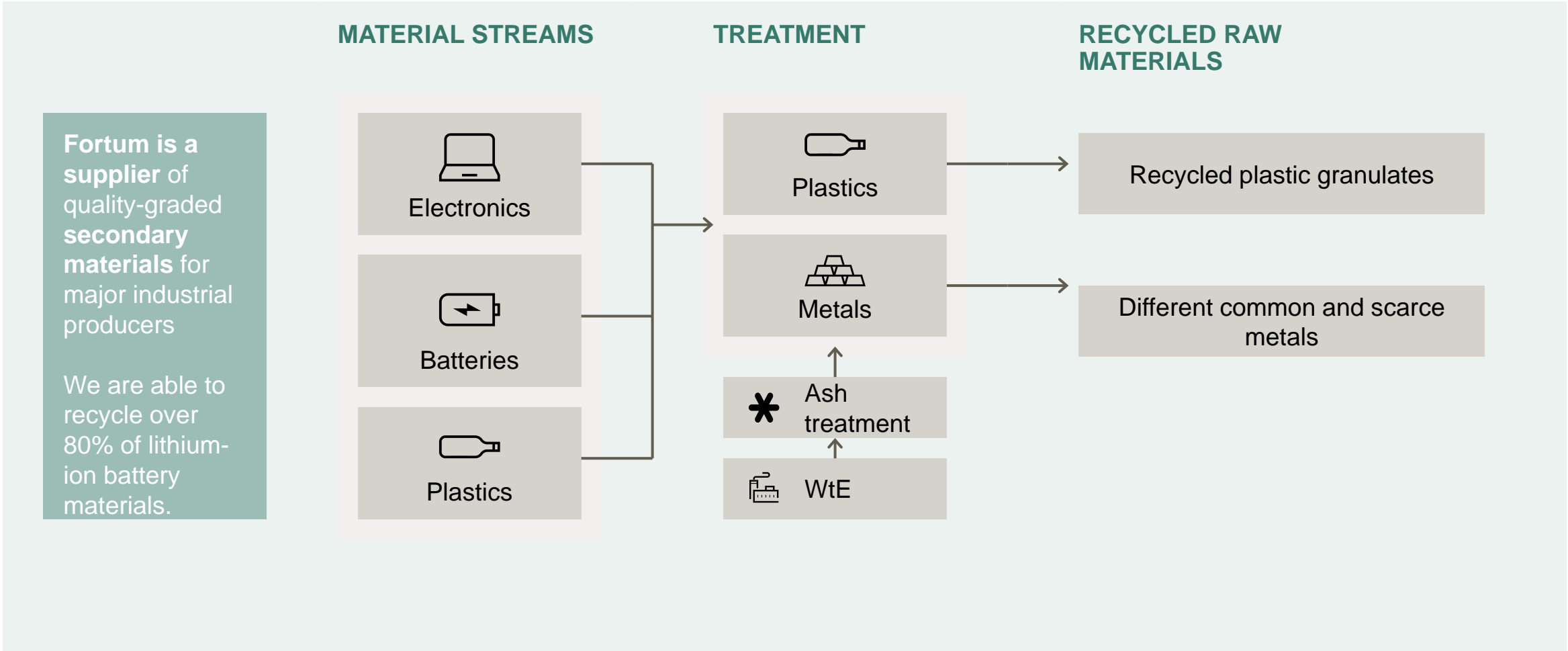
Fortum's vision is even more valid today in updated strategy – *For a cleaner world*



Spearheading material revolution with recycling and bio-based solutions – options for significant new businesses



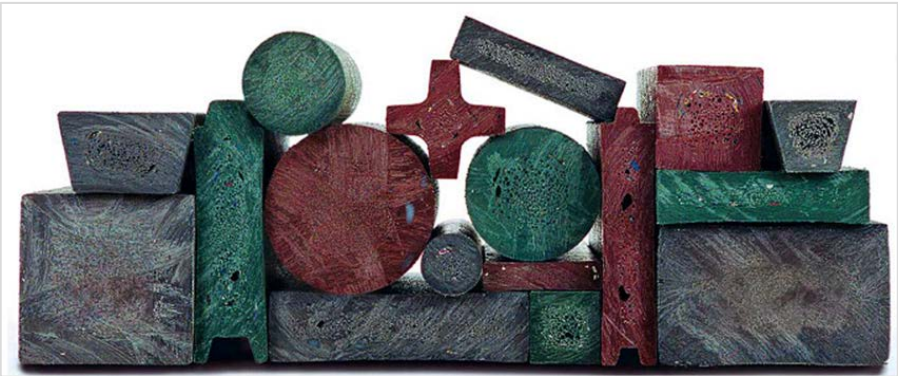
Electronics, batteries, and plastics form an efficient basis for value-adding recycling



Fortum is a supplier of quality-graded secondary materials for major industrial producers

We are able to recycle over 80% of lithium-ion battery materials.

Products from CIRCO® and other Fortum recycled plastics





Fortum
Bio2X

**Our vision:
The straw refiner with superior material
efficiency and leading supplier of
responsible textile fibers**

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**Why do we waste precious natural resources,
and simultaneously pollute the environment?**



Bio2X Key strengths

Utilization of waste – Raw materials otherwise considered as waste replace fossil, other non-sustainable and scarce raw materials

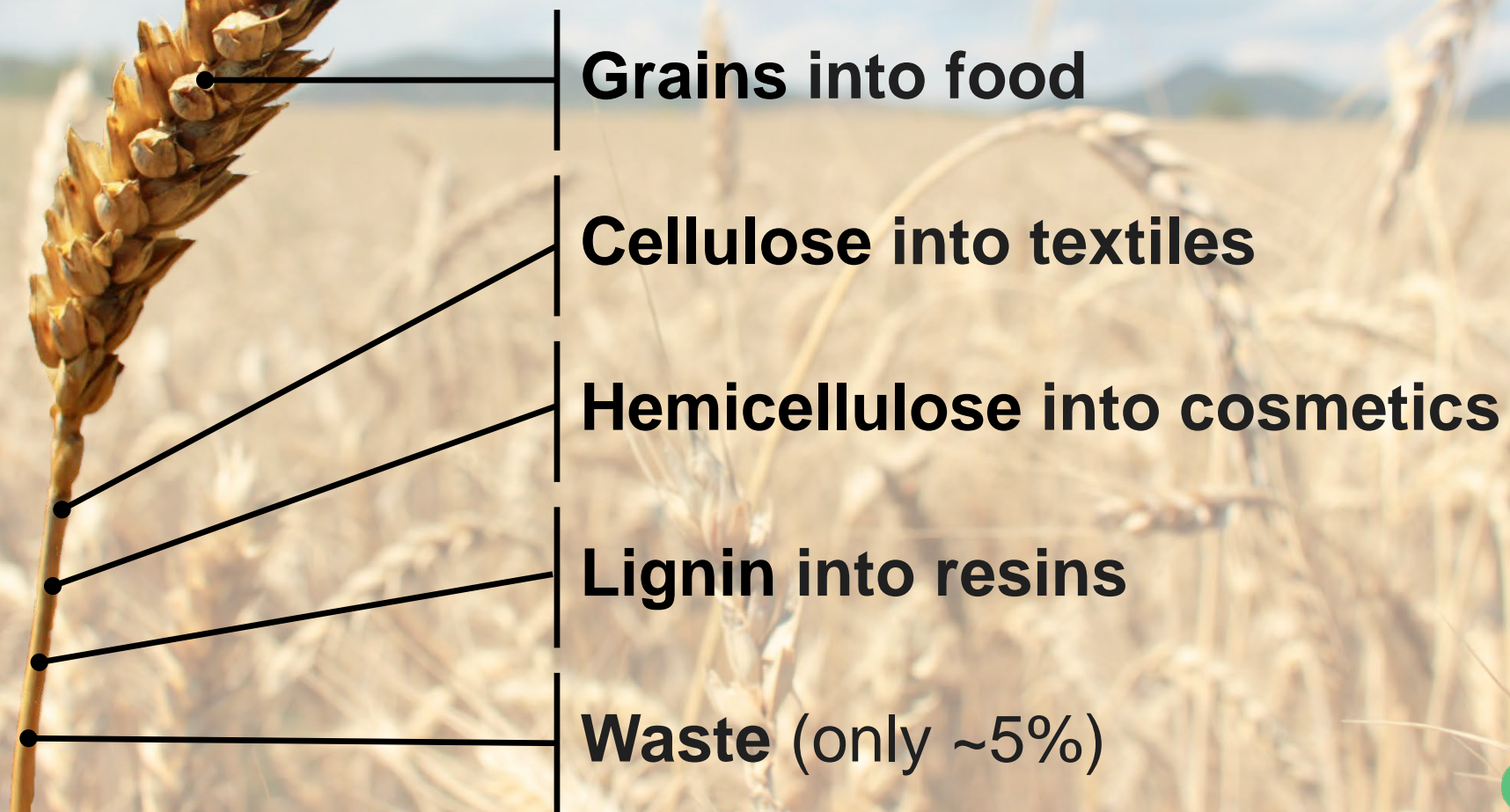
Superior material efficiency – Bio2X fractionation technology enables >90% material efficiency thus leaving minimum amounts of waste

High performance and quality of products – Our outputs are at least on par in performance with materials currently available on the market

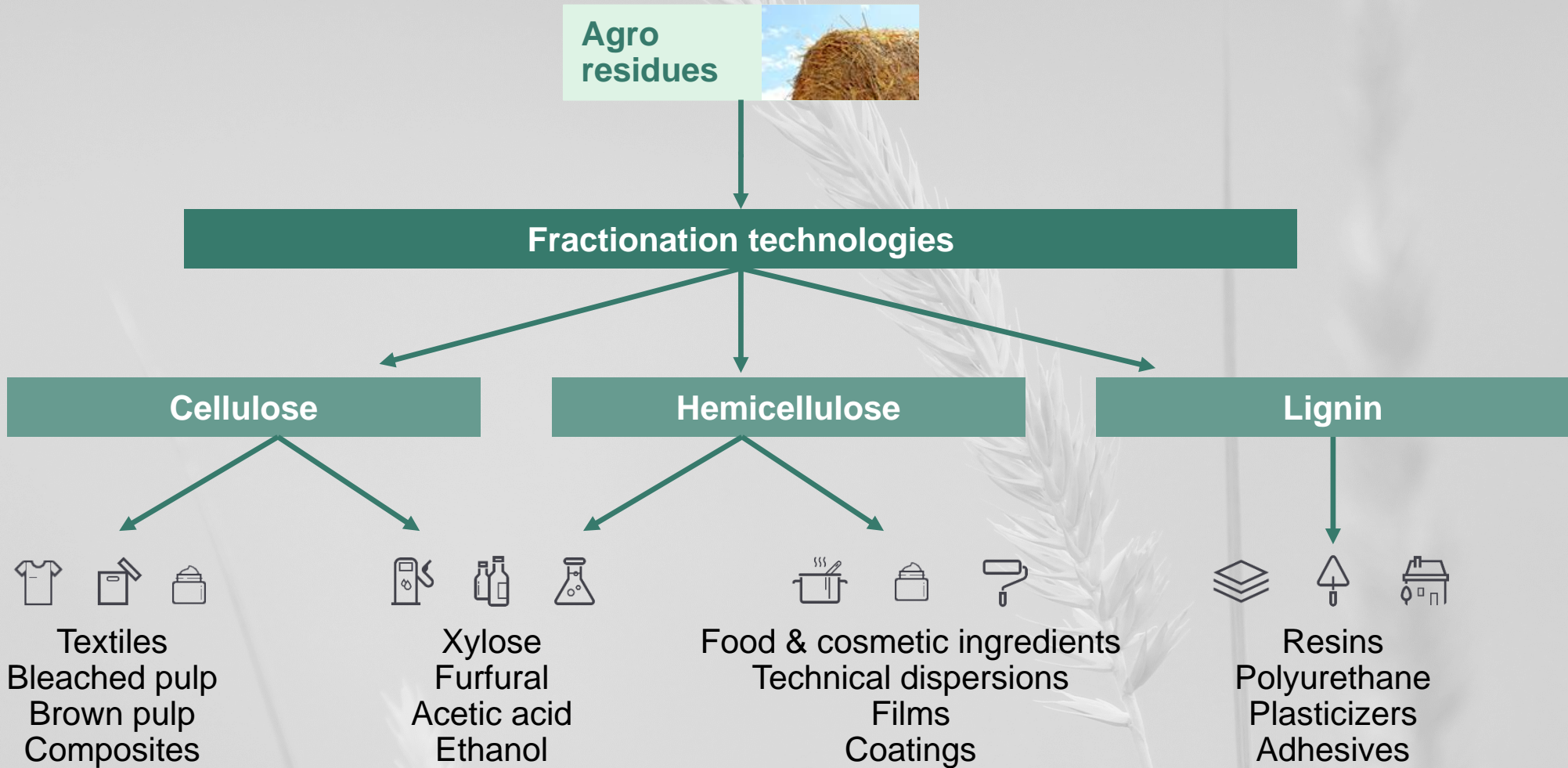
Minimized environmental impact – Excellent LCA (life cycle assessment) results proving the process and the outputs are truly sustainable also in large scale

Ecosystem of local production sites – Instead of a global production hub, multiple production units ensure access to raw materials (in required volumes) and control over social responsibility issues

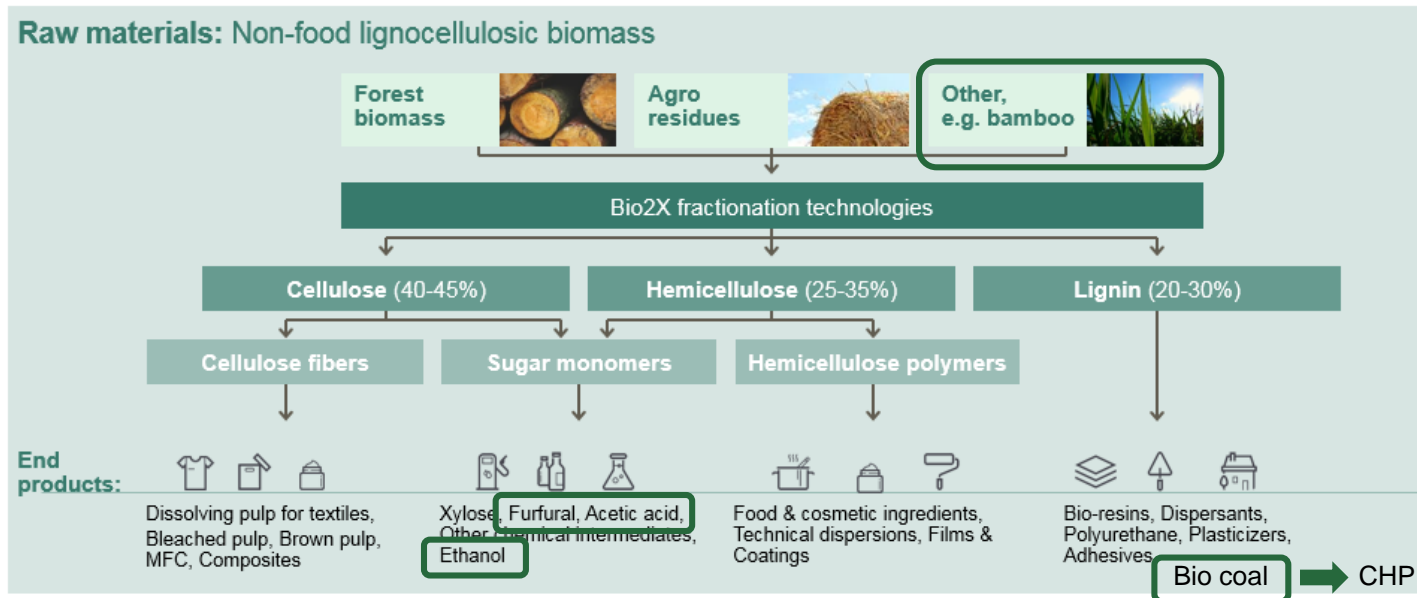
Superior material efficiency



Bio2X



Status in India



- Fortum has established a joint venture ABRPL together with Numaligarh Refinery Limited (NRL) and Chempolis for building and operating a biorefinery in Assam, India.
- The joint venture owns the biorefinery. Construction work ongoing, with the target date for beginning operations at the site set for 2021/2022.
- Raw material local bamboo (feed 300 kt/a, dry)
- The total investment cost estimate is 200 million euros.

Fortum has signed MoU to research paddy straw together with Chaudhary Charan Singh Haryana Agricultural University. The goal is to understand paddy straw availability, value chain and potential locations. In addition work is ongoing to understand product portfolio. The longer term target is towards commercial operations.

First garments ever made of wheat straw introduced at Vancouver Textile Exchange Summit in Oct 2019

- The cooperation of Fortum, Chempolis and Spinnova has given birth to the world's first wheat straw -based clothing prototype.
 - Based on a life-cycle assessment (LCA), the environmental footprint of sourcing, processing and manufacturing the clothing is small compared to alternative raw materials and processes.
 - The clothing includes a knitted t-shirt, as well as a jacket and skirt made of a woven fabric on organic cotton warp.
- Fortum has also invested in sustainable textile technology company Infinited Fiber Company



Lignin and hemicellulose applications also in focus

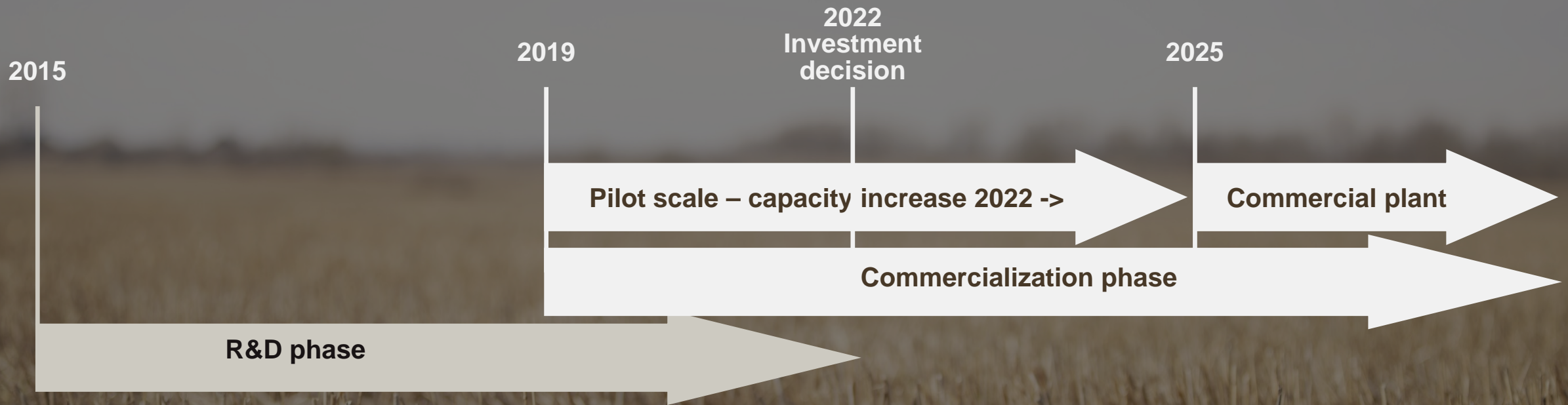
- Lignin is the second most abundant aromatic biopolymer on earth accounting for 20-30 % of biomass.
- Fortum produces lignins with high quality containing only low amount of impurities and ash.
- The target application areas are resins and glues, thermoplastics, concrete additives and asphalt binders where lignin replaces fossil-based components.



- Hemicellulose consists of sugars, the main sugar being xylose.
- The first target application area is xylitol. In longer term, xylose is a versatile platform for a variety of chemicals and materials.
- Part of is hemicellulose converted into furfural, having existing markets e.g. as solvent and resin component.



Fortum Bio2X: From R&D phase towards commercialization to produce textile fibres





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