

INDUSTRIAL APPLICATIONS OF SOLID BIOFUELS

CARBONFX TECHNOLOGY

Who we are

Airex Industries is an innovative company providing industrial and commercial air treatment solutions

- Private company founded in 1975
- Head office in Laval (QC) and manufacturing plant in Drummondville (QC)
- Design and manufacture a wide range of products such as baghouse dust collectors, cyclone dust collectors, wet dust collectors, downdraft tables and air make-up units
- Established **Airex Energy in 2008**, a new division dedicated to industrial energy-saving and energy-recovery solutions
- Airex Energy has successfully developed a pilot scale 250 Kg/hr biomass torrefaction technology based on a unique cyclonic bed reactor
- Approximately 80 employees

Products

Dust collectors



DCCH Series – Cartridge dust collectors



TR & TRP Series – Baghouse dust collectors

Innovations

Heat recovery technologies



AIREX
ENERGY

Power FX - Heat recovery system with heat pump



AIREX
ENERGY

Lintx - Heat recovery for industrial laundry dryers

Innovations

Thermal treatment technologies



CarbonFX
Biomass torrefaction reactor



FEBX500
Heat treated wood kiln

Solid biofuel ?



Firewood

First solid fuel
used by man

- Bulky
- Wet
- Expensive grinding
- Low energy density
- Biodegradable
- Expensive to transport

Solid biofuel ?



Charcoal

Second solid fuel
used by man !

- Dry
- Hydrophobic
- Easily crushed
- Non biodegradable
- High energy density
- Homogeneous

Barbecue ?

No ! Iron production !



- Charcoal is largely used as a reducing agent in iron production
- Brazil is the largest charcoal producer in the world: **11.6M tonnes in 2010;**

Barbecue ?

Brazilian charcoal production plant...



- Traditional brick furnaces
- Partial burning of wood to supply energy
- No recycling of process gas (methane emission)
- Long cycle – 6 days
- Low yield: 250kg to 340kg of charcoal per dry ton of biomass

BioEnergia charcoal production...

- BioEnergia (own by ArcelorMittal/Aperam) was the third largest charcoal producer in the world in 2010 with annual production capacity of 194K tonnes/year
- Oct 2011 : 254 kilns in operation

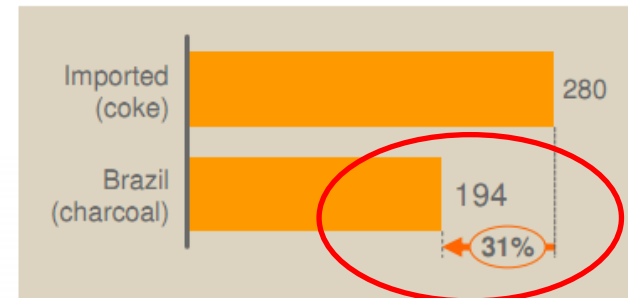
A unique capability to produce stainless and specialties from Biomass



Nov
2010

- Strategic participation of 36% in Bioenergía which produces biomass (charcoal) from eucalyptus - planting, maintenance and cutting at 7 years old
- Consumed 194,000t of biomass (charcoal) in 2009 and target to double consumption of biomass (charcoal) by shifting Blast Furnace #2 from coke to biomass by 2012
- Positive impact on environment

Equivalent Coke and Charcoal cost in 2009 (USD/t)*



ArcelorMittal/Aperam

March
2011

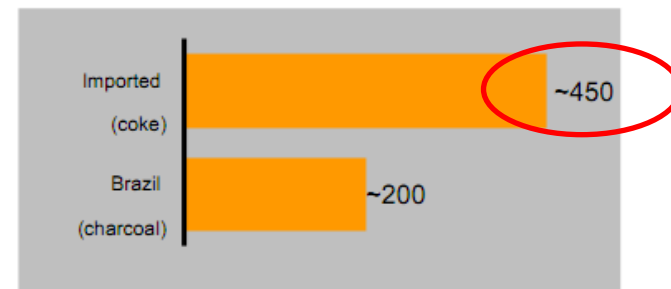
Unique strengths

A unique capability to produce stainless and specialties from biomass



- Strategic participation of 36% in Bioenergia which produces biomass (charcoal) from eucalyptus - planting, maintenance and cutting at 7 years old
- Consumed approximately 200,000t of biomass (charcoal) and target to more than double consumption of biomass (charcoal) by shifting Blast Furnace #2 from coke to biomass by 2012
- Positive impact on environment

Equivalent Coke and Charcoal cost in 2010 (USD/t)*



Nov
2011

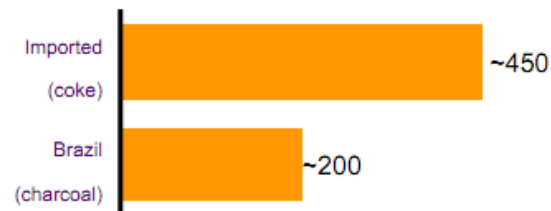
Aperam strengths and strategy

A unique capability to produce stainless and specialties from biomass (charcoal)



- Bioenergia produces biomass (charcoal) from eucalyptus - planting, maintenance and cutting at 7 years old
- Target to produce of 450,000t of biomass (charcoal) for 2012 following the forest development and the conversion of Blast Furnace #2 from coke to biomass
- Positive impact on environment

Equivalent coke and charcoal cost (USD/t)*



Biomass integration (% of Aperam production)

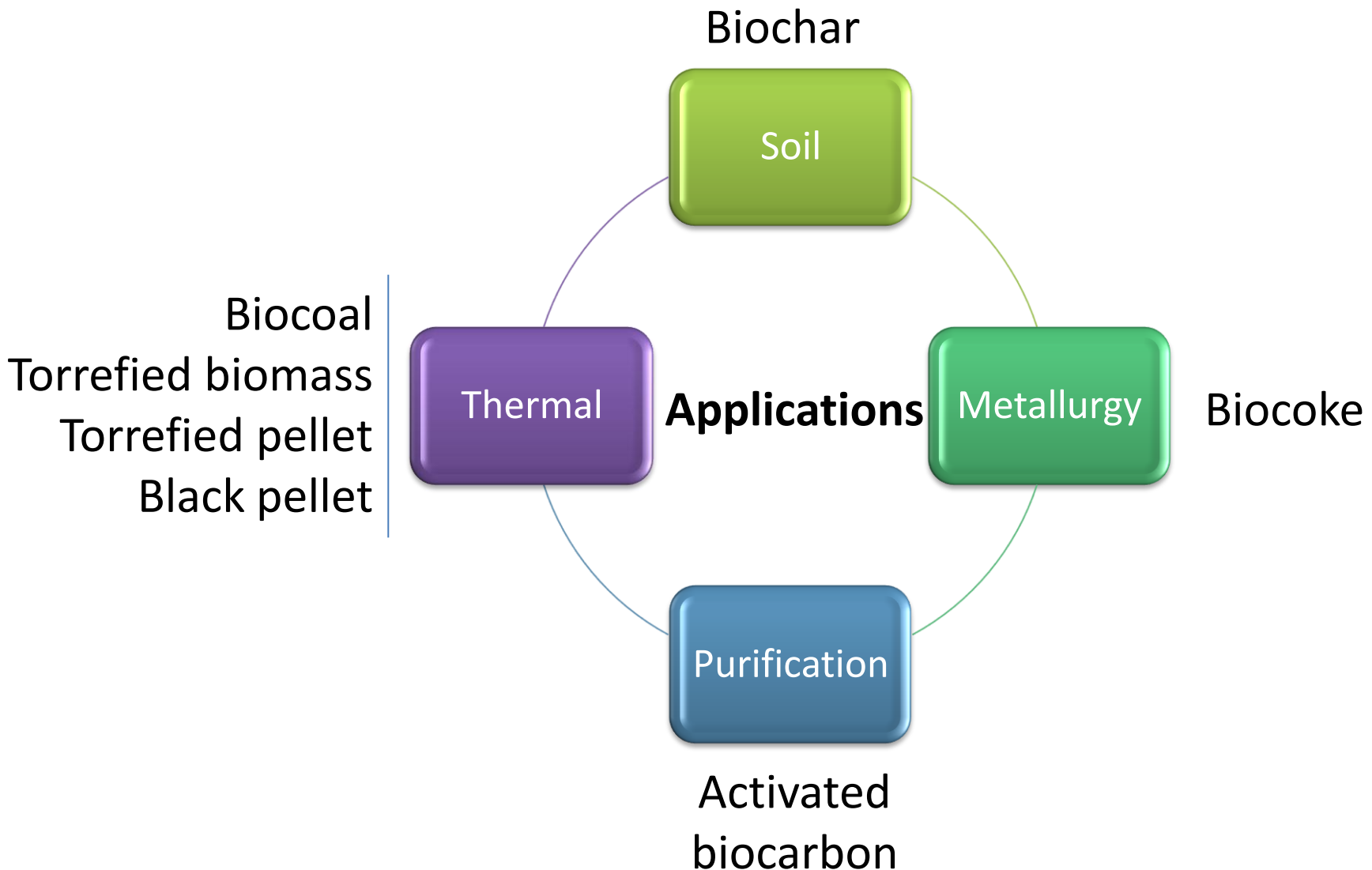
Biocoal production



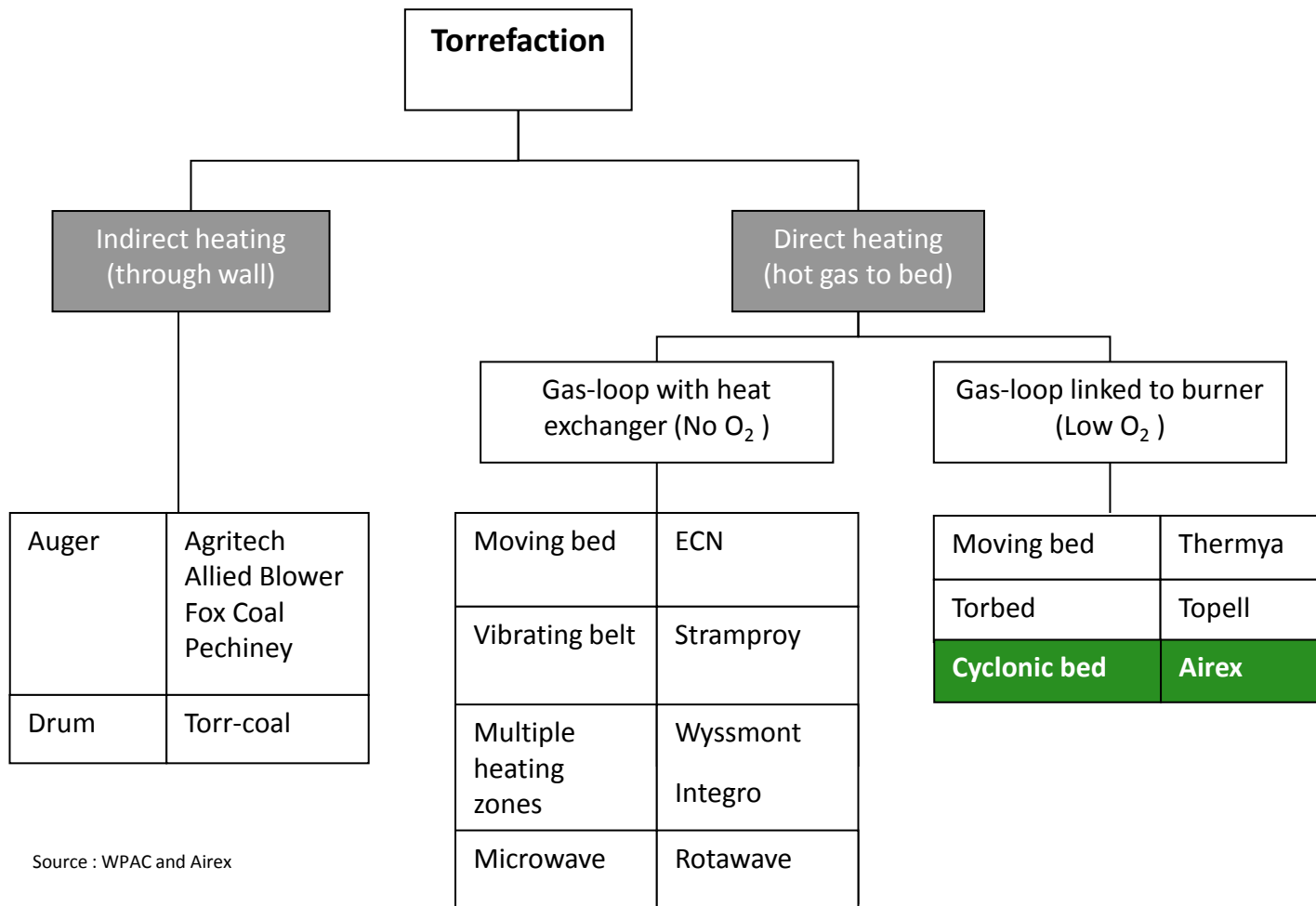
CarbonFX
Torrefaction
reactor



Bio what ?

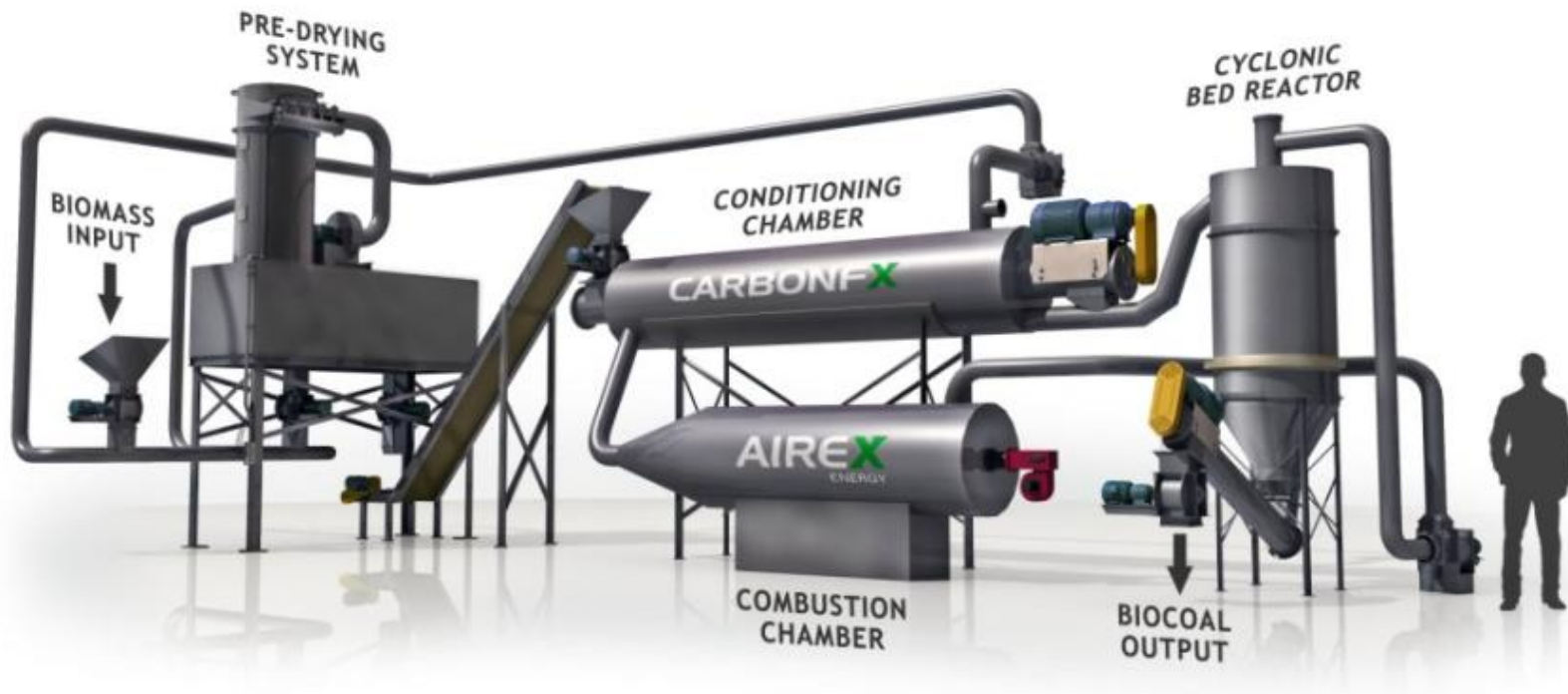


Technology



Technology

CarbonFX technology



Technology

Airex Energy technology highlights

- Direct heating technology with gas-loop linked to burner
- Integrated pre-drying system
- Conditioning chamber with indirect heating
- Patented Cyclonic Bed Reactor

- ⇒ **Simple**
- ⇒ **Reliable**
- ⇒ **Scalable**
- ⇒ **Excellent controllability**
- ⇒ **High energy efficiency**

Pilot plant

- Pilot unit successfully commissioned in March 2011
- Input of up to 250 kg/hr of wet biomass
- Several tons of biocoal produced for industrial customers



Projects under development

R&D Projects

1 - Torrefaction and value-added products

- Partners: FPInnovations, NRCan, NSERC, CTRI, CRIBIQ, Airex, Resolute Forest Products, End-User ?
- Timeline: 24 months, starting in Q2 2012
- Budget: \$2.1M
- Objectives:
 - Optimize torrefaction process (temperature, residence time, feedstock size)
 - Study relationship between feedstock variability (species, regions) and end-product properties
 - Develop value-added products like activated biocarbon
 - Produce samples for industrial trials

Projects under development

R&D Projects

2 – High carbon content biocoal

- Partners: FPInnovations – International metallurgical company
- Objective:
 - Production of high carbon content biocoal (biocoke) for metallurgical applications

3 – Recycled wood as a feedstock

- Partner: Centre Spécialisé en Pâtes et Papiers (CSPP) – Trois-Rivières, QC
- Objective:
 - Production of biocoal from recycled wood

Projects under development

R&D Projects

4 – Biochar field trials

- Partner: Université Laval
- Objective:
 - Biochar field trials for soil remediation, re-vegetation and restoration

Projects under development

Torrefaction demonstration plant



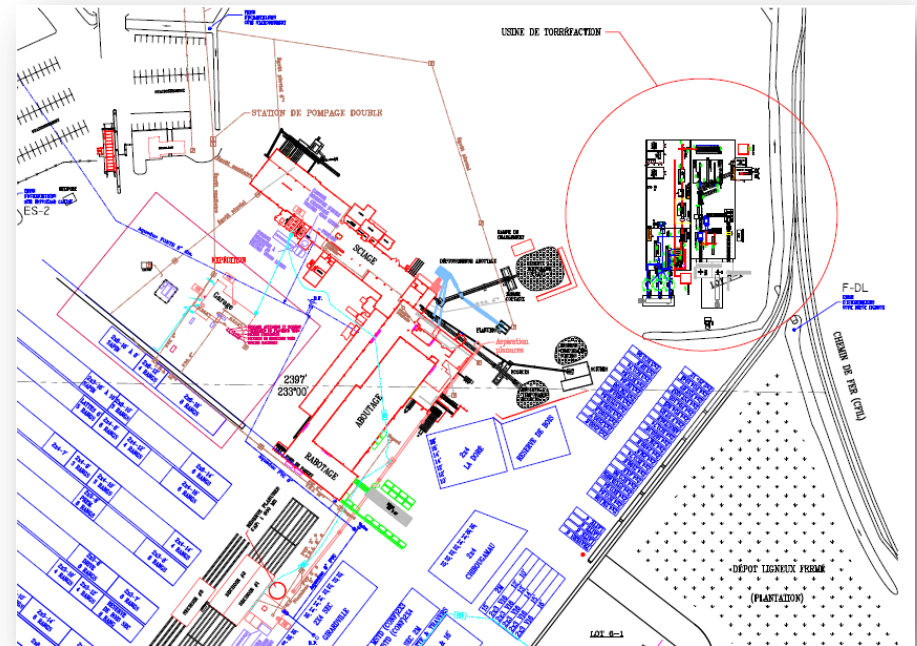
- Location : Airex HQ (Laval, QC)
- Capacity of 2 tonnes/hour
- Feedstock : softwood sawdust
- Delivery : bulk pellets

Projects under development

First commercial-scale plant

- Developed in partnership with Resolute Forest Product
- Capacity of 35K tonne/year of torrefied pellets
- Pre-engineering completed
- Financing plan submitted to Government agencies

Torrefaction plant



Costs

Estimates

Location: Province of Québec

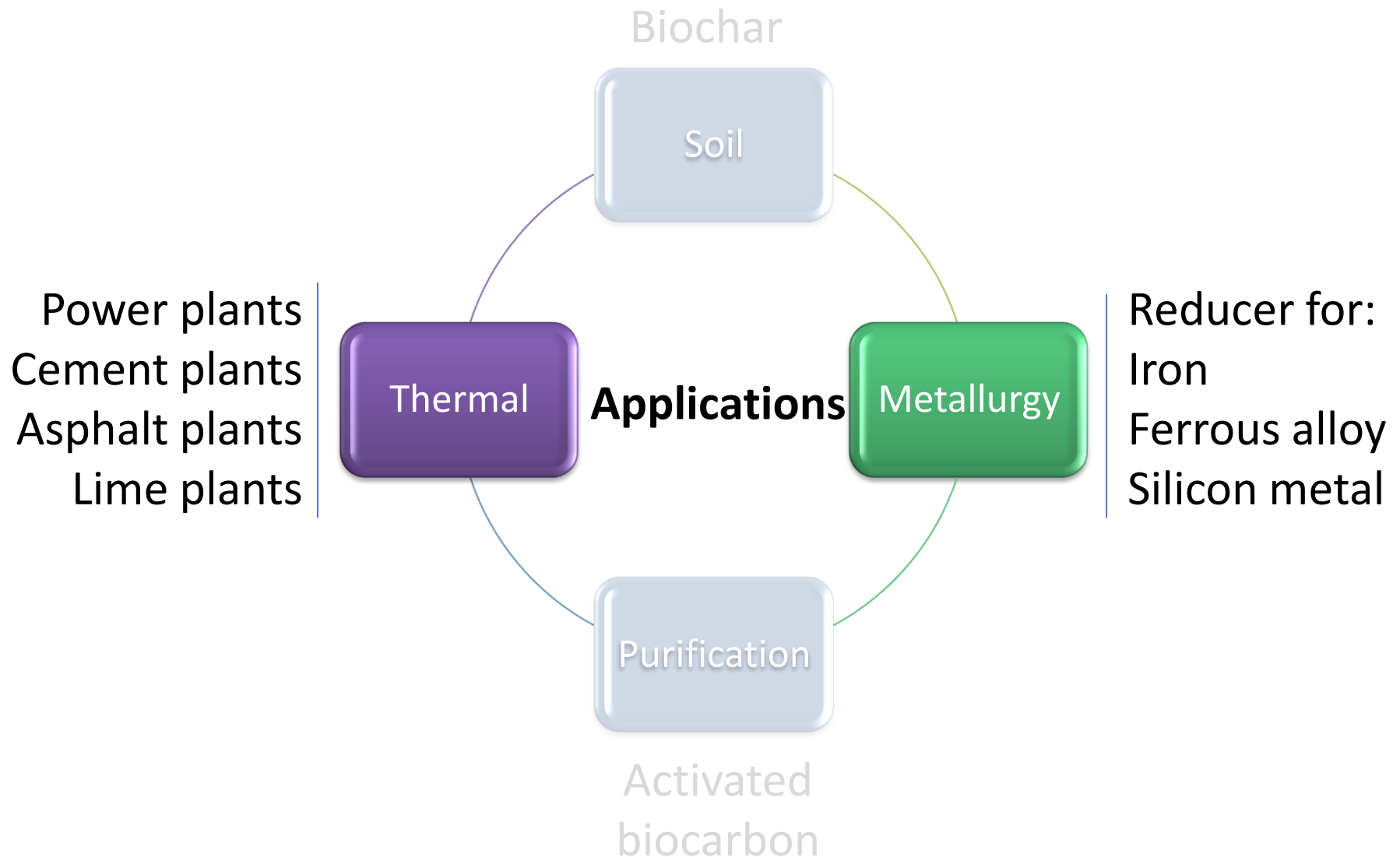
Fuel	Delivered \$/unit	Delivered \$/GJ
Wood pellets	175 \$/tonne	9.7 \$/GJ
Heavy fuel oil	0.70 \$/liter	17.0 \$/GJ
Thermal coal (bituminous)	150 \$/tonne	5.5 \$/GJ
Metallurgical coal	250 \$/tonne to 500 \$/tonne	Carbon content
Torrefied pellets	215 \$/tonne	9.8 \$/GJ

Cost competitive
right now !

Cost competitive
right now !

Based on Québec's fiber cost

Market - Focus



Market - Thermal

Cement plants

- More than 15 cement plants in Canada (CAC members)
- Total cement production in 2008: 15M tonnes
- Required thermal energy per tonne of cement: 3.2 GJ
 - Coal and petcoke: 85% of thermal energy
 - Biomass: 3% of thermal energy
- Coal consumption: 1M tonne/year



Market - Thermal

Large scale trial - Cement plant



- 10 tonnes co-firing test at Colacem in Grenville-sur-la-Rouge, QC
 - 5 tonnes light torrefaction - bulk
 - 5 tonnes high torrefaction - bulk
- Trial done in January 2012 with great results !

Contact information



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