ABTCP 2015 48º CONGRESSO E EXPOSIÇÃO INTERNACIONAL DE CELULOSE E PAPEL

48º CONGRESSO INTERNACIONAL DE CELULOSE E PAPEL
1ª CONFERÊNCIA IBEROAMERICANA SOBRE BIOECONOMIA

"New" Bioenergy technologies: Strengths and challenges in Brazil

Marcelo Hamaguchi

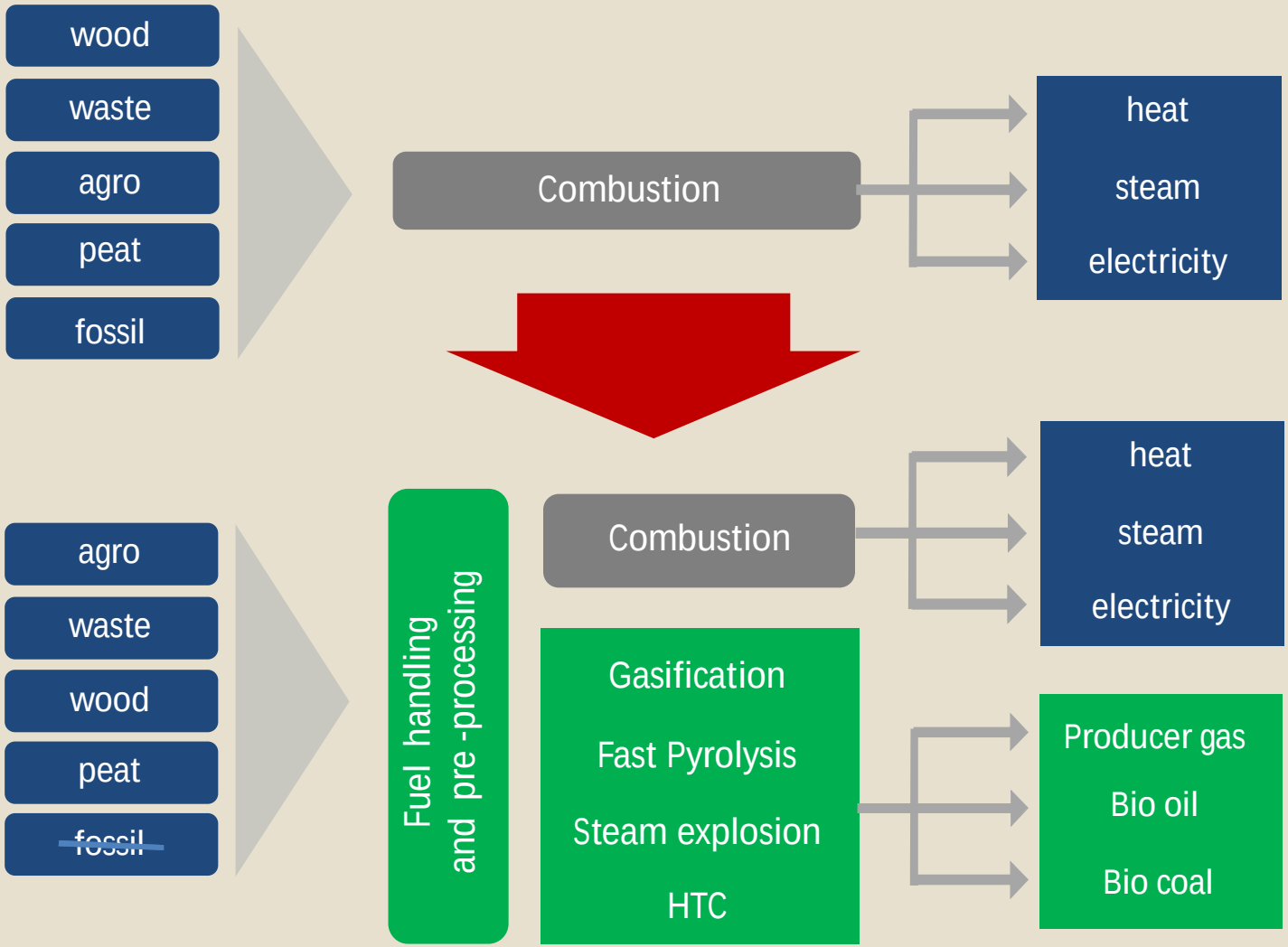
Valmet

REALIZAÇÃO ABTCP

CORREALIZAÇÃO IPEF

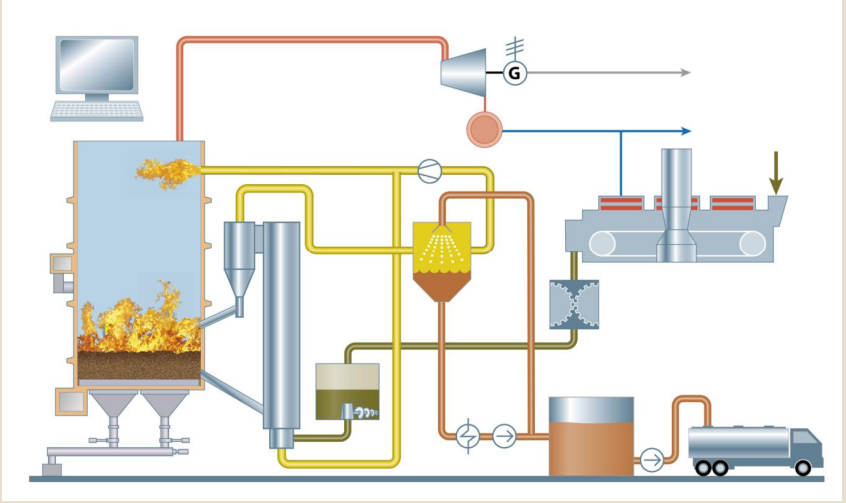
- “New” bioenergy technologies (cases)
- Economics (attractiveness)
- HTC (Hydro Thermal Carbonization for sludge)
- Challenges > Opportunities
- Summary

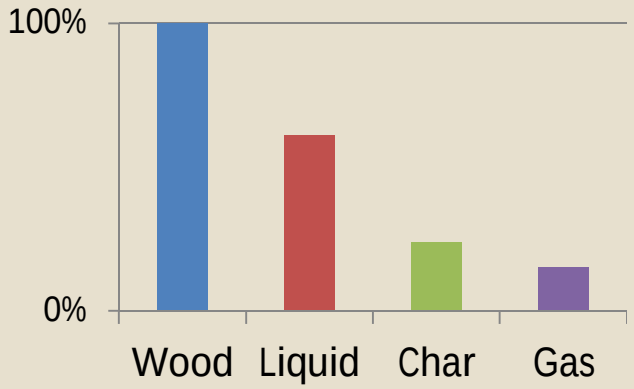
Bioenergy technologies in transition



Case: Pyrolysis bio-oil

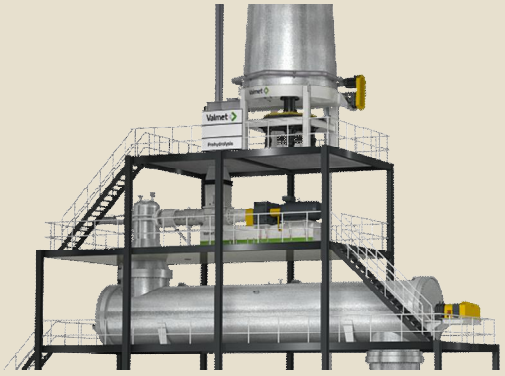
- Boiler bed material used as heat source
- Residual matter from pyrolysis process is combusted in the boiler
- Basis of feasible operation:
  - Simultaneous heat, power & bio-oil production
  - Waste heat utilization for drying
  - Infrastructure and procurement of biomass
  - Fortum pyro plant: 30M EUR (8M support)





Case: Steam exploded pellets

Key Criteria	Zilkha Black® Pellets	Conventional Pellets
Handling	Water-resistant	Disintegrate upon water contact
Logistics	19.4 GJ per bdmt 750 kg/m^3 4.0 MWh/m^3	17.0 GJ per bdmt 640 kg/m^3 3.0 MWh/m^3
Dust	98% durability index 99% is >74 microns (low-risk)	96.5% durability index Dust particles prone to explosion
Grinding	20-25 HGI 11 kW/mt mill energy demand	15-20 HGI 19 kW/mt mill energy demand
Combustion	Higher ignition potential at 16.3 [kJ/kg fuel/°C]	Lower ignition potential at 12-14 [kJ/kg fuel/°C]



- Cost 20-25% higher (vs white pellets)
- Waste heat utilization for drying
- Sales price of pellets

Case: Lahti waste gasification

- Two 80MW$_{th}$ gasifiers
- Processes 250 ktpa of Refuse Derived Fuel (RDF) to produce:
  - 50 MW of electricity
  - 90 MW of district heat
- Total investment ca. 160M€
  - Partly funded by EU and Finland

Not allowed:
Diapers and similar hygiene products, packaging that contains food, leather, videotapes, DVDs and CDs, PVC, waste that contains aluminum, metals.

Case: Vaskiluolto gasification

Biomass receiving and pre-handling

Large-scale belt dryer

CFB gasifier 140 MW_{fuel}

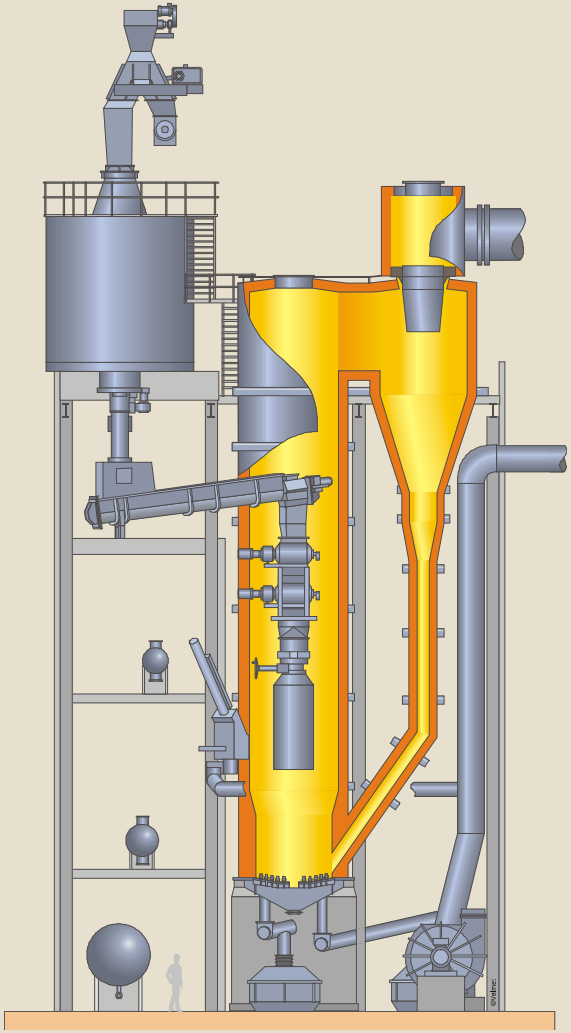
Existing PC boiler

Case: Vaskiluolto gasification

- Cost savings:
  - Reduction of CO_2-emissions up to 230 000 t/yr.
  - Feed-in tariffs of renewable energy
  - Reduction of the environmental taxes of district heating
- Other benefits:
  - Low total cost compared with the construction of a totally new biofuel power plant
  - Gasification compared with wood pellet firing: higher cost of pellet production (around +50%) and pellet milling is avoided
  - Local fuels - Positive effects to the local economy, 15 M€/a.
  - The new activities employ 100 people in fuel logistics

Total investment cost ca. 40 M€. State investment subsidy 10,8 M€

Case: gasifier for lime kiln



Huanggang, China, 2017
Gasifier 50 MW

Metsä Fibre Äänekoski, Finland, 2016
Gasifier 87 MW, dryer evaporation 23 ton/h

APP OKI, Indonesia, 2016
Gasifier 2 x 110MW, dryer evaporation 2x19 ton/h

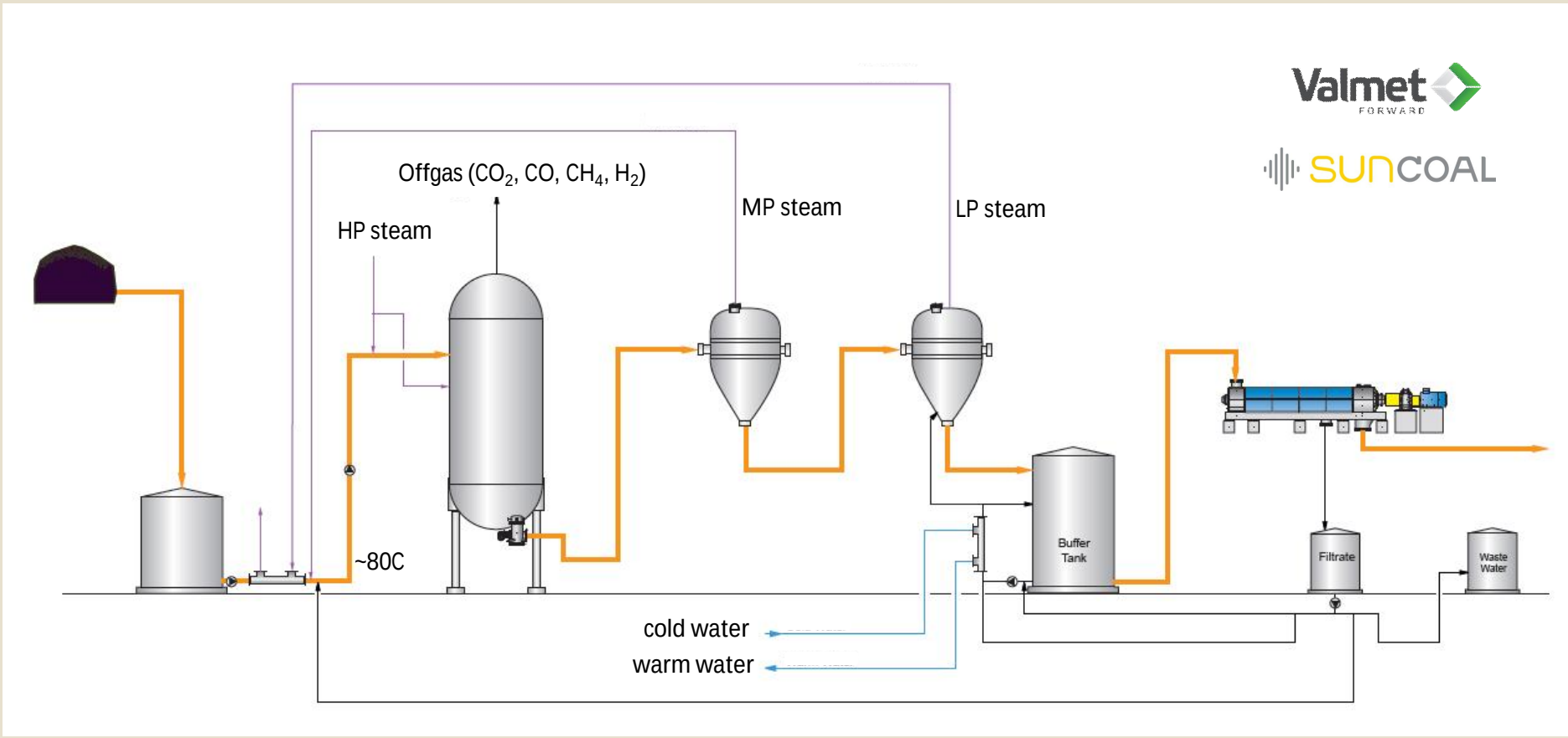
Example: Integration into a modern kraft pulp mill

		Boiler	Bio-coal pellets	Integrated pyrolyser	Gasifier
Heat power input	MW_{th}	3.7	22.7	10.1	14.4
Heat load to boiler	MW_{th}	124.7	-	120.3	-
Heat load to pyro/SE/gasif	MW_{th}	-	124.7	56.4	124.7
Steam generation	MW_{th}	102.4	-	95.9	-
Gas/volatiles	MW_{th}	-	-	-	115
Bio-oil	MW_{th}	-	-	35.4	-
Bio-coal	MW_{th}	-	123.6	-	-
Mill sellable power	MW_e	77	39	70	45

- Heat needed for drying the biomass
- Possibility of separating part of the bio-coal from pyrolysis
- Boiler as best option to export electricity to the grid

HTC - HydroThermal Carbonization

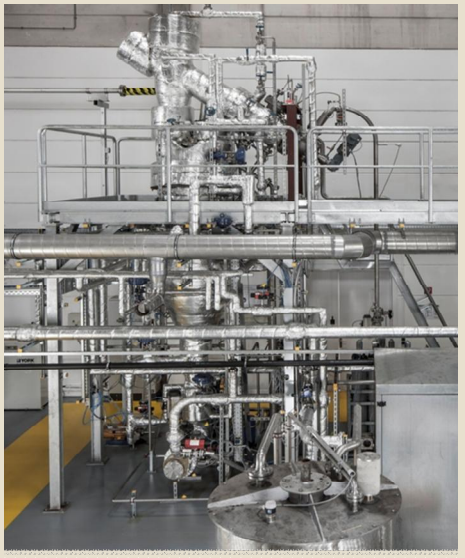
Reducing costs related to sludge handling



- Pre-dewaterd sludge at 20 - 30% DS and with significant odor
- Continuous thermal treatment at 200°C and 20 bars
- Chemically bound oxygen, hydrogen as well as intracellular water is removed in the process
- Dewatered cake – 60% DS; ready for co-firing with a positive net calorific value

Case: HTC reduces cost for sludge treatment

Customer challenge	How?
Dewatering issues of sludge	Decomposed, hydrofobic sludge – easy to dewater
High NPE in sludge causing problems in evaporation plant and boiler	HTC process have a washing effect on the sludge with the potential to remove NPEs from the end product.
Ineffective incineration due to high water content of dewatered sludge	Higher dry matter content due to higher dewatering capacity and a higher coal content gives a higher calorific value
High costs related to sludge treatment and sludge transports	Reduced transportation and treatment cost due to an overall mass reduction of up to 70 %
Energy	Solid filter cake ready for co-firing, ~ 1300 kWh / ton
Safety and usability	The treated sludge has no odor, is sanitized and explosion safe.



Challenges > Opportunities

- Resistance to new technologies
  - Better/cleaner technology doesn't mean changing the user perception/satisfaction
  - Lack of public understanding or industrial references
- High investment cost for novel technologies
  - Drivers: enough to be green?
  - Different technologies competing in the same energy auction
- Political inactivity and also a powerful fossil fuel lobby
- Technology transfer and open innovation
  - IPR as important issue
  - More incentives for partnerships
- High cost with labour and feedstock logistics

Challenges > Opportunities

- Market still developing
  - E.g. upgrading of bio-oil as interesting pathway
- R&D resources
  - E.g. more funding in the form of subvention > focus on local R&D.
- No actual policies favoring the consumption of bioenergy
  - E.g. part of increase in electricity production should come from bio
  - Long term commitment (impact of rain season on bioelectricity sales)
- Process limitations
  - Gasification for lime kiln: impacts on WLP and challenges for existing mills
  - Pyrolysis: limitation when using e.g. agro-based biomass or bark
- More fuel to do the same job when compared to fossil fuel

Potential, drivers and impacts

- Integration into e.g. pulp and sugarcane mills
- High availability of biomass waste (e.g. forest residues, cane bagasse)
- Possibility to use other feedstocks (waste from coal mines, MSW, etc)
- Large country with *favorable* weather conditions
- Higher agricultural productivity and rural development
- Brazilian energy crisis

Summary

- Bringing a new technology to market can be challenging and expensive (opportunity)
- Non conventional technologies have reached good levels of maturity.
- Feasibility influenced by feedstock quality, electricity/fossil sales price, biomass availability, scale and process maturity/efficiency.
- Importance of increasing “nationalization index”
- HTC as a interesting technology to reduce cost of sludge disposal and power production
- Need for more consistent government policies. Mill joining forces

Obrigado

Marcelo Hamaguchi
marcelo.hamaguchi@valmet.com