Small Scale Solid Biofuel Combined Heat and Power (CHP) for Ontario

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BHCP @ Viessmann, Waterloo

Ontario

Outline, 15 minutes

- Provincial Government Partners Group (PGPG) Supporting Biomass Heating in Ontario
- Why CHP in Ontario ? 5 opportunities
- What does it look like?
- Has other jurisdictions used Solid Biofuel CHPs?
- What are the current knowledge gaps?
- What is the current regulatory landscape?
- Any upcoming important events in Ontario?

PGPG Supporting Biomass Heat in Ontario

- This event is organised and sponsored by the lead ministry (Ministry of Natural Resource and Forestry)
  - Inter-ministerial working group collaborating on biomass (solid biofuel) heating initiatives
  - Provides opportunity to pursue new technologies that use CAN/CSA-ISO-17225 Solid Biofuel standards, now used for small wood combustor

- <u>New Item:</u>
  - Solid biofuel (wood) CHP has been identified as an innovation requiring further investigation and can benefit from using CAN/CSA-ISO-17225

5 Opportunities - Why Solid Biofuel CHP in Ontario?

- Supporting wood pellet and sustainable bioenergy production in forest based communities:

  - Forests can supply non-merchantable wood fibre and residues from logging operations to generate renewable energy (heat and electricity)

  - Forestry operations can create value added products from residues into bioenergy, such as pellets

Ontario Wood
The natural choice

Local Food! *Local Biofuels?*
#OntarioWood
#ChooseLocal
@OntarioWood

Why Solid Biofuel CHP in Ontario? (2)

- Supporting Ministry of Northern Development and Mines (MNDM) Growth Plan for North
  - 2014 OMAFRA Mandate Letter: “Work with other ministries and partners to explore opportunities to develop the agricultural sector in the North”
  - Opportunity to provide a lower cost fuel source for Northern agri-businesses not connected to the natural gas grid to generate renewable heat and electricity
  - Complements solid biofuel heating opportunities and keeping dollars in the community

Why Solid Biofuel CHP in Ontario? (3)

- Aligned with Indigenous and Northern Affairs Canada (INAC) recent funding announcement for Northern Responsible Energy Approaches for Community Heat and Electricity (REACH) Program,
  - Objectives of the REACH program to reduce Northern community reliance on diesel for heating and electricity
  - Increase the use of local renewable heat and electricity and retaining dollars in the community
  - Potential: 26 remote communities with 15,000 people are consuming 22 million litres of diesel per year in Ontario (2013) @ + 1$/kWh

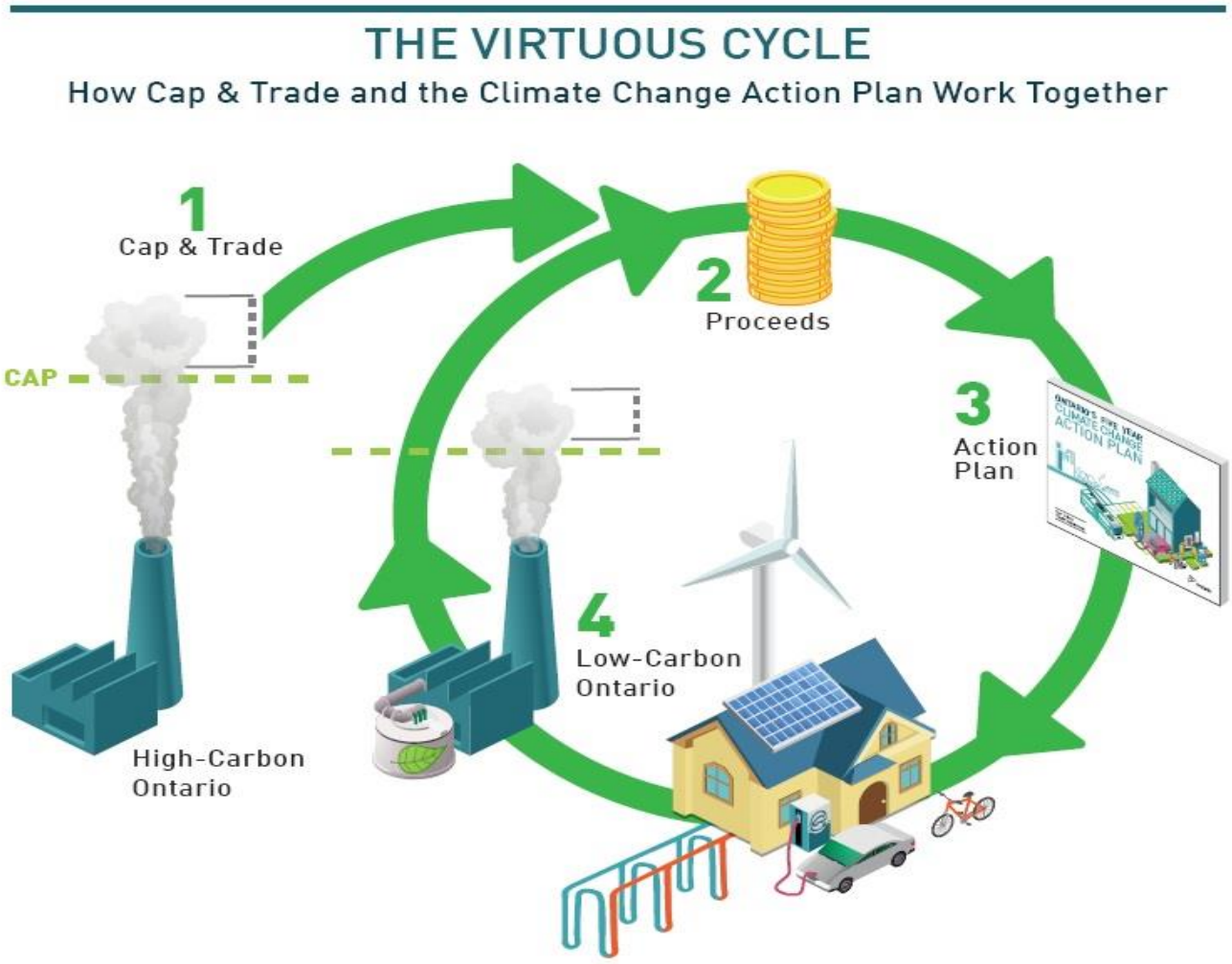
Why Solid Biofuel CHP in Ontario? (4)

- Coordinates with interests of the Ontario Federation of Agriculture to explore CHP for rural areas
  - December 2016 letter to Ministry of Energy regarding the Long Term Energy Plan (LTEP) :

"Advancing access to pipeline natural gas and RNG does not mean abandoning other fuels from rural Ontario. For communities beyond the reach of current pipeline expansion initiatives … combined renewables, CHP … will all provide energy solutions for rural and remote communities."

- Opportunity for small scale solid biofuel CHP in areas not connecting to the natural gas grid in rural Ontario

Why Solid Biofuel CHP in Ontario? (5)



<u>CCAP – Buildings and homes</u>: Reduce emissions from fossil-fuel use in buildings

<u>CCAP – Industry and Business</u>: Competitiveness and cleantech

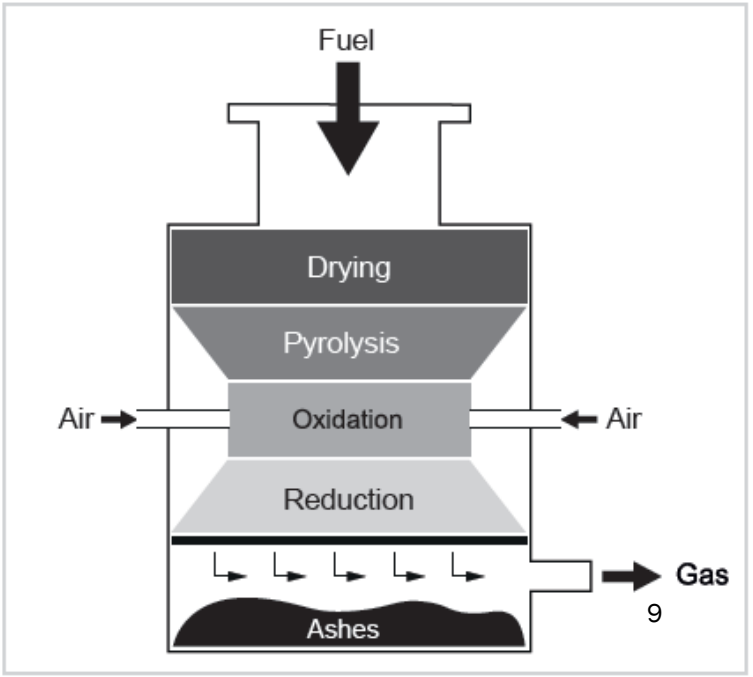
Potential alignment of objectives for many CCAP Action areas

What does this technology look like?

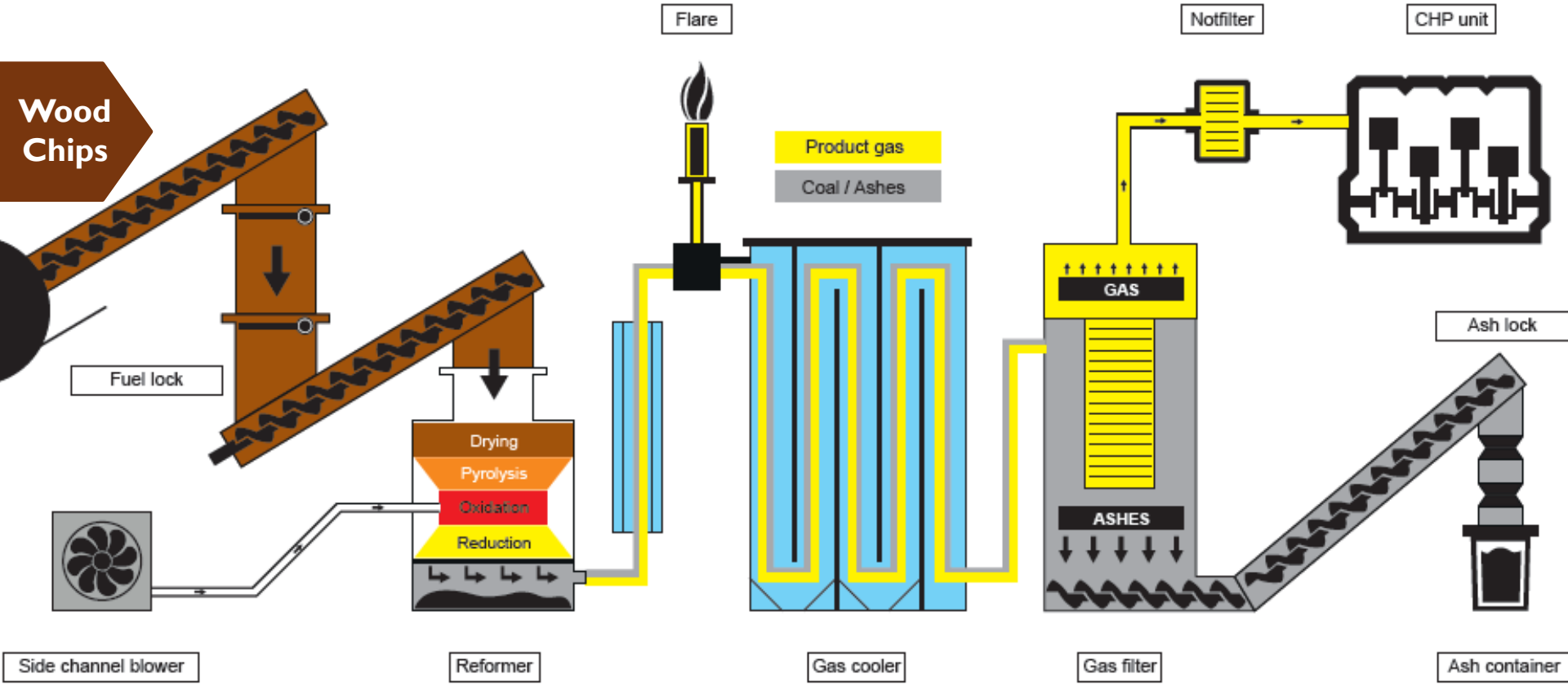
- For every 1 kg of dry wood chip or dry pellet processed (5.5 kWh):
  - 1 kWh of renewable electricity generated
  - 2.25 kWh of renewable heat energy is captured
  - For an overall energy efficiency of >60%
  - Operating above 83% (7,270 hr/yr availability)
- CAPEX ~7,000$/kWe installed for ~50 kWe capacity

fröling
besser heizen

Drying (up to ~ 200 °C)
Pyrolysis (~ 200 °C to 600 °C)
Oxidation (up to ~ 1200 °C)
Reduction (~ 900 °C)

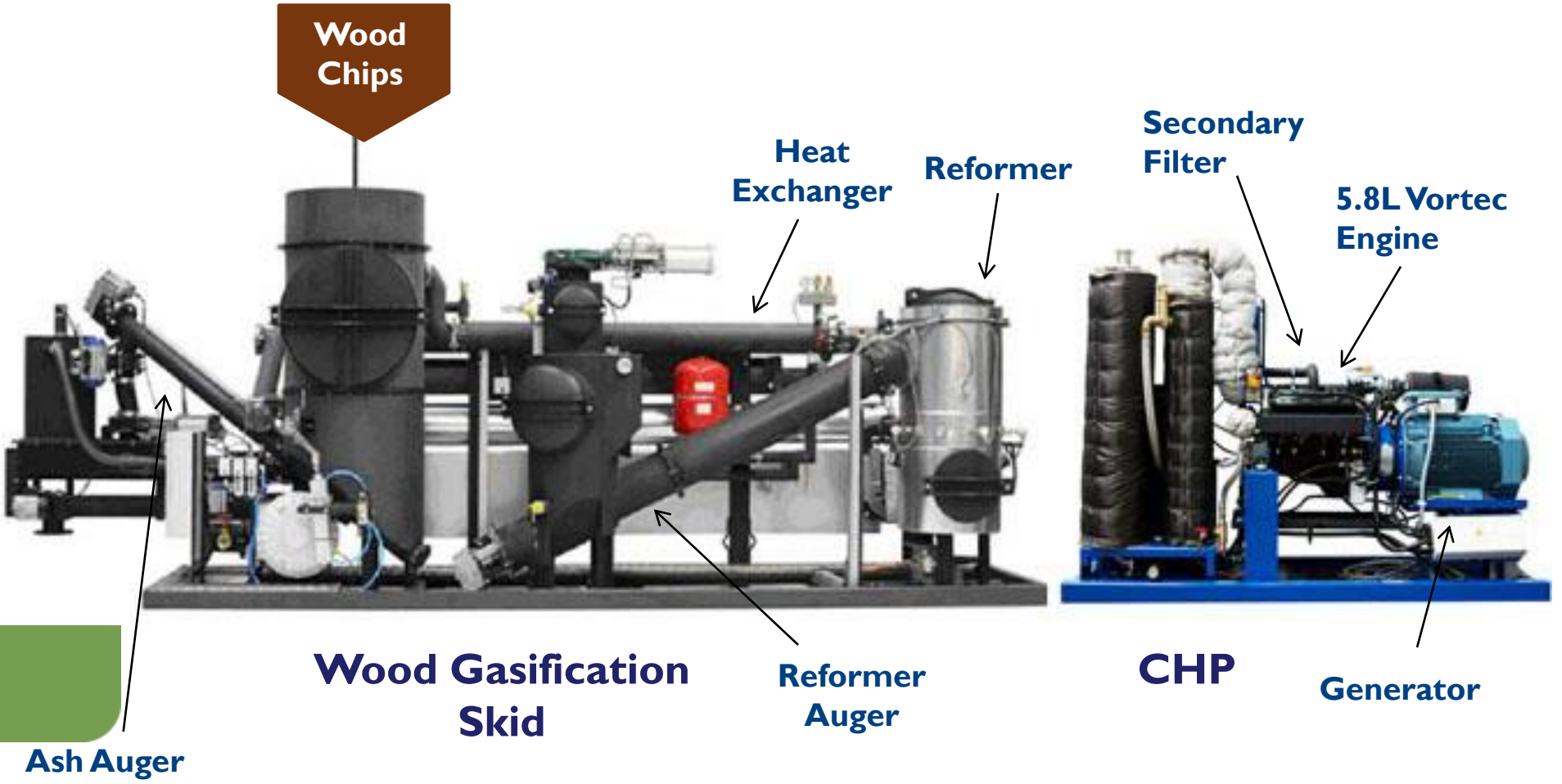


Fröling reactor and 50 kWe CHP



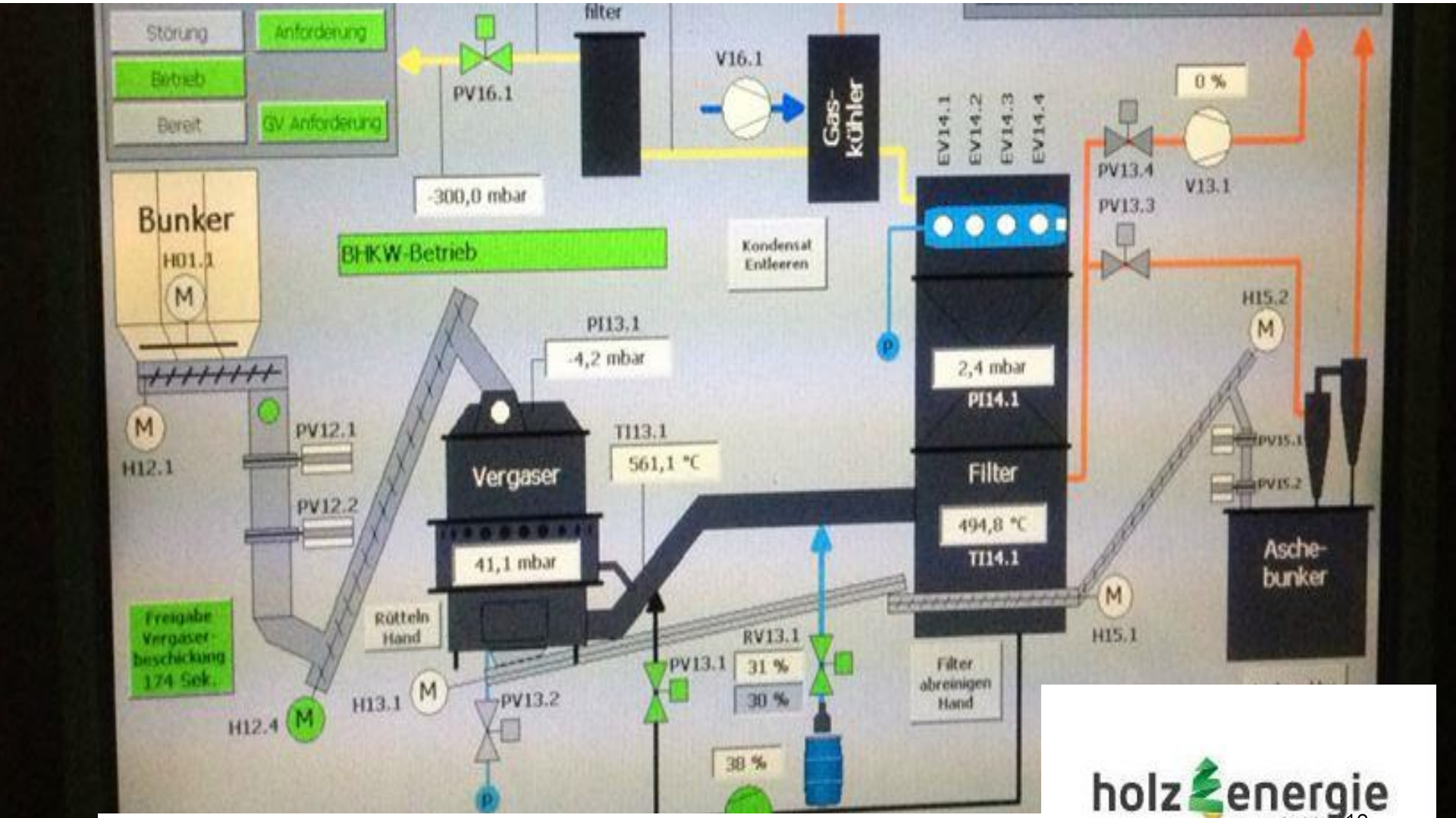
Source: Fröling promotional materials

Borealis reactor and 45 kWe CHP



Source: Borealis/Spänner promotional materials

Remote Control and Automation – 65 kWe



Source: Holz Energie Wegscheid promotional materials

holz energie wegscheid

Small Solid Biofuel CHP in Germany

- Well established since early 2000, due to Renewable Energy Law (EEG) in Germany which stimulated its development:
  - combustion sensors (oxygen sensors used in automobile sector), improvement on gas cleaning, automation and Smart Grid interconnection
  - Size range from 15 kWe to 5 MWe
- Spreading also to Northern Italy, Sweden, Finland and Austria due to forest bioeconomy incentives from local governments
- FEE Thermochemical Biomass Gasification 2015 guide
  - 400 systems in Germany alone with 42 MWe capacity
  - 12 manufacturers and a 50 member network organisation
- Equipped for large heat users such as greenhouse, agri-food processing, forestry operation and institutions using a district energy system without access to natural gas
- Detailed info of 21 sites EnergetischeBiomassenutzung website

Demonstration in Canada – Fast moving

- Small scale solid biofuel CHP projects:
  - British-Columbia: 3 sites being commissioned in BC and additional one in planning stage
  - Yukon: 1 site in planning stage at a school size 45kWe
  - Manitoba-Hydro: 1 demo size 100 kWe at a greenhouse nursery decommissionned
  - Ontario: 1 demonstration 45kWe relocating to a greenhouse and 1 planning stage for testing 40kWe
  - Quebec: 1 gasification pilot plant at Sherbrooke Univ.
  - NWT and Nunavut: training courses offered by a German vendor, sites in planning stage

What are the current knowledge gaps in Ontario?

- Lack of validated data for emissions on solid biofuel CHP (generators). Limited data from the Borealis demonstration site in Burlington, ON. Validation would be necessary to obtain performance and emissions profile to compare them with fossil fuel CHP limits
- MOECC policy for fossil fuel CHP for internal combustion engine generator sets used for non-emergency use

https://www.ontario.ca/page/emission-limits-and-operating-conditions-emergency-generator-sets-non-emergency-situations

- Small scale on-farm biogas CHP are exempt air emissions

What is the current regulatory landscape in Ontario for this technology?

- A small scale 45 kWe solid biofuel CHP needs approval with MOECC for a Renewable Energy Approval (REA) before connecting to the grid
- This is the same process that larger municipal waste and waste wood gasification >10 MWe
- Capacity limits (eg 500 kWe) have been removed from Net-Metering for certain LDCs (Hydro-One)

Can we use the CAN/CSA-ISO 17225 Solid Biofuels standard to specify solid biofuel quality like fossil fuels?

(standard biofuel + novel technology = lower risk)

What are the next events in Ontario that are of interest to this technology?

- “German Partnership Program “Bioenergy with a Focus on Wood Cogeneration – Made in Germany“
- The Canadian German Chamber of Commerce and Industry is sponsoring 8 German companies manufacturing solids biofuel CHP for a trade mission in Toronto on October 16-20, 2017

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Conclusion

- Small scale solid biofuel (wood) CHP has been identified as an innovation requiring further investigation
- Seeking additional information to validate emission data and compare them with other jurisdictions or other sites in operation
- Seeking applications in agriculture, and other large heat users in rural areas located in forest based communities which don't have access to natural gas grid

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