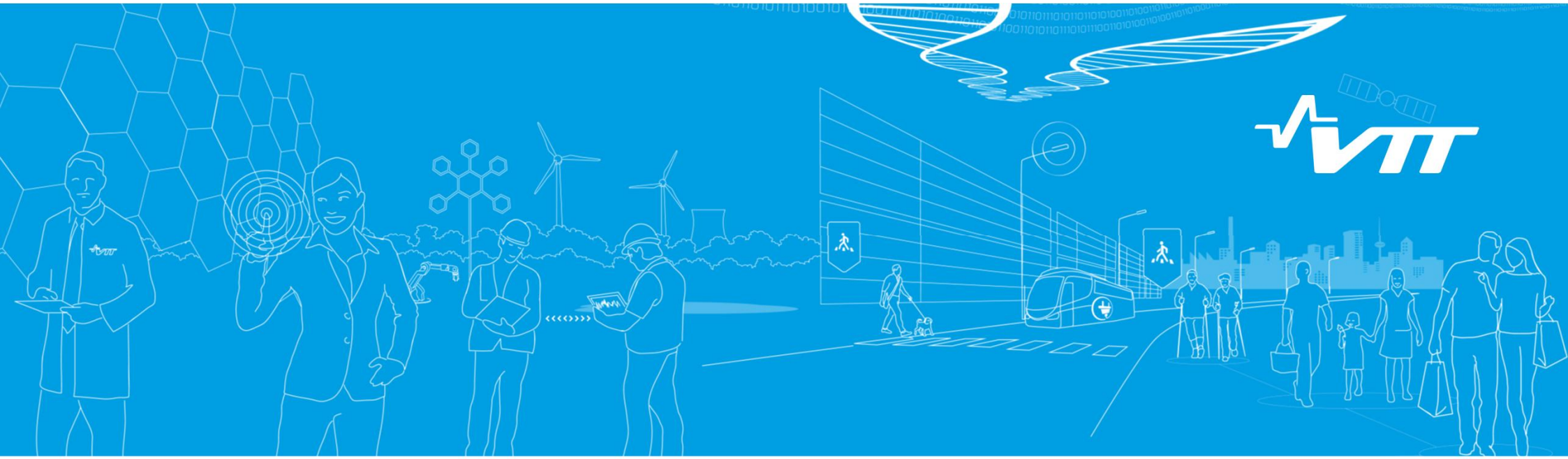


Tulevaisuuden kierrätyskuitu -suljettu kierto Suomessa?

Tekstiilikierrätyksen haasteet ja mahdollisuudet, Lahti 26.3.2015

Ali Harlin, Marja Pitkänen, Pirjo Heikkilä, Marjo Määttänen
Teknologian tutkimuskeskus VTT Oy

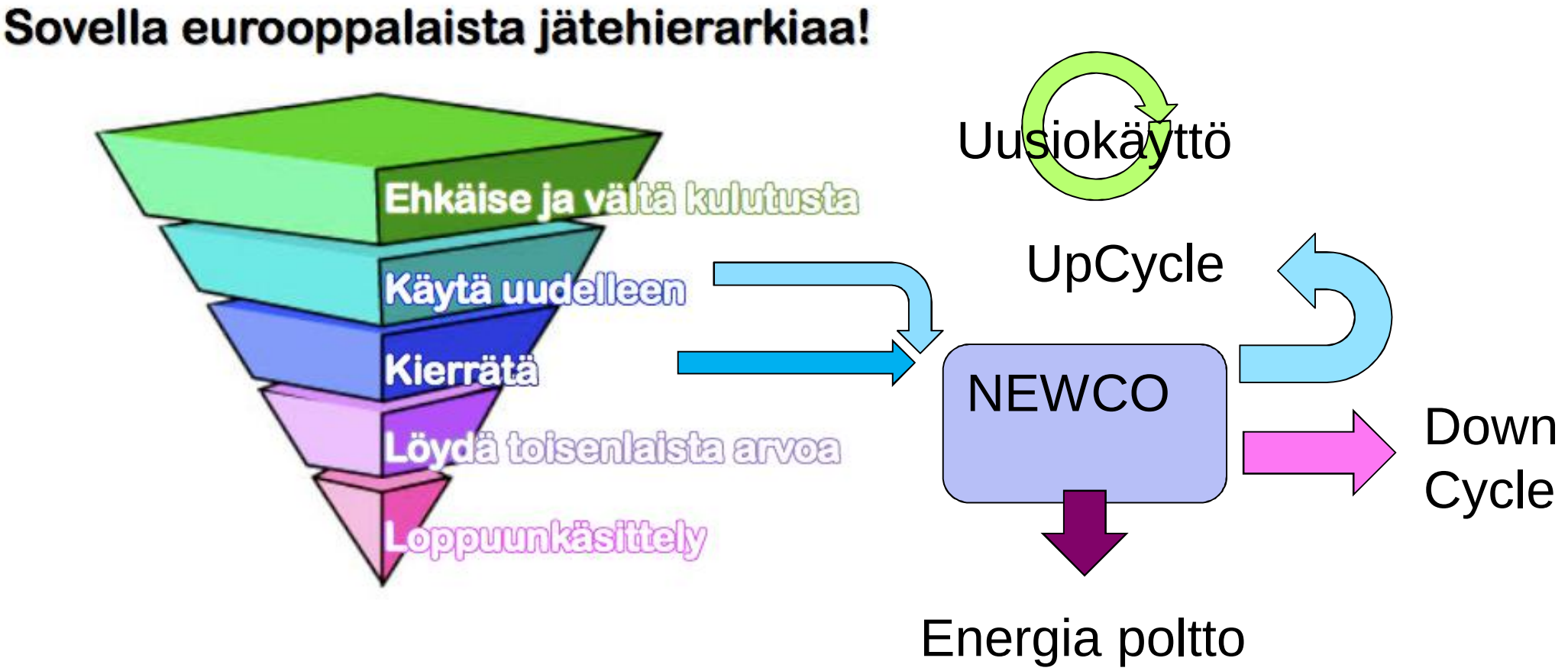
PUUVILLAN YMPÄRISTÖHAASTE

POLYESTERIN ÖLJYPOHJAISUUS

TEKSTIILI POIS KAATOPAIKALTA

POLTTO VIIMEISENÄ

Tekstiilijäteen toimiala



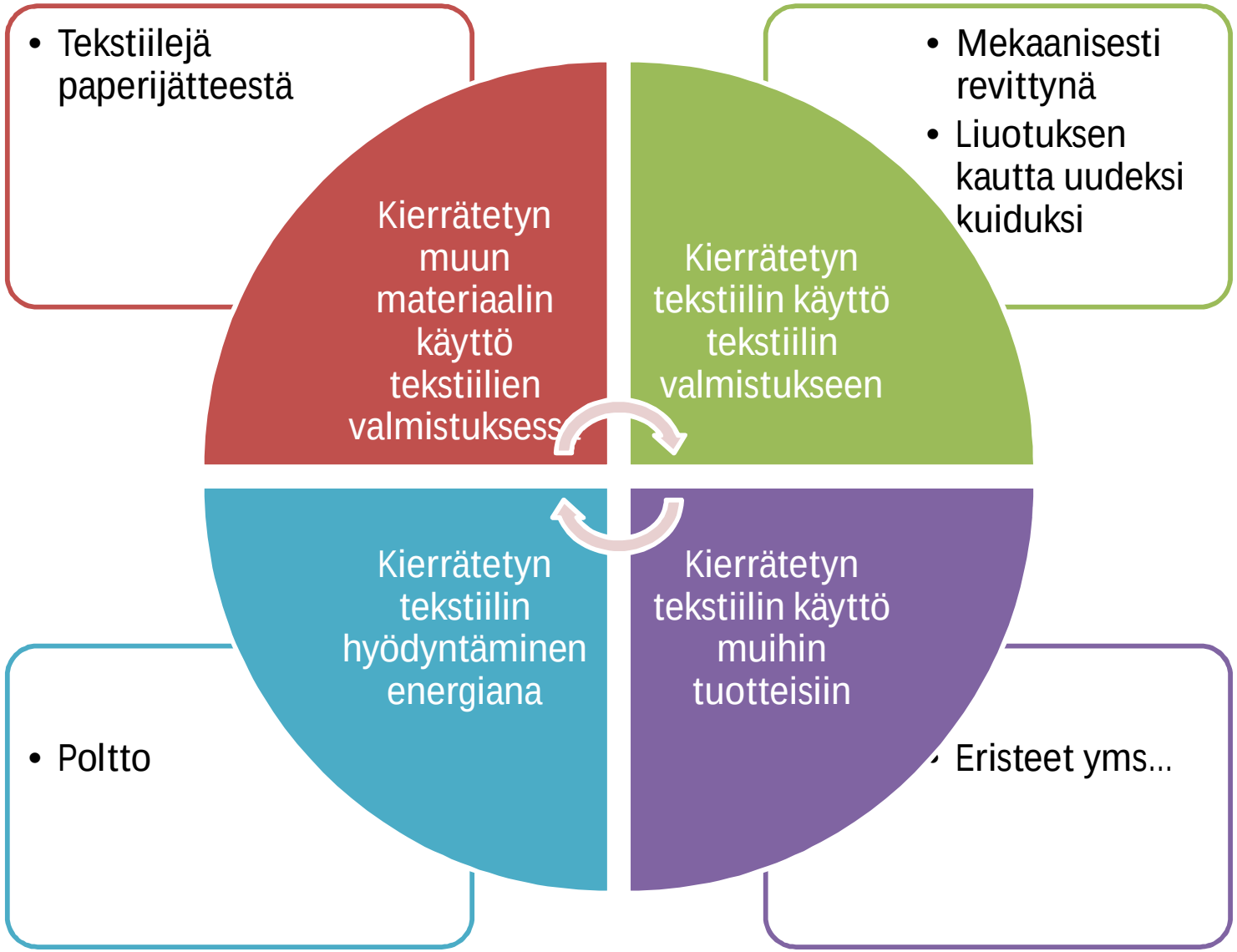
Tekstiilijäte hallinnollisesti

EU: Orgaanisen jätteen vienti kielletty kaatopaikoille 2016 koskee myös tekstiilejä

- The project is part of the Nordic Prime Ministers' green growth initiative, The Nordic Region – leading in green growth. The initiative identifies eight priorities aimed at greening the Nordic economies, one of which is to develop innovative technologies and methods for waste treatment.
- During 2013 a number of EPR options and new business models for extending the active lifetime of textiles products and increasing their recycling at end of life were identified and evaluated.
- The main aim for 2014 is to propose policy packages which would support the more promising of the EPR systems and business models. The packages are intended as inspiration for Nordic governments. An evaluation of the policy packages will subsequently be carried out.
- Pohjoismaat Several reports, e.g.
  - Proposals for policy packages that support EPR-systems and new business models for reuse and recycling of textiles
  - Report 1: Survey of existing EPR-systems and business models
  - Report 2 :Evaluation of eight EPR-systems and business models
  - Report 3: Costs and benefits of EPR-systems and two business models
- and workshops under the title Nordic Workshop on Reuse and Recycling of Textiles

Pohjoismaiden ministerineuvosto on ehdottamassa Tekstiilikeirrätyksen pilotointia 2015

Kierrätysmahdollisuuksia



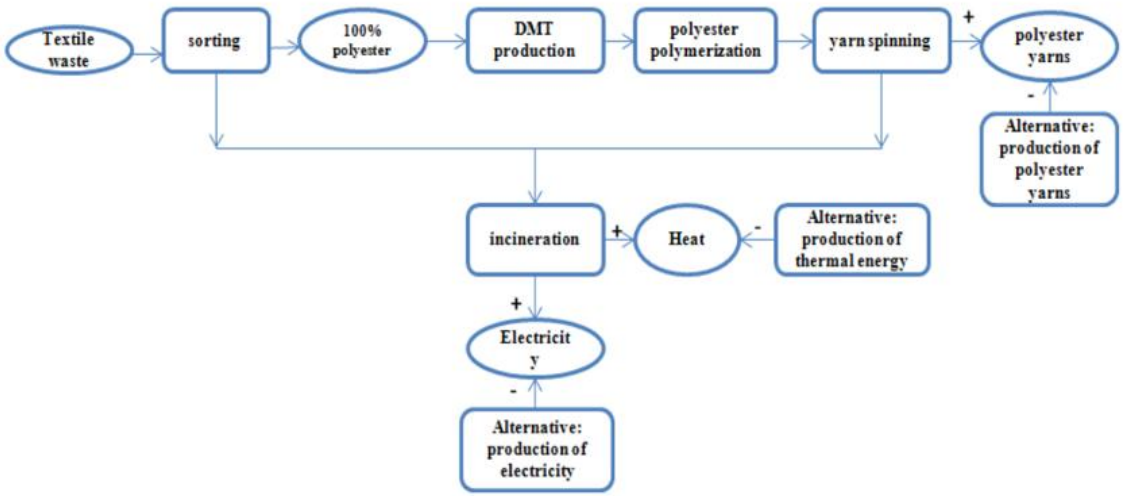
Eco Circle process - a chemical recycling technology

- In the Eco Circle process (Teijin, Japan) polyester is chemically decomposed at the molecular level and then converted into new polyester raw material.
- Purity and quality of the recycled material are both comparable to polyester derived directly from petroleum [1].
- Polyester is broken down and granulated into small pellets. Pellets are decomposed using chemicals, and returned into the raw material (DMT, dimethyl terephthalate) that can be polymerized and spun in to new polyester fibers.[2]
  - Due to confidentiality issues, detailed data on the chemicals and the process is not available.
- Manufacturing cost is about 10-20% higher than virgin material due to higher production costs and investments in the technology and machineries, however, reduction in energy consumption is about 84% and in CO_2 emissions 77% [2].

1. http://www2.teijin-frontier.com/english/sozai/specifics/ecopet-plus.html
2. *Palm et al. (2014) Towards a Nordic textile strategy. Collection, sorting, reuse and recycling of textiles. TemaNord 2014:538, 142 p.*

Patagonia process

- Closed loop recycling of polyester: polyester will be turned into dimethyl terephthalate (DMT) and polymerized to polyester granules in a closed loop.
- Technique applied by Patagonia Co.
  - Manually separated discarded clothes, being 100% polyester, are cut into pieces and broken down until only small granules exist.
  - A chemical reaction is applied to break the granules down into dimethyl terephthalate (DMT).
  - DMT is chemically treated and polymerized to produce polyester granules, and spun into polyester yarns.



Scheme of Patagonia process for quantifying the energy usage and global warming potential of different textile recycling techniques [1].

Zamani (2011) Carbon footprint and energy use of textile recycling techniques. Case study: Sweden. Master of Science Thesis. Chalmers University of Technology, Göteborg, Sweden.

RE:NEWCELL process

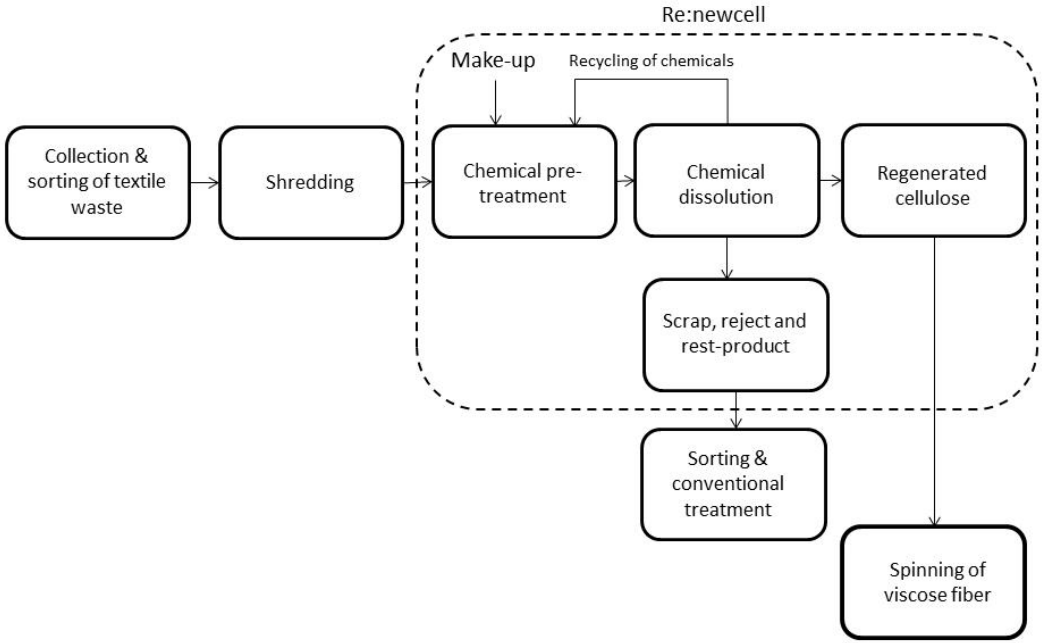


Fig 1. Re:newcell method for producing regenerated cellulose or pulp.

Source: Lena Youhanan. Environmental Assessment of Textile Material Recovery Techniques. Examining Textile Flows in Sweden. Master of Science Thesis, Stockholm, 2013, 98 p.

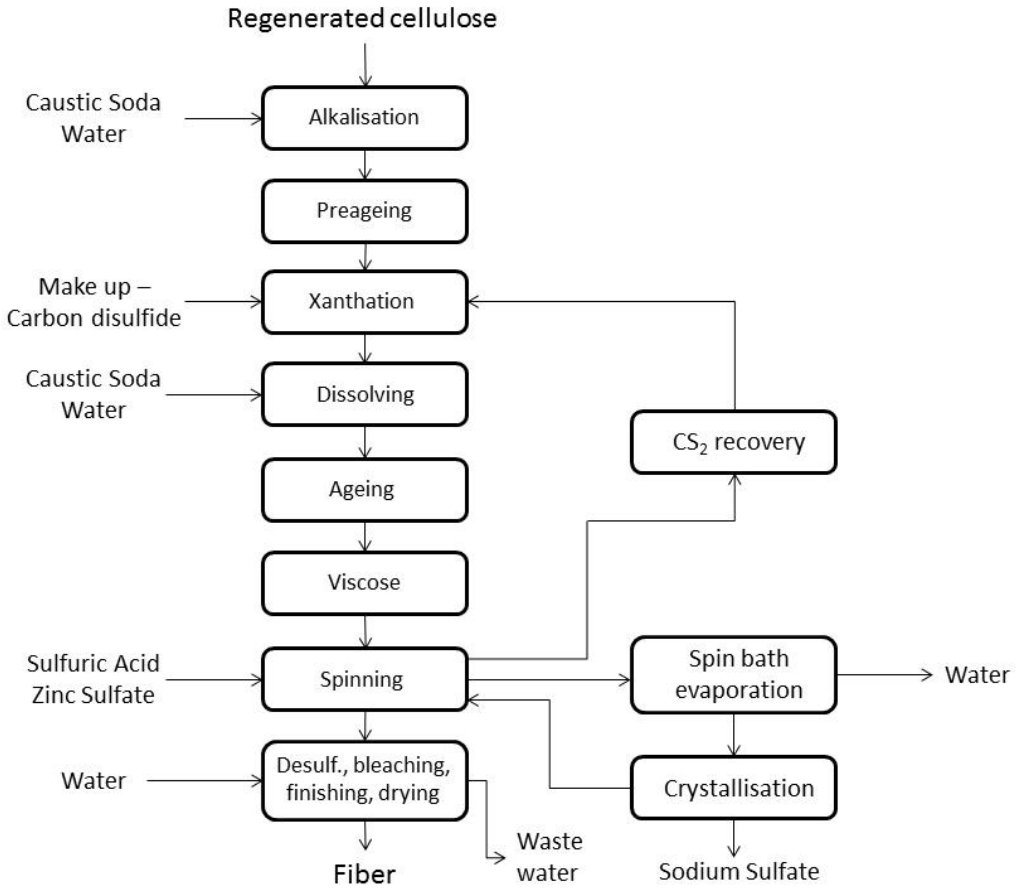
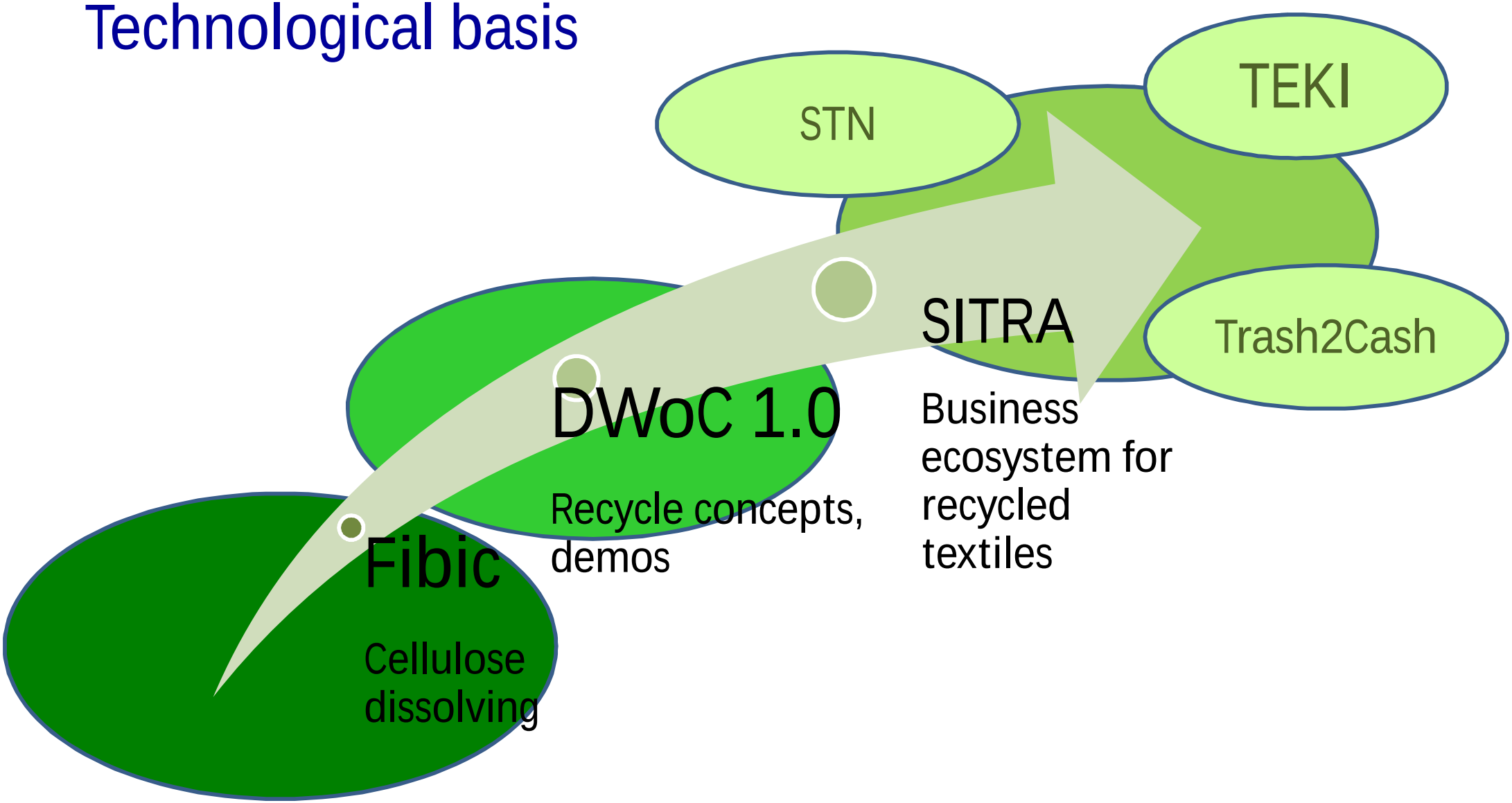


Fig 2. Steps for producing viscose fiber from the pulp.

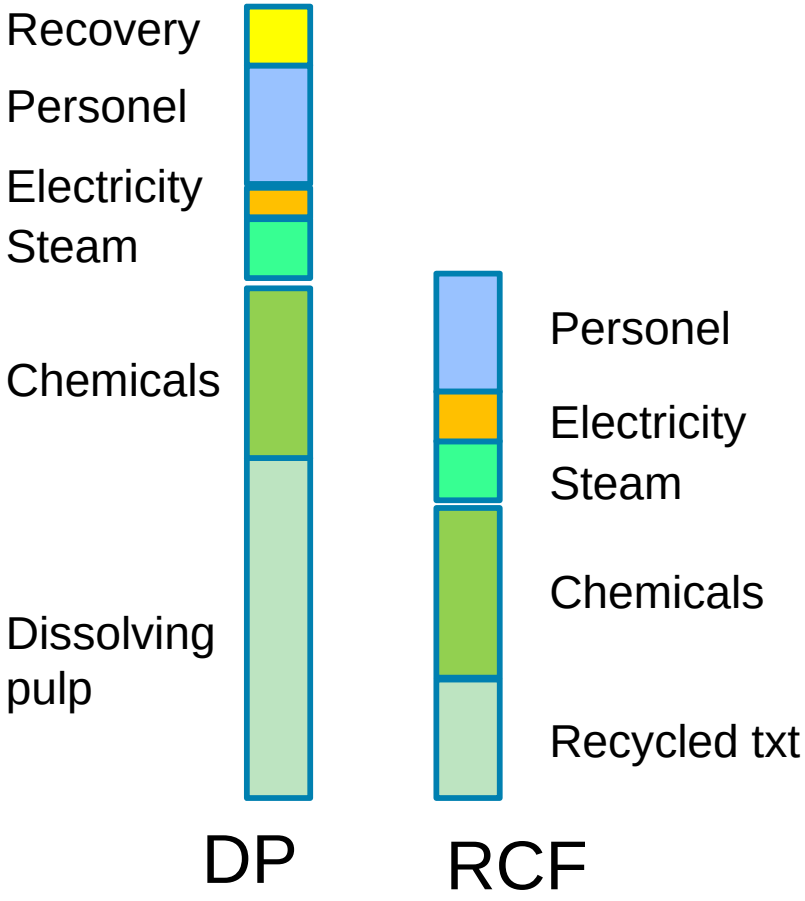
Due to confidentiality issues, detailed data on the Re:newcell process is not available. However, regenerated cellulose is formed in the second chemical treatment step (Re:newcell, 2012: http://renewcell.se/processen.html).

Kohti tekstiilien kiertotaloutta
Technological basis



New value added circular cellulose ecosystems to Finland

Cost structure



PULP

New recycle to be developed

Bioenergy

Fashion

Green building

Interior

Hygienic & Technical textiles

COMPETITIVENESS FOR TISSUE AND NONVOWENS

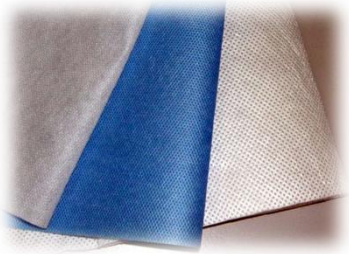
Fluff by extraction

Dissolvin pulp of recycled fibre

ADVANCED RAW MATERIAL COMBINATIONS

Resource-efficiency

Increased value & novel properties



Applications

Fashion and Clothing

For different purposes e.g. street wear, high fashion, work wear, sports wear, accessories etc.

Interior and Living

Home textiles

Contract textiles =
textiles for public premises
e.g. offices, hotels, ships, aviation, hospitals, schools etc.

Technical textiles

Agrotech, Buildtech, Geotech, Indutech, Medtech, Mobiltech, Packtech, Protech
(by Techtextil Fair)


TEKNOLOGIASTA TULOSTA