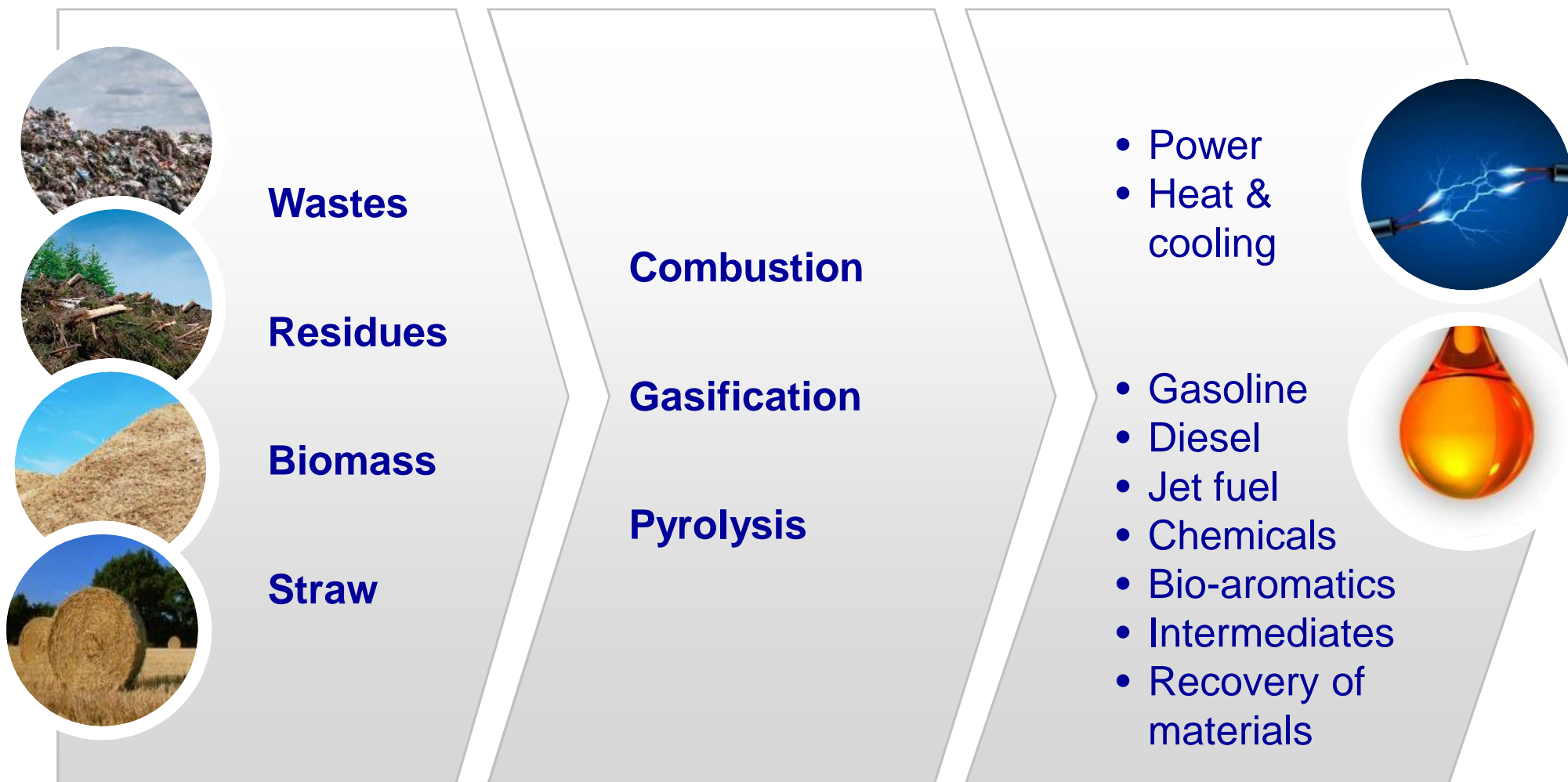




# **From research to innovations – some examples**

**Jussi Manninen, VTT Ltd**

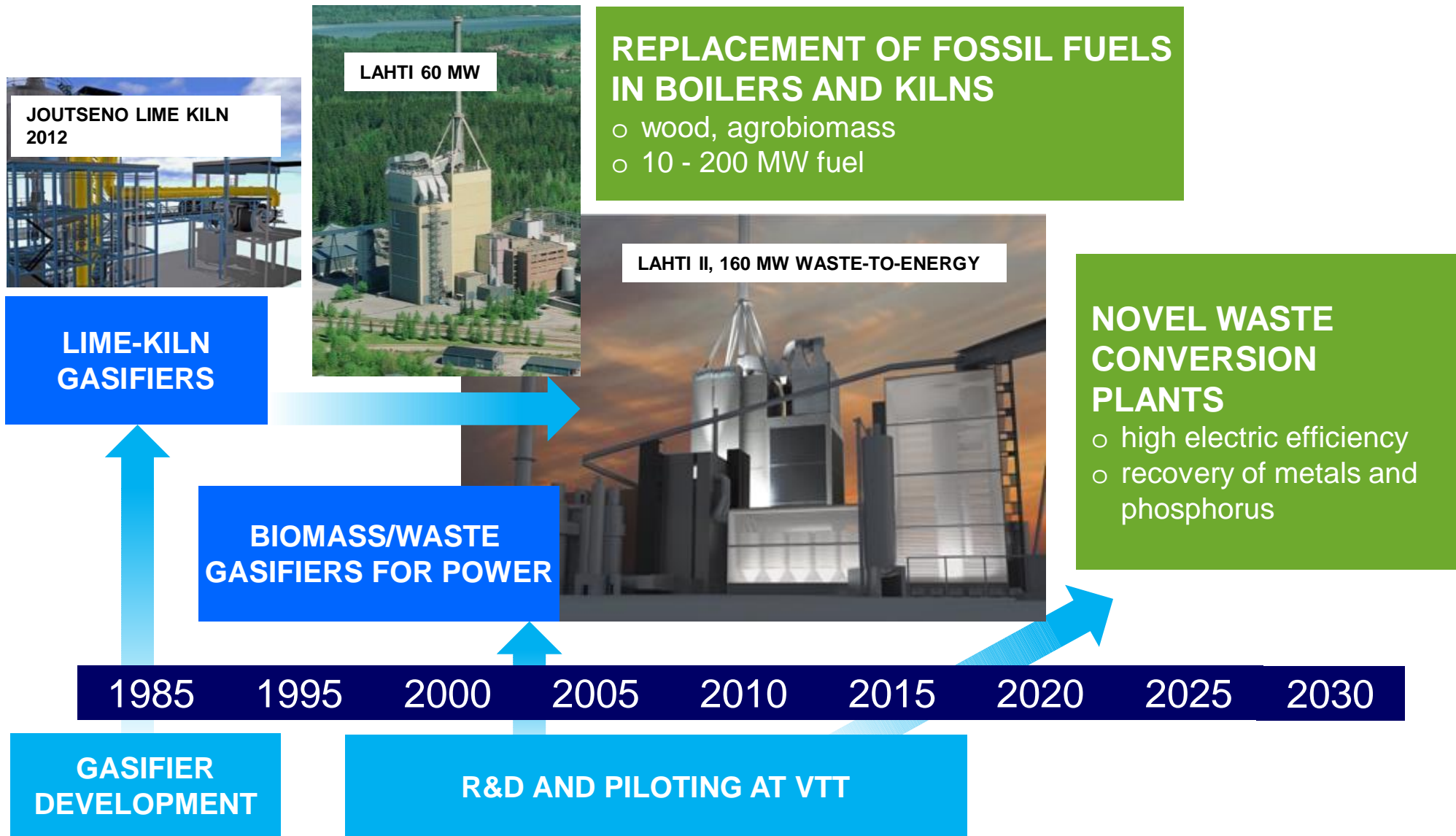
# VTT biomass thermochemical conversion platform



# Biomass and waste gasification for boilers and kilns

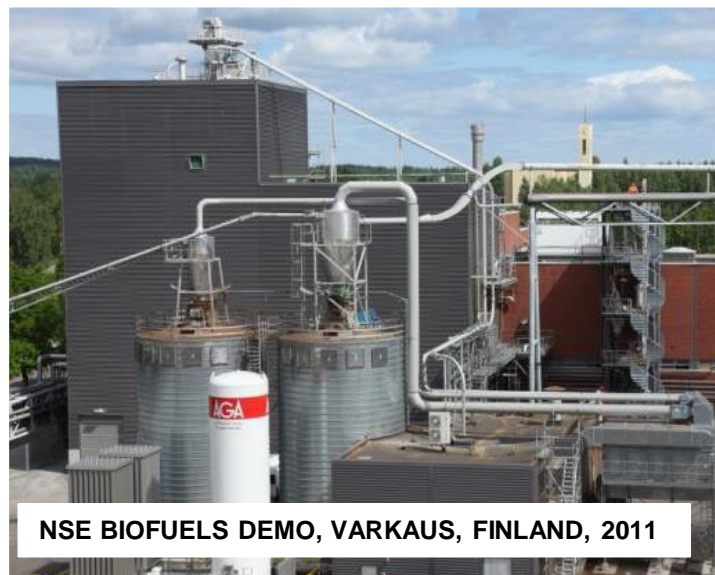


- Industrial experience in Finland since 1980's supported by VTT's R&D activities



# Biomass gasification for biofuels and bio-chemicals

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



1985

1995

2000

2005

2010

2015

2020

2025

2030

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

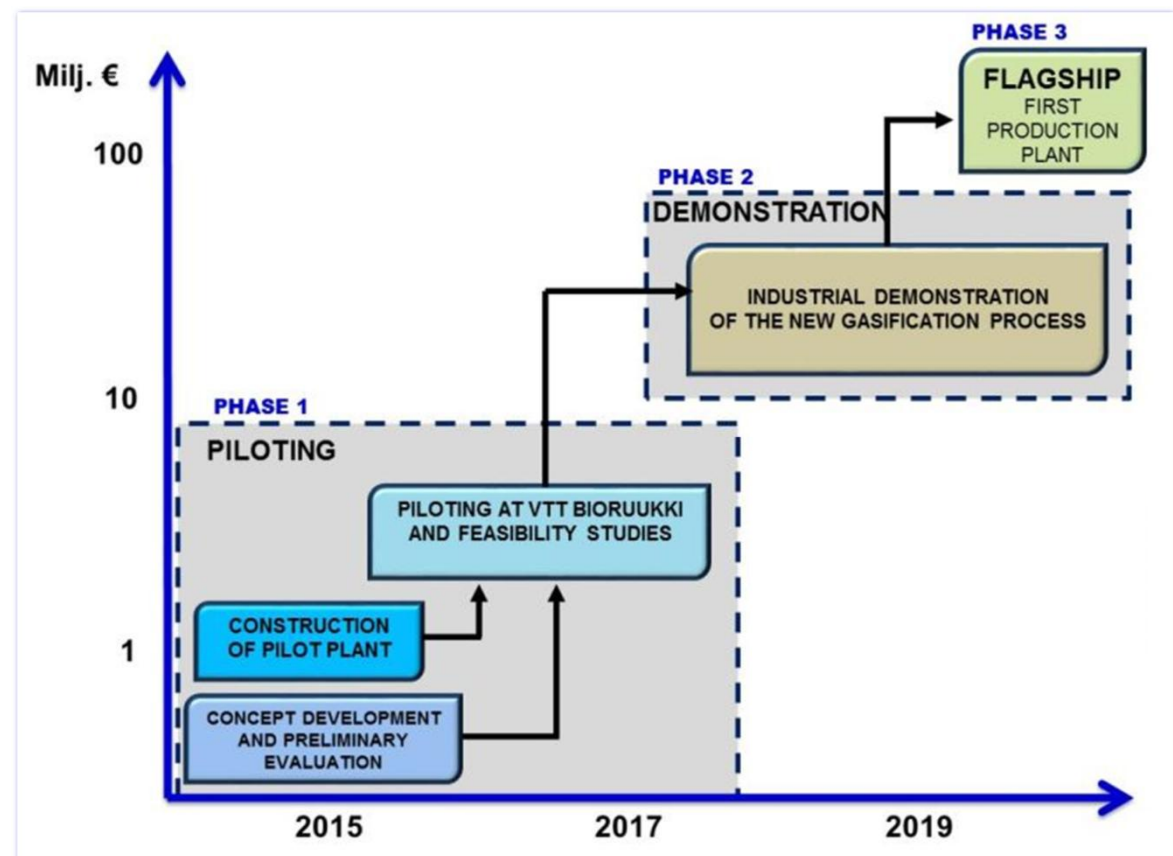
**Phase 1:** Piloting at Bioruukki & system studies 2016 - 2018, 3 M€

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

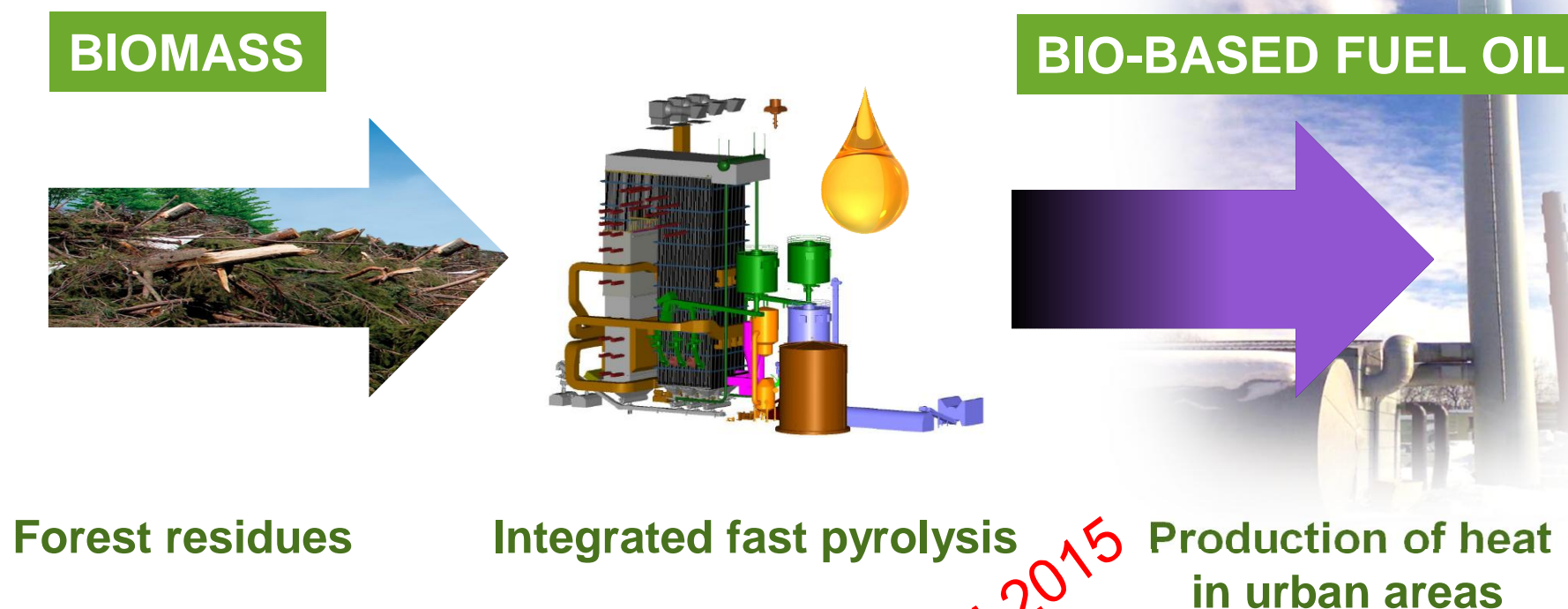
**Phase 3:** First production plant, 220 M€, investment decision 2020

**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



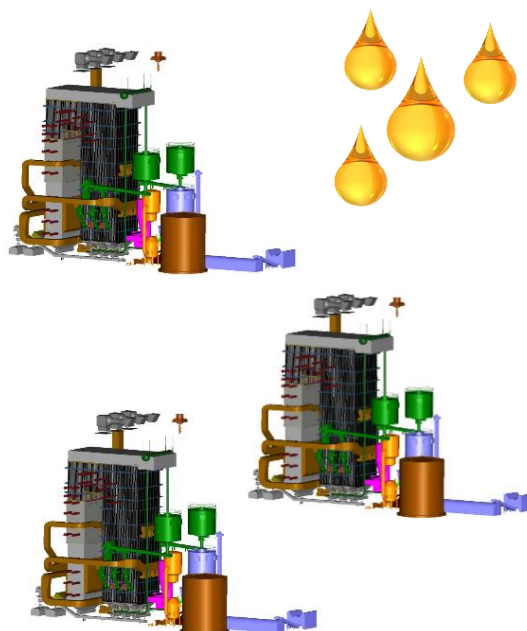
Accomplished 2015

# 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

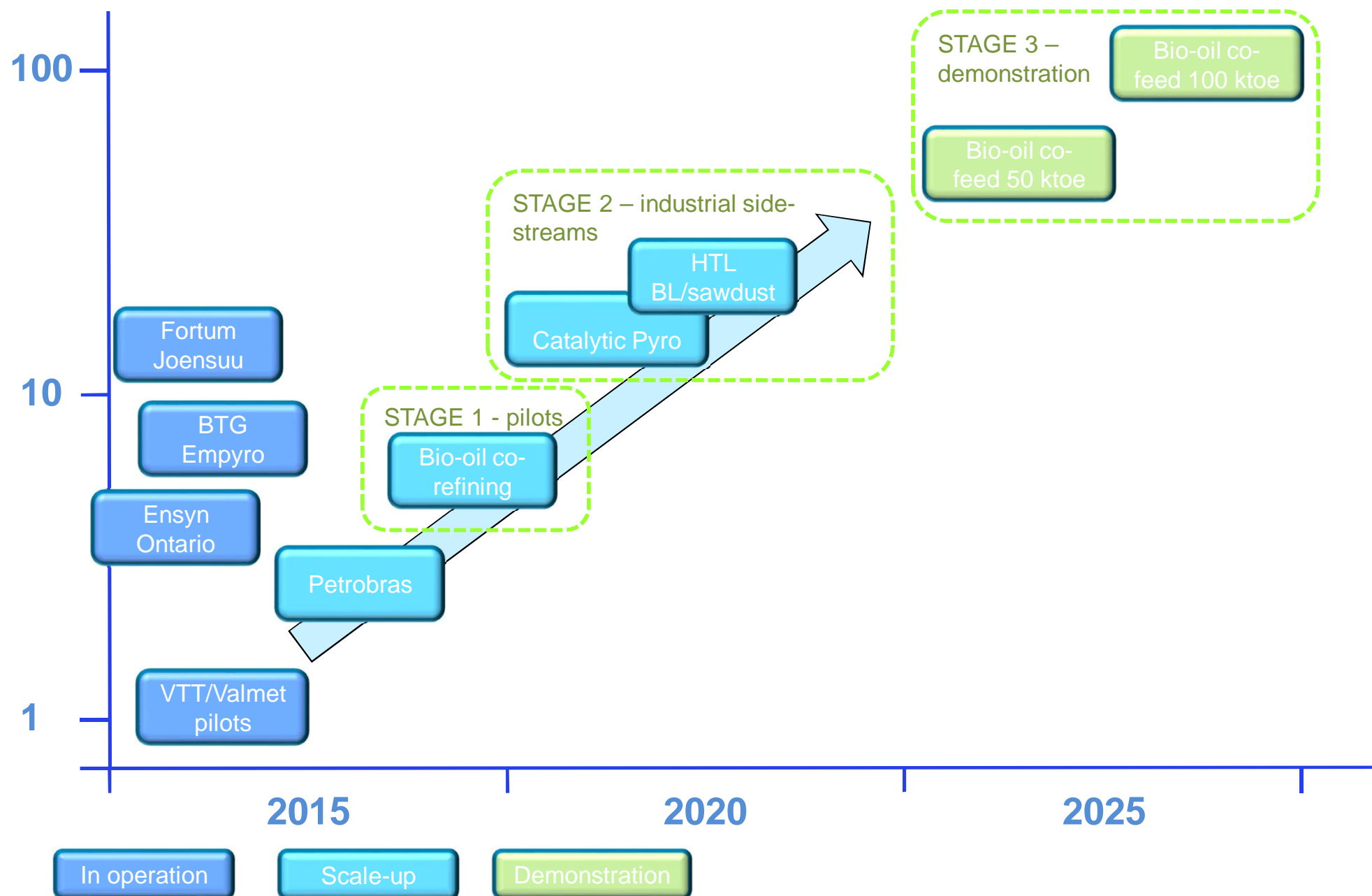


Co-refining with mineral oil  
By-production of chemicals  
Power and heat production



Investment M€

# Future Developments for Bio-Oil





# 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

A hand is holding a white shopping bag made of PAPTIC material. The bag has two red handles and a stylized infinity symbol with the word 'PAPTIC' printed on it. The background is a light gray gradient.



# COMMERCIALISING A NOVEL BIOBASED MATERIAL



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INTENSIVE  
DEMAND FOR A  
WOODBASED  
ALTERNATIVE FOR  
PLASTIC ON THE  
MARKET

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CHICKEN, ITS  
DAUGHTER AND  
AN EGG -  
PHENOMENON

---

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

