



Production of **S**olid **S**ustainable **E**nergy **C**arriers  
from Biomass by Means of **TOR**refaction

# SESSION I - Torrefied Fuels Part 3 - Demonstration

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# Session I “Torrefied fuels” - Part 2: Demonstration

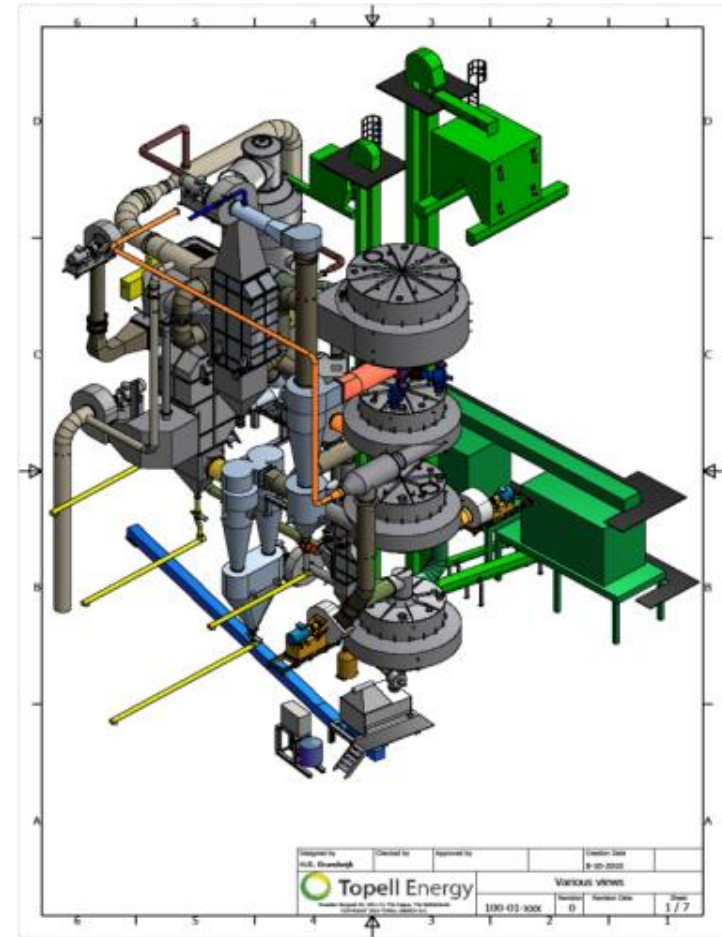
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## WP5: Motivation / Objectives of Work Package

- Production of small and large amounts of torrefied biomass:
  - Production and delivery of torrefied material for activities under other WP’s
  - Demonstrate Topell’s torrefaction technology at commercial scale
- Optimisation of torrefaction system and densification

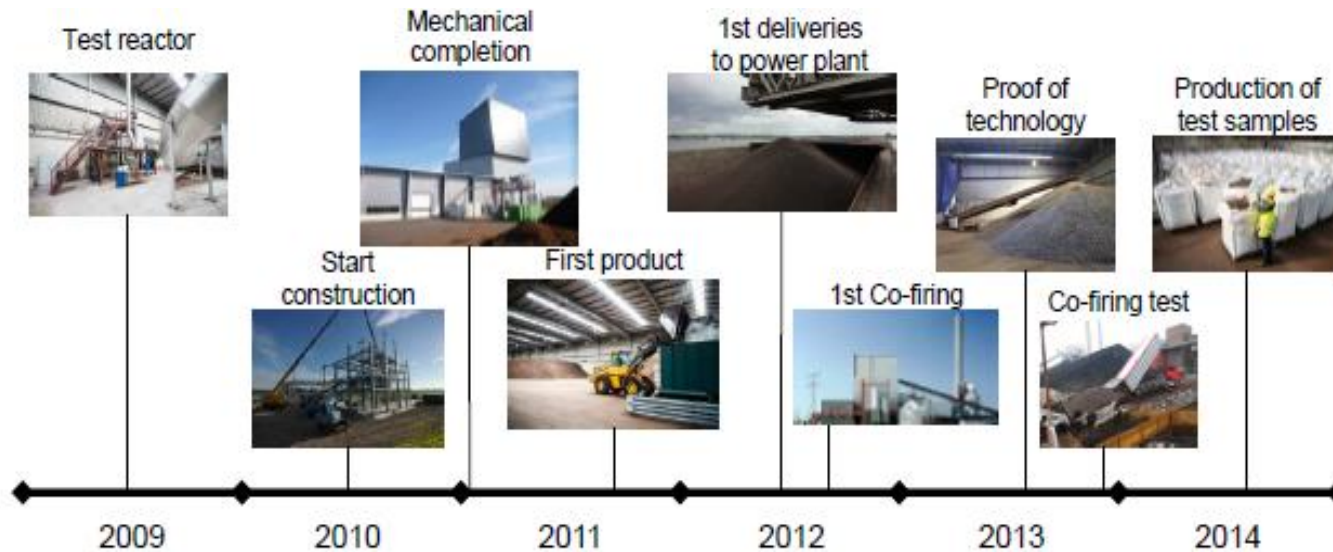
# Topell Torrefaction Plant

- **Pre-conditioning (off-site)**
  - Size reduction to specification
  - No stones
  - No metals
- **Pre-drying (on site)**
  - Feedstock to 10-15wt% moisture
- **Torrefaction**
  - Column of toroidal reactors
  - Direct cooling of torrefied product
- **Densification**
  - Pre-conditioning for pelleting
  - Pelletisation of torrefied material
- **Heat integration**
  - Volatiles burned in combustor
  - Heat demand TTS provided by torrefaction gas
- **Feedstock**
  - Seasonal forest residues



# Progress of Topell's Energy technology

- Activities of Topell Energy including SECTOR



# WP5: Overview of activities

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## January 2012-November 2012

- Production of large amounts of pellets, out of specifications of receivers
  - high ash content
  - low durability
  - high content in dust and fines

## November 2012-June 2013

- Major overhaul plant
  - Change combustor
  - Heat integration
  - Densification process
  - Optimisation of product quality

## July 2013-December 2013

- Production of several thousand tons of pellets from torrefied forest residues
  - All pellets for deliveries under WP5 are produced
  - Increased product quality to specifications of utilities

## WP5: Overview of activities

- Improved plant-process



- Increased product quality



## WP5: Achieved results

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### ■ Total quantities produced and delivered

Material	Quantity (kg)
White chips	61.5
Torrefied chips	51.5
Torrefied pellets	139,887.5
<b>TOTAL</b>	<b>140,000.5</b>

### ■ Use of materials supplied:

- WP4: Densification characterisation and oxygen depletion
- WP6: Outdoor storage (weathering, durability, transport, leaching)
- WP7: Grinding, gasification, co-firing in small and large utilities
- WP8: Characterisation (e.g. Prox/Ult analysis, ash composition)

## WP5: Achieved results

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- **Plant**
  - All changes implemented commissioned and successfully tested
  - Optimisation of torrefaction unit and densification island tested
- **Process**
  - Successful production runs 4-6tons/h
  - Developed production recipes for different feedstocks
  - Several thousands tons of pellets already produced (all demand in the project included)
  - Pellets produced successfully tested in power plant (press release end January 2014)
  - Optimisation of biomass pre-conditioning and product quality accomplished
- **Leading position in the torrefaction sector**
  - Due to the improvements on the process and product quality, Topell achieved a leading position in the torrefaction market.



## WP5: Progress beyond state of the art

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- Proof of concept of Topell's torrefaction system in 2013 at commercial scale.
- Achieved continuous production of torrefied material and pellets from torrefied biomass at commercial scale with a smooth and easy operating system.
- Achieved and demonstrated continuous production of pellets from torrefied biomass at commercial scale with the product quality required by end consumer (co-firing biomass in power plants).
- Achieved and demonstrated full heat integration within the plant, including using the torgas produced during torrefaction process to supply most of the heat demand of the plant, including the drying and the torrefaction steps.
- Proofed the viability of co-milling and co-firing with coal up to 25wt% on one coal mill/burner.
- Proof that for torrefied pellets lower quality feedstock can be used compared to wood pellets.

## WP 5: Further research required (follow-up activities)

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### ■ Challenges

- Market for product
- Policies affecting the product/usage
- End users demands (depending on utility and feedstock)
- Production capacity vs life time of equipment
- Hydrophobicity product

### ■ Research topics:

- Definition of torrefaction recipes for other feedstocks and mixtures per technology
- Definition of densification recipes for other feedstocks and mixtures per technology
- Hydrophobicity of product - outdoor storage
- Further optimisation of the process and technology



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thank you very much for your attention!



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