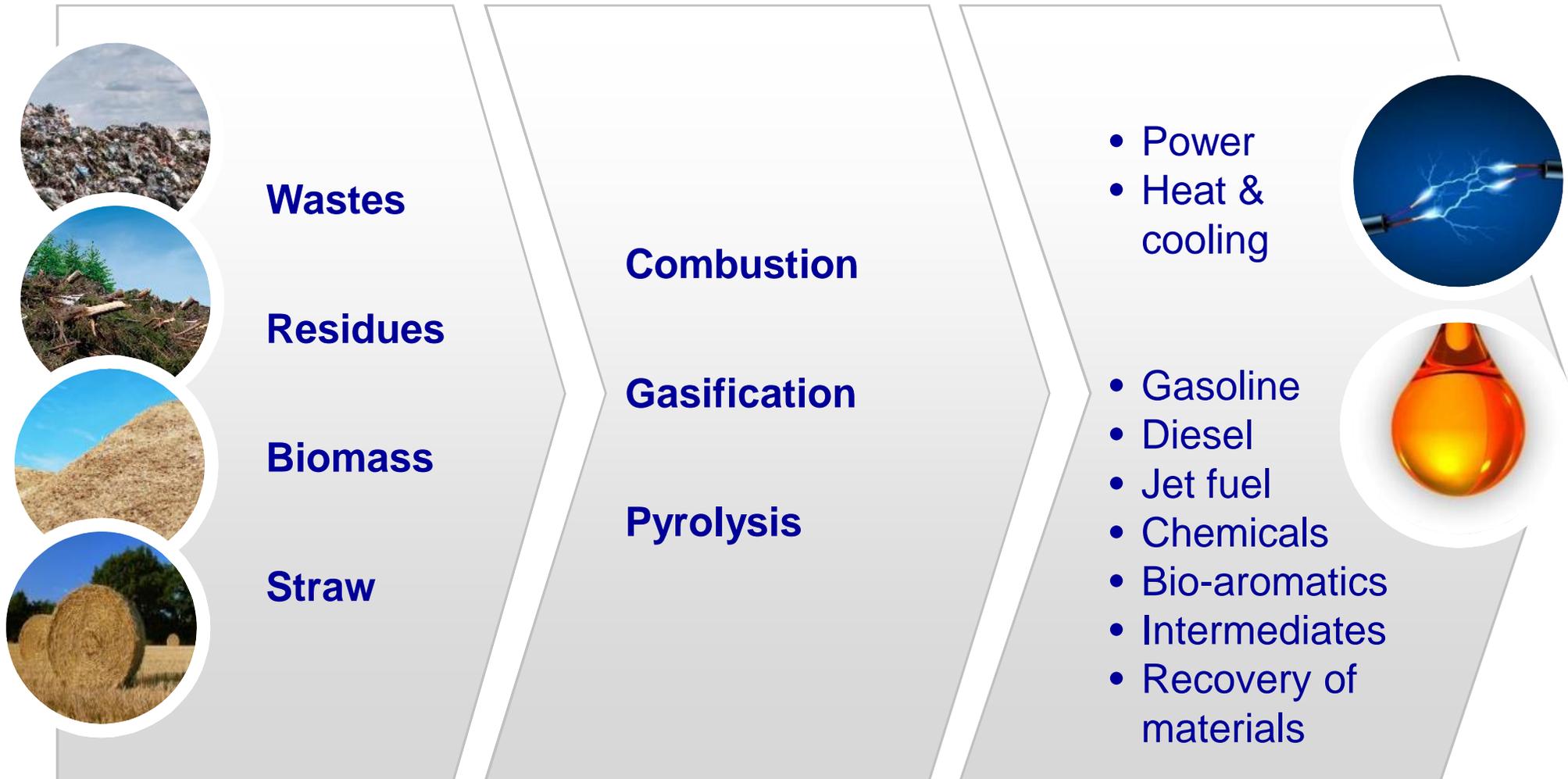




# From research to innovations – some examples

Jussi Manninen, VTT Ltd

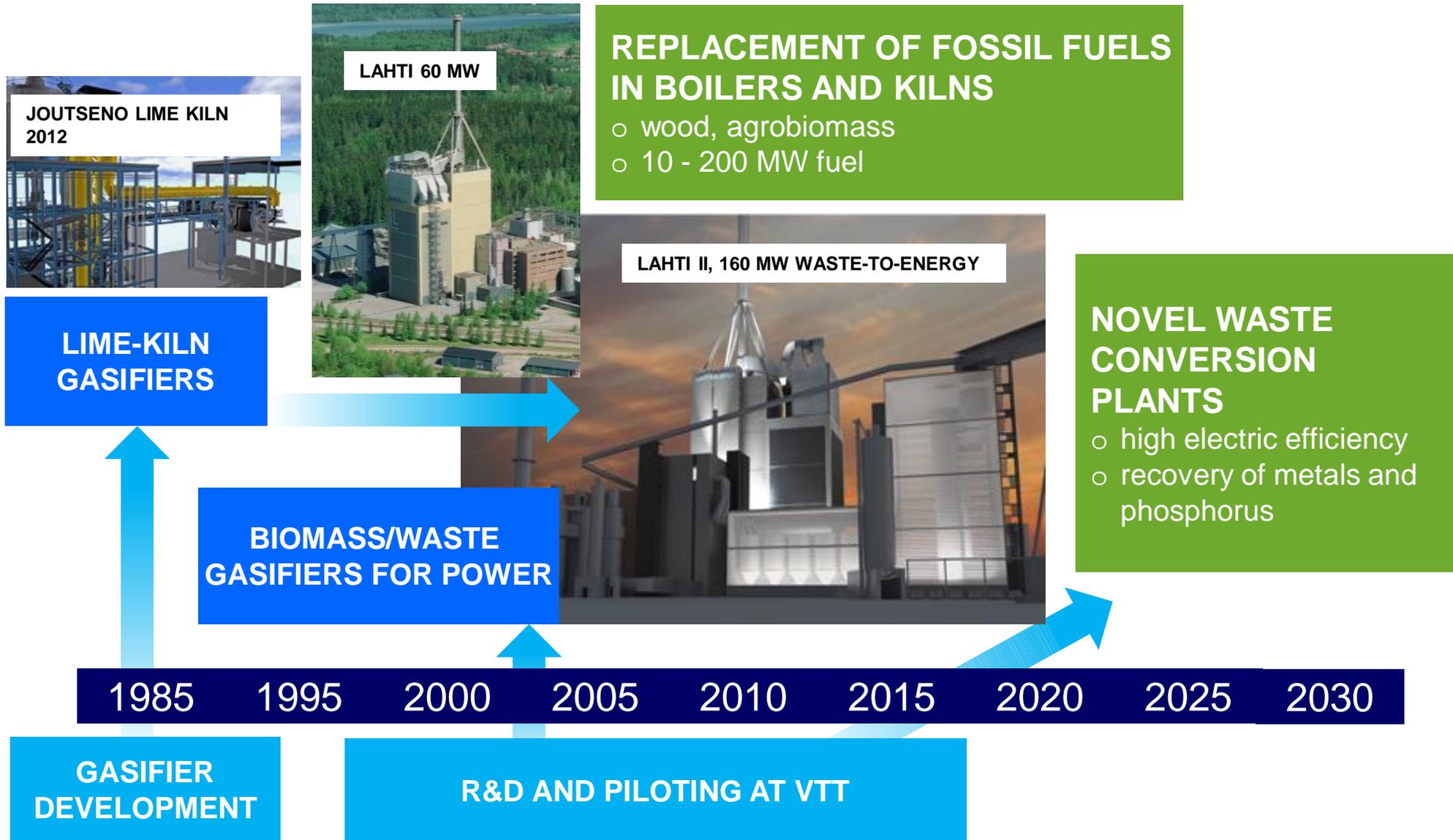
# VTT biomass thermochemical conversion platform



# Biomass and waste gasification for boilers and kilns



- Industrial experience in Finland since 1980's supported by VTT's R&D activities

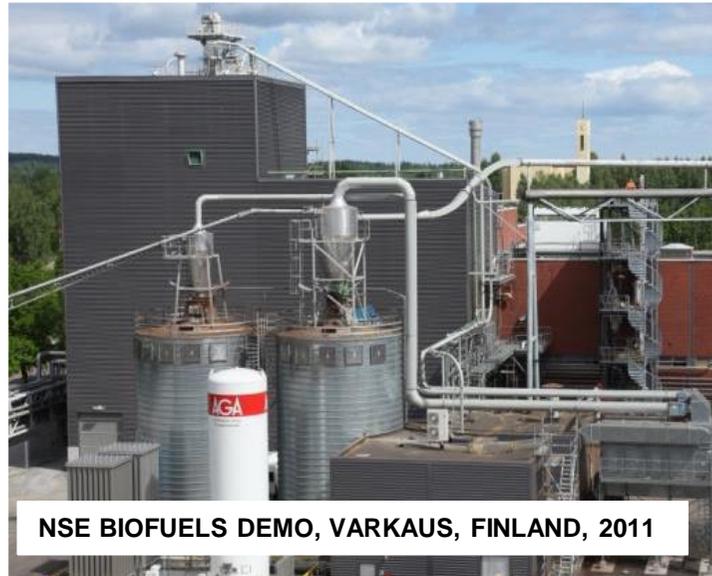


# Biomass gasification for biofuels and bio-chemicals

- Long experience of medium-to-large scale thermochemical biorefineries



PEAT AMMONIA PLANT  
OULU, FINLAND, 1991



NSE BIOFUELS DEMO, VARKAUS, FINLAND, 2011



PILOT PLANT AT VTT BIORUUKKI, ESPOO, 2016



COAL GASIFIER  
APPLIED FOR  
PEAT AND WOOD

LARGE-SCALE GASIFICATION  
SPECIALLY DEVELOPED  
FOR WOOD FEEDSTOCKS

NEW PROCESS FOR SMALLER  
SCALE AND WITH LOWER CAPEX

# Road map for medium-scale low CapEx BTL process via piloting and demonstration

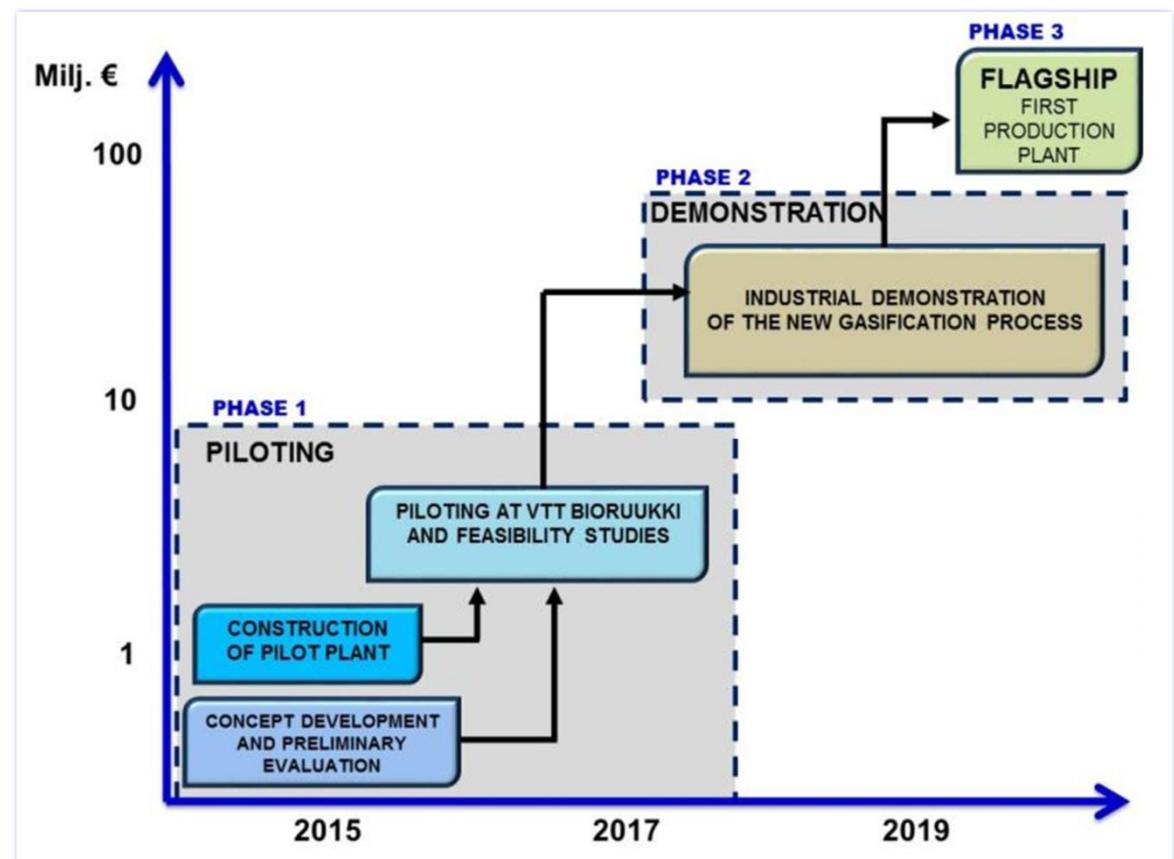
**Phase 1:** Piloting at Bioruukki & system studies 2016 - 2018, 3 M€

**Phase 2:** Demonstration at an industrial site 2019 - 2020, 30-50 M€

**Phase 3:** First production plant, 220 M€; investment decision 2020

**Phase 4:** Replication at global markets at 150 - 250 M€/plant

- 2025: 5 plants
- 2030: 10 - 20 plants
- 2030 > full market penetration

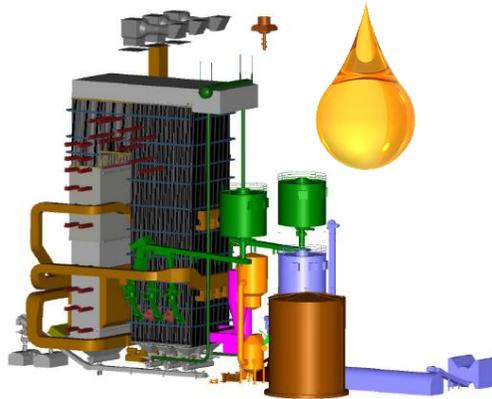


# Phased implementation of biofuel industry based on integrated pyrolysis – a demonstration plant

**BIOMASS**



Forest residues

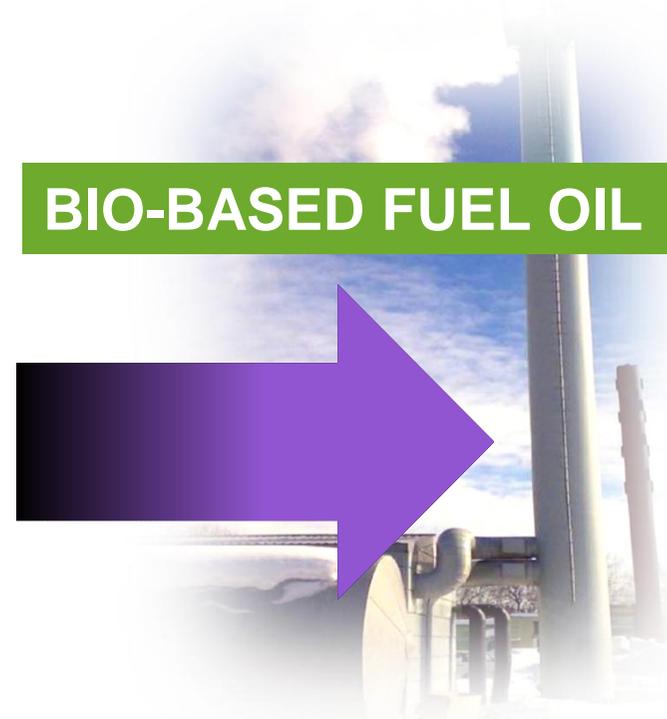


Integrated fast pyrolysis

**BIO-BASED FUEL OIL**



Production of heat in urban areas



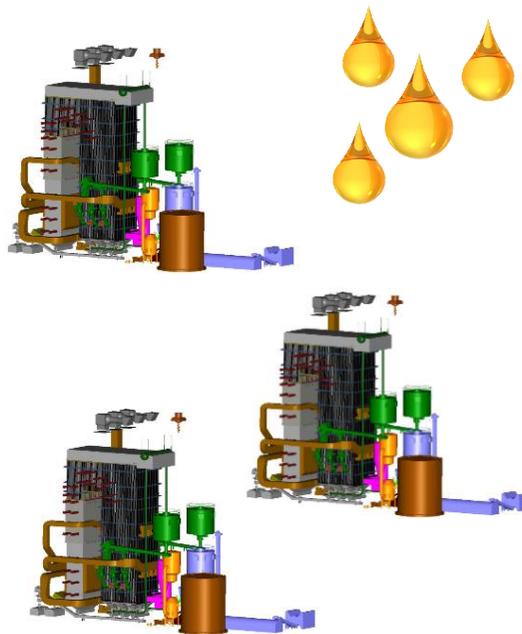
Accomplished 2015

# Reducing the investor risk, building up capacity – Co-refining on bio-oil in refineries

**BIOMASS**



**Forest residues**  
**Agricultural residues**



**Pyrolysis and fractionation**

**BIO-BASED FUEL OIL**  
**REFINERY BIO OIL**

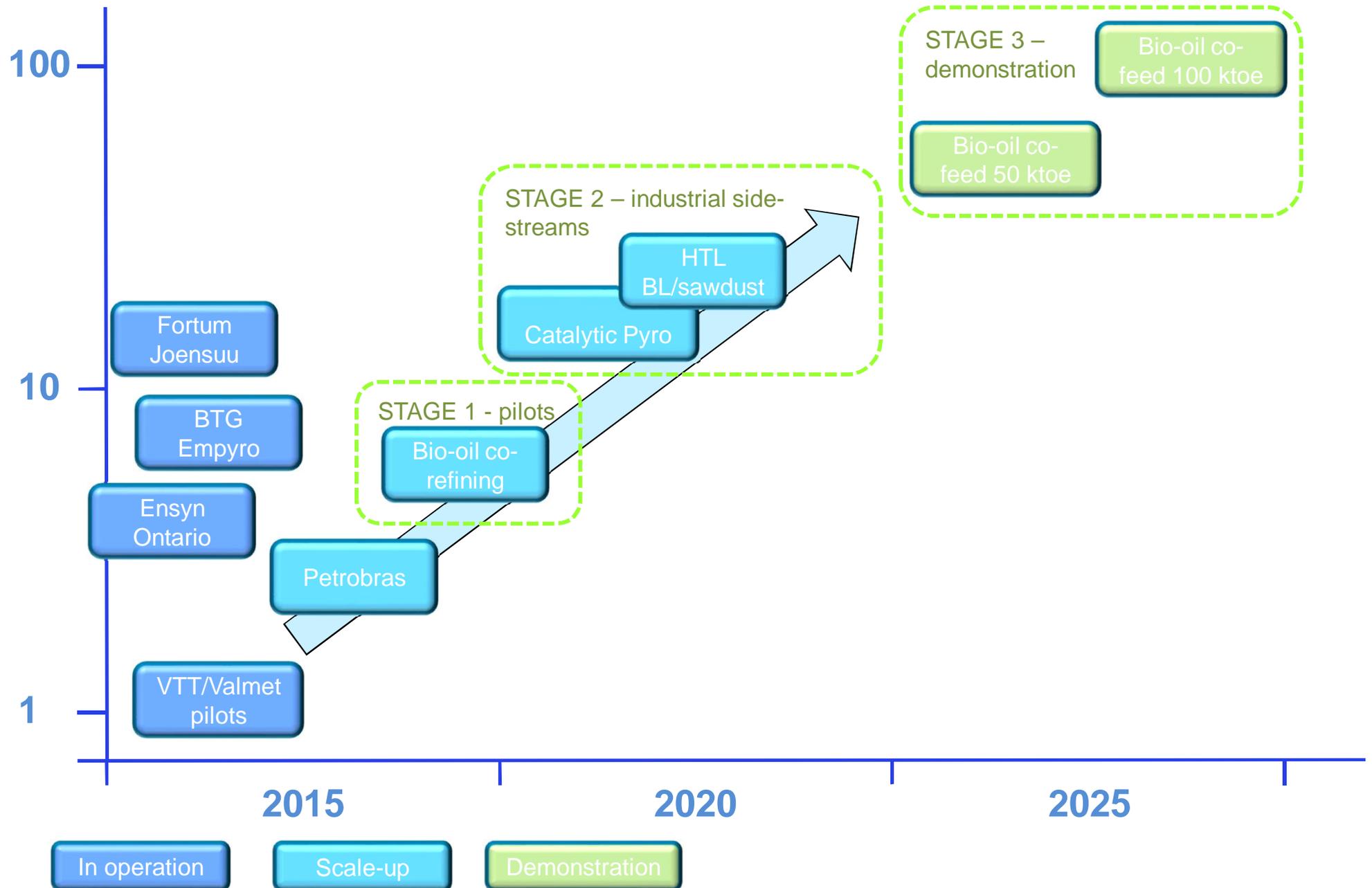


**Co-refining with mineral oil**  
**By-production of chemicals**  
**Power and heat production**



# Future Developments for Bio-Oil

Investment M€



# Bioruukki R&D center for biomass

- Complete development services including laboratory and pilot scales supported by state-of-the-art CFD-modelling



- **Gasification, gas cleaning and conditioning**
- **Fast pyrolysis (thermal & catalytic) and bio-oil co-refining**

- Fluidised bed gasification test facilities from laboratory to pilot scale
- Cutting-edge tools for techno-economic evaluations and process modelling (CFD, ASPEN, Balas)
- Unique catalyst testing laboratory
- Mobile slip stream testing facilities
- Analytical services to your sites
- Commissioning services to your pilot sites



PAPTIC® is a revolutionary  
new material made of  
wood fiber, enabling sustainable  
brands and retailers to shift from  
non-degradable plastics to  
renewable, recyclable and  
re-usable material

# COMMERCIALISING A NOVEL BIOBASED MATERIAL



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INTENSIVE  
DEMAND FOR A  
WOODBASED  
ALTERNATIVE FOR  
PLASTIC ON THE  
MARKET

---

CHICKEN, ITS  
DAUGHTER AND  
AN EGG -  
PHENOMENON



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LEGISLATION, NORMS AND  
OLD INDUSTRY  
STANDARDS SHOULD NOT  
BE ALLOWED TO SLOW  
DOWN DEVELOPMENT