Biogas; a case for a sustainable future

Michigan BioEnergy Conference

April 26h, 2011

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There is a great potential …

… and the journey has just started

Cities

Sludge
Household waste
Industry org waste
Landfill

Agriculture

Manure
Rest-products
Energy crops

Forest

Residues from
forest & industry

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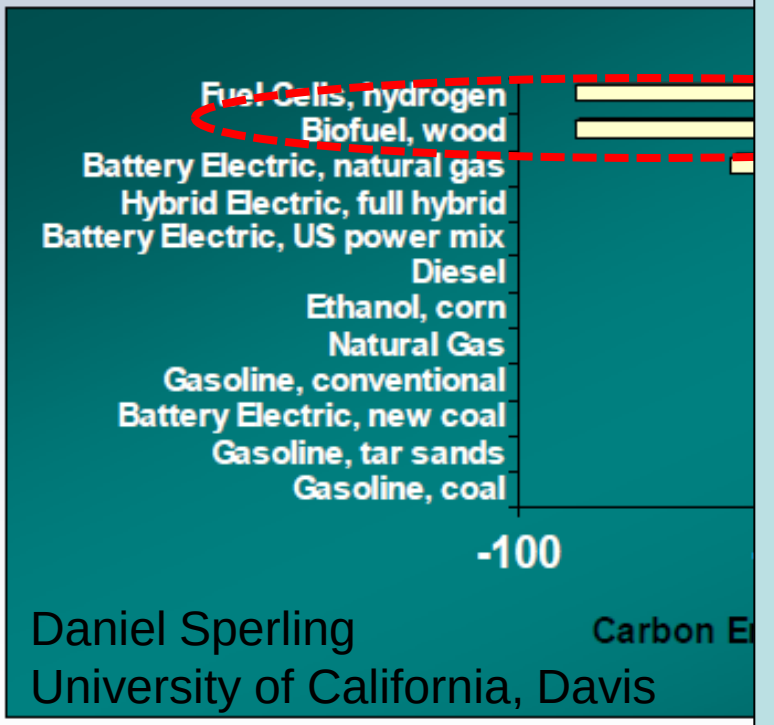
Many Promising Replacements for Petroleum Fuels

Some better than others…



Benefits

- Improves public health
- Supports a sustainable society – renewable
- Promotes energy security
- Steady supply helps level out commodity price swings
- Reduce volume to landfills
- Reduces greenhouse gases - Methane

Can Biomethane have an Impact for the Future Energy System?

- Renewable energy share (2006)
- Global 12%
- EU 7%
- Sweden 43%

Ground Breaking September 2008

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Vision

To create a Center of Energy Excellence that will be the leading authority on biogas systems based on digested biomass in North America.


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Supply Chain
Suppliers
Customers
Competitors
Industry Support
Trade Groups
Service Providers
Growth Capital
Venture Capital
Angels
Banks
Private Sector
Universities & Laboratories
Research
Technology Transfer
Schools & Training Centers
Workforce Development
Academia
Utilities
Workforce
Business
Infrastructure
Anchor Company
Logistics
Transportation
Natural Resources
Government
Policies
Incentives
Regulatory Climate
Permitting
KETTERING UNIVERSITY
MICHIGAN
ECONOMIC DEVELOPMENT CORPORATION
THE UPPER HAND
THE GREAT SEAL OF THE STATE OF MICHIGAN
TUEBOR
CIRCUMSPICE
A.D.MDCCCXXXV.

Business Idea

- Design, build, and own biogas plants.
- Operate and optimize biogas plants with profit sharing.

Leading experience from stable and high load operation within

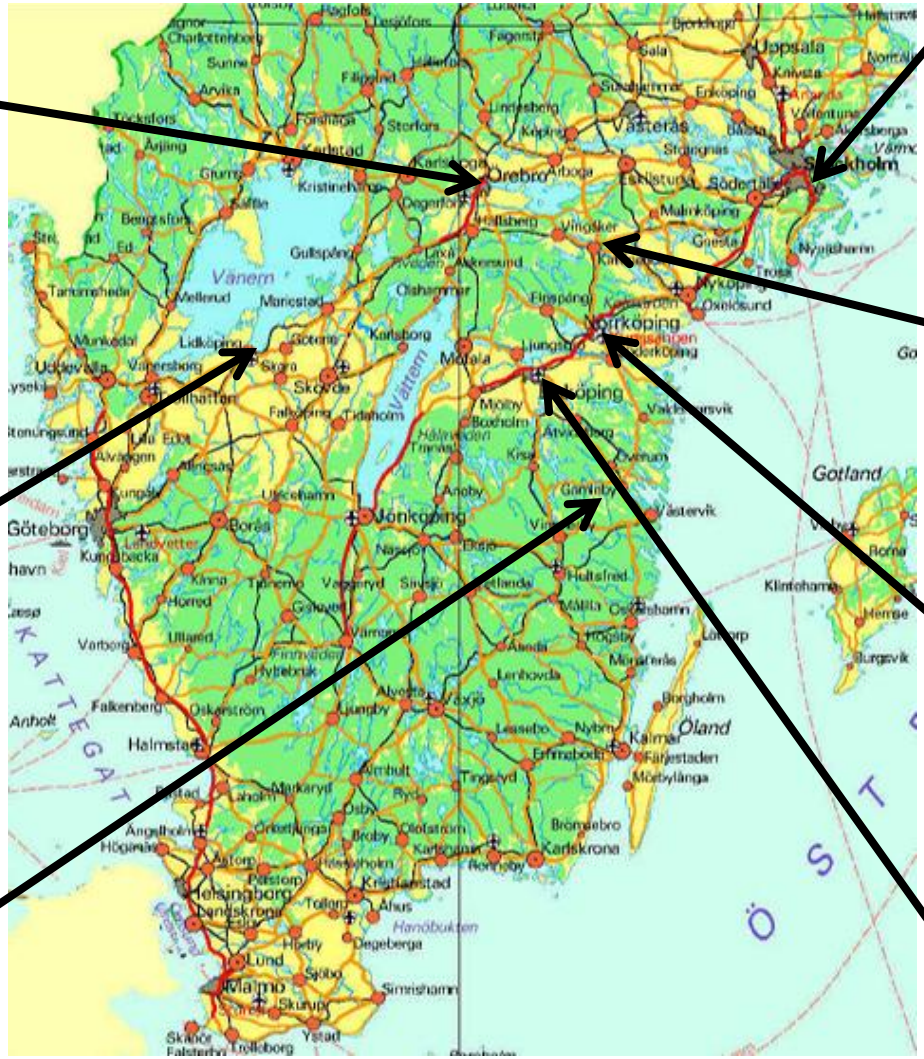
- Biogas from waste water treatment plants.
- Biogas from industrial organic wastes (slaughter house, food industry, etc.)
- Biogas from clean organic substrate (ethanol stillage, crops, etc.)

Full access to laboratory and pilot plant

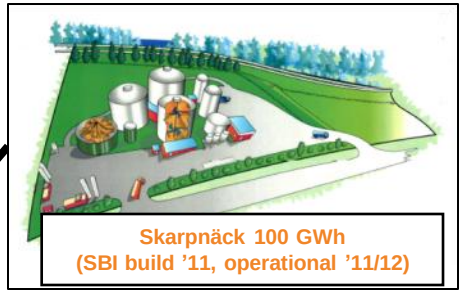
Örebro 70GWh
(SBI operational since 2009)

Lidköping 60GWh
(SBI build ’10, operational ’10)

Odensviholm 3 GWh
(Operational since 2008)



Since 1st of October –’10, bus depot in Gävle.



Skarpnäck 100 GWh
(SBI build ’11, operational ’11/12)

Katrineholm 30 GWh
(SBI build ’10, operational ’10/11)

Norrköping 20GWh
(SvB operational since ’06)

Linköping 60 GWh
(SvB operational since ’96)

References in Sweden

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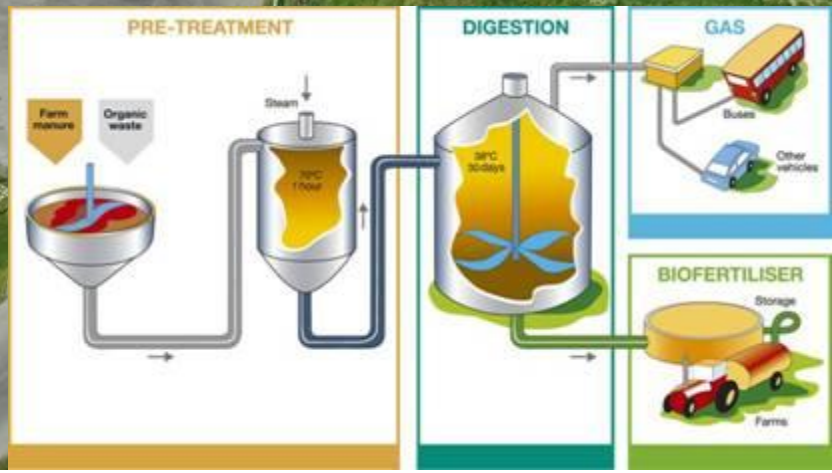
50,000 Tons per year



Example from Åby (Linköping)

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1 ton_{TS} manure
170 Nm^3 CH4
1 700 kWh

1 ton_{TS} carbohydrates
420 Nm^3 CH4
4 100 kWh

1 ton_{TS} proteins
510 Nm^3 CH4
5 000 kWh

1 ton_{TS} fat
960 Nm^3 CH4
9 400 kWh

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Feedstock Energy Values

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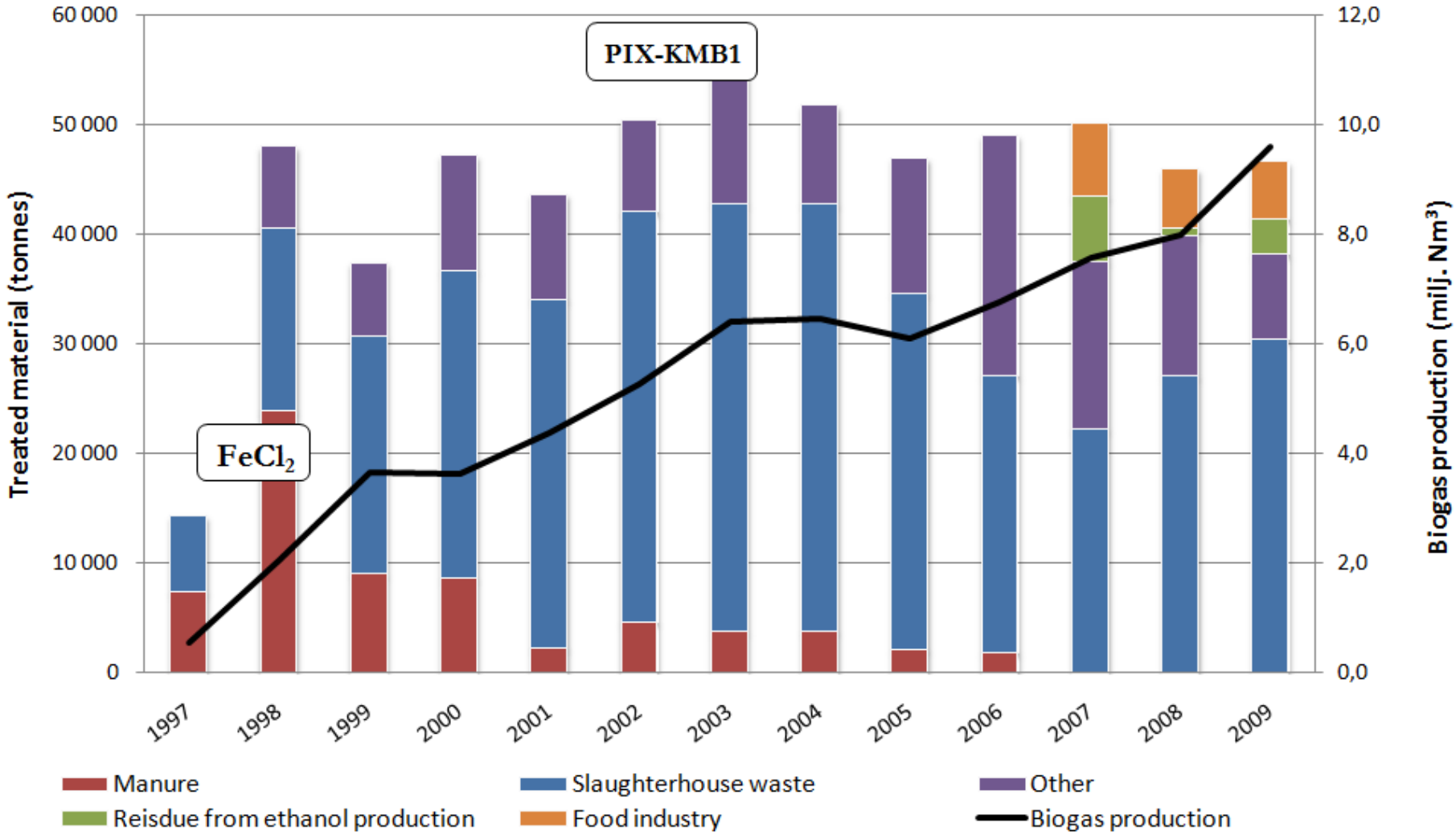
Linköping Biogas



Co-digestion of waste

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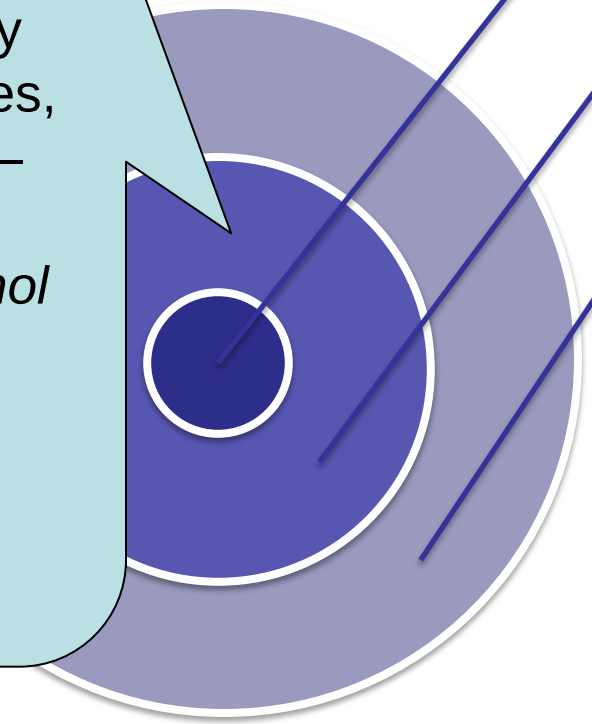
SBI Substrate Experience

- Slaughter house waste
- Dairy products and waste (chocolate, milk, butter milk, cheese, milk powder etc)
- Sludge from WWTP
- Stillage from ethanol or breweries
- Mycelium from pharmaceutical industry
- Glycerol
- Waste from biodiesel production
- Vegetables
- Fish waste
- Corn, grain, wheat, ensilage, etc
- Food waste from household
- Waste from food industry
- Manure (cow, pig, poultry etc)
- Alcohol
- Fat

360° Degrees of Biomethane COEE

Partnership Opportunities

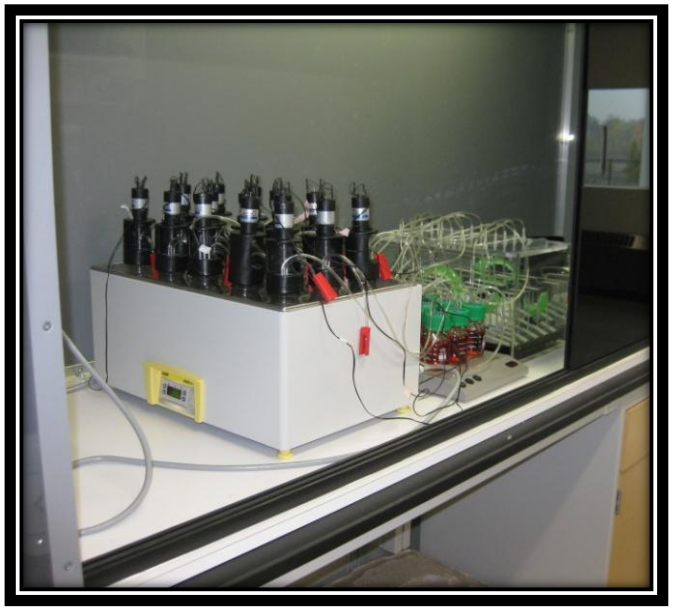
- DOE grant to study biodigestion, vehicles, & stationary power – Kettering
- *SBIR – Corn Ethanol Stillage*
- *Other partnerships with MI universities*



SBI core Business i.e. Flint POTW Biomethane plant

Partnerships i.e. Kettering research thru DOE

Collaboration with trade groups, universities, and societies i.e. University of Michigan



North American Advanced Biomethane (NAAB) Lab

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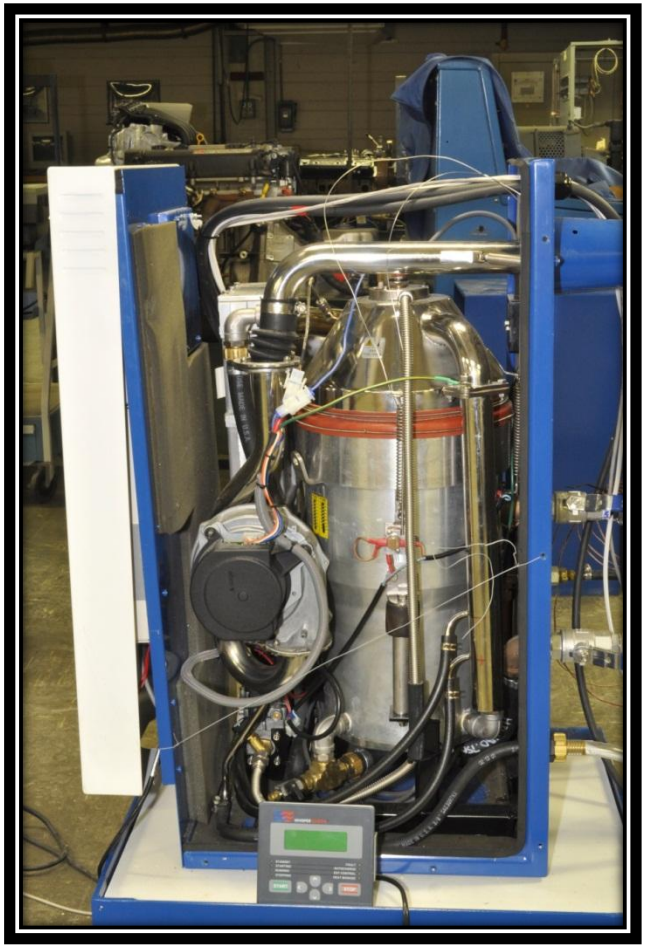
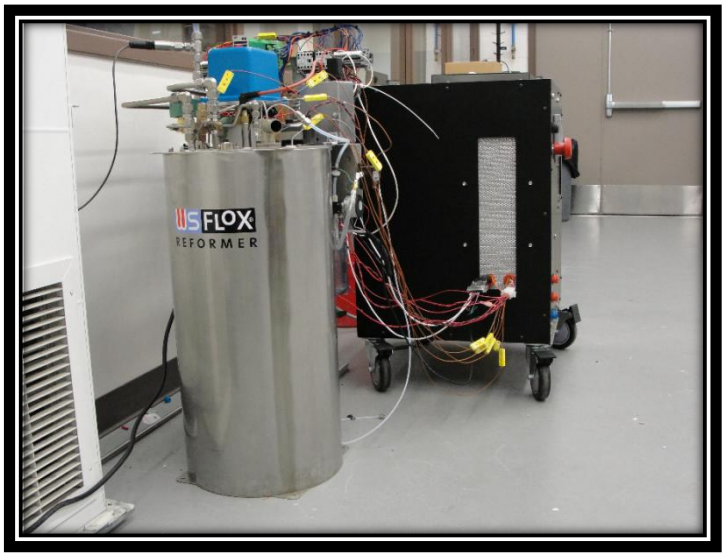
Biomethane Vehicle

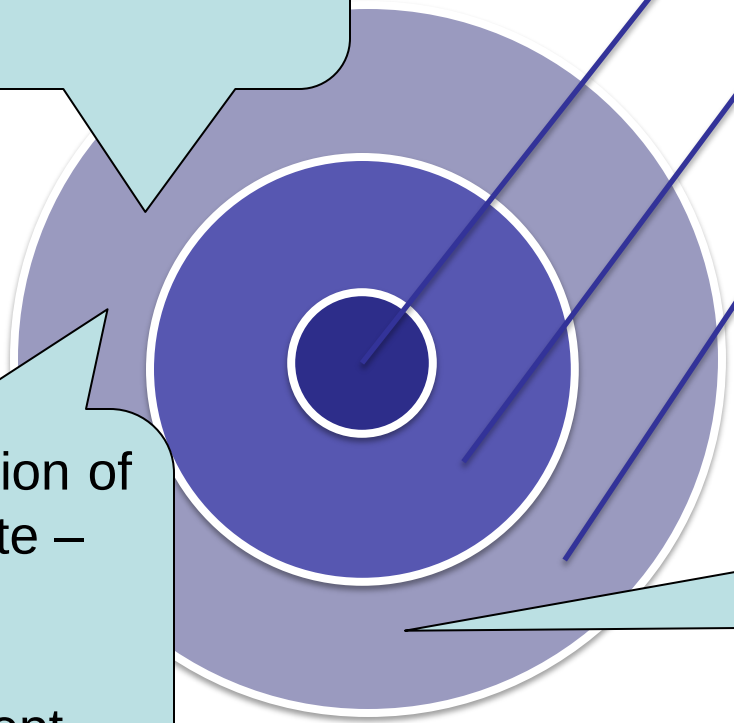


Stirling Engine



HTPEM Fuel Cell

360° Degrees of Biomethane COEE



Coalition for Biomethane (NGV) use – Flint, MTA, Consumers Gas, Kettering

SBI core Business i.e. Flint WWTP Biomethane plant

Partnerships i.e. Kettering research thru DOE

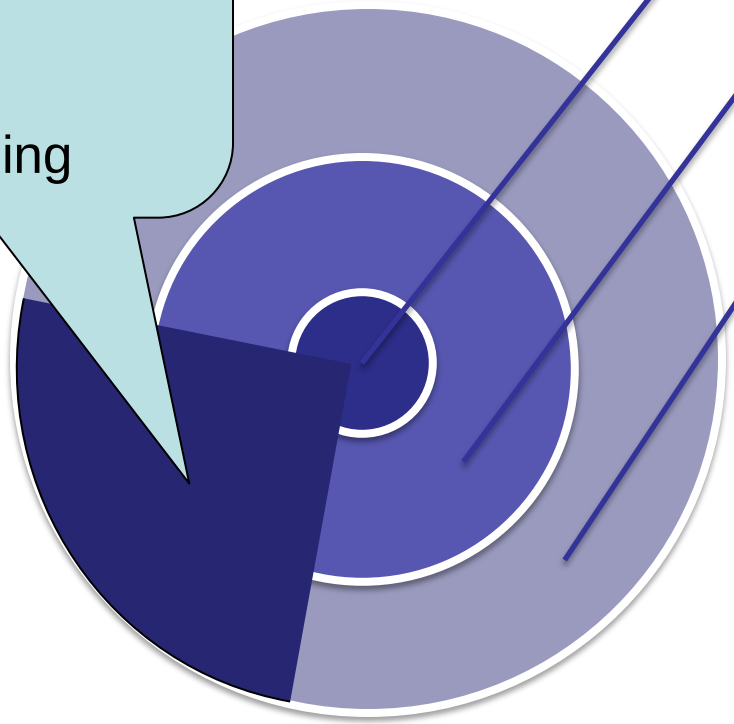
Collaboration with trade groups, universities, and societies i.e. University of Michigan

Land application of digested waste – MSU, Farm Bureau, MI agricultural dept.

Biogas / Biomethane research committee - MI universities

360° Degrees of Biomethane COEE

Education and Community Outreach
- Students
- Teachers
- Community
- Worker Training



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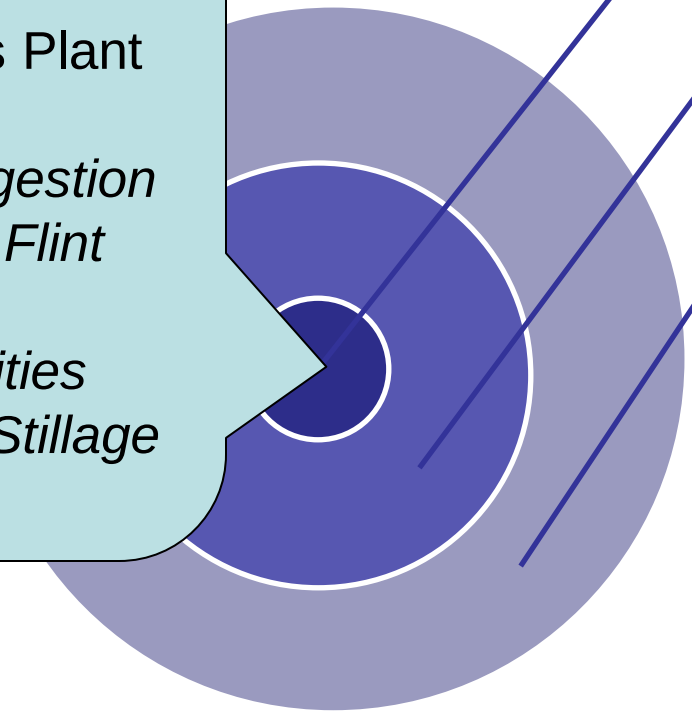
Creation of educational center for:

- K-12 Educational Tours
- Pre-college programs i.e. Kettering
- College programs
  - Kettering and UofM Flint – Alt. Energy Engineering
  - Mott & Baker – Alt. Energy Technical Training
- High School Educator Training
- Community / Public Tours
- Industrial Education – MWEA, American Biogas Council

360° Degrees of Biomethane COEE

Projects in MI for SBI

- POTW Biogas Plant – Flint, Mi
- *POTW to codigestion & biofertilizer – Flint MI*
- *Regional Facilities*
- *Ethanol Plant Stillage*



SBI core Business i.e. Flint POTW Biomethane plant

Partnerships i.e. Kettering research thru DOE

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Location of biogas plant @ existing WWTP

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SBI Business Model is to design, own, and operate biogas- and biomethane plants.

SBI LLC is established in US (Michigan) to lead the way in Biogas.

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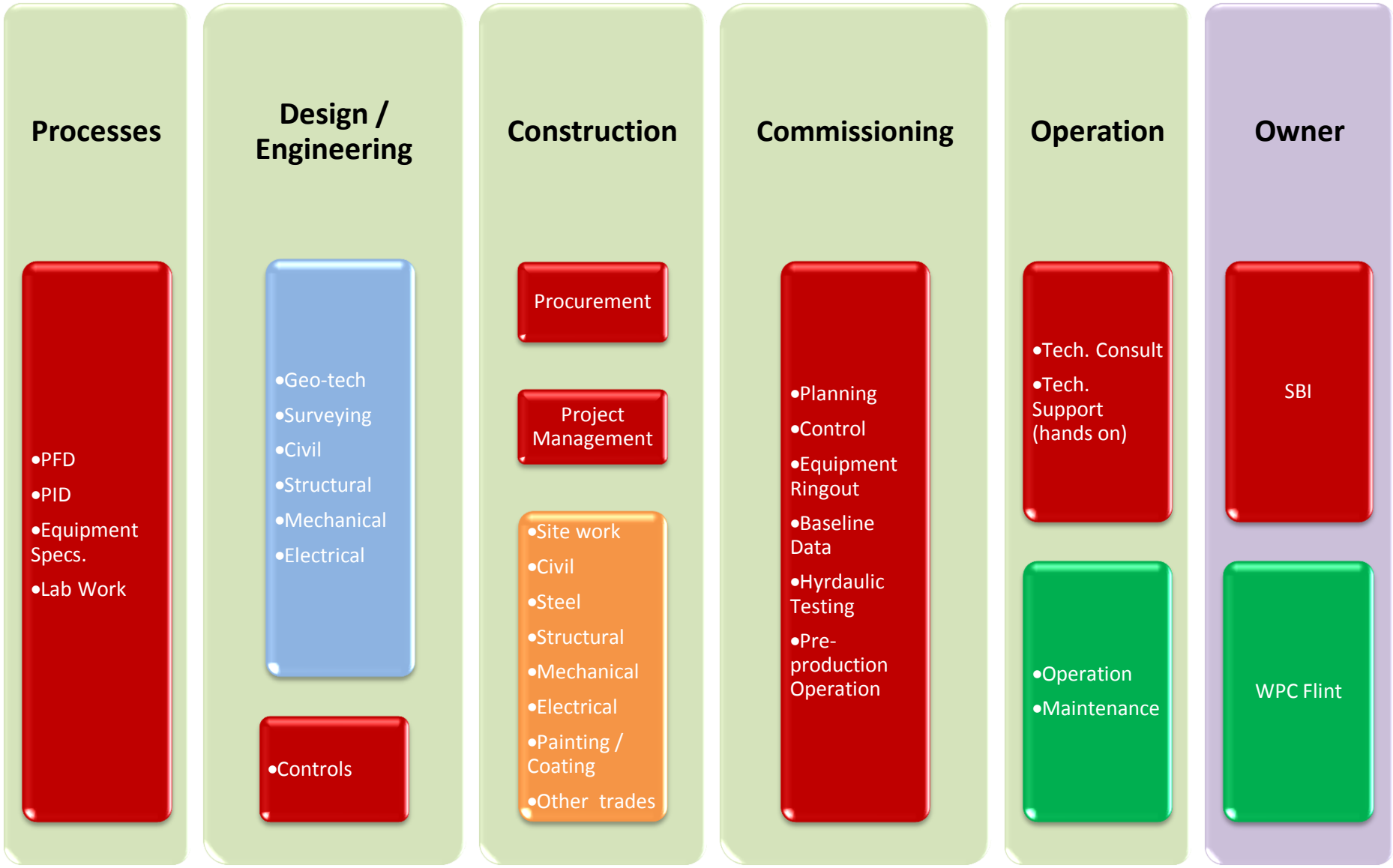

Flint Execution Model

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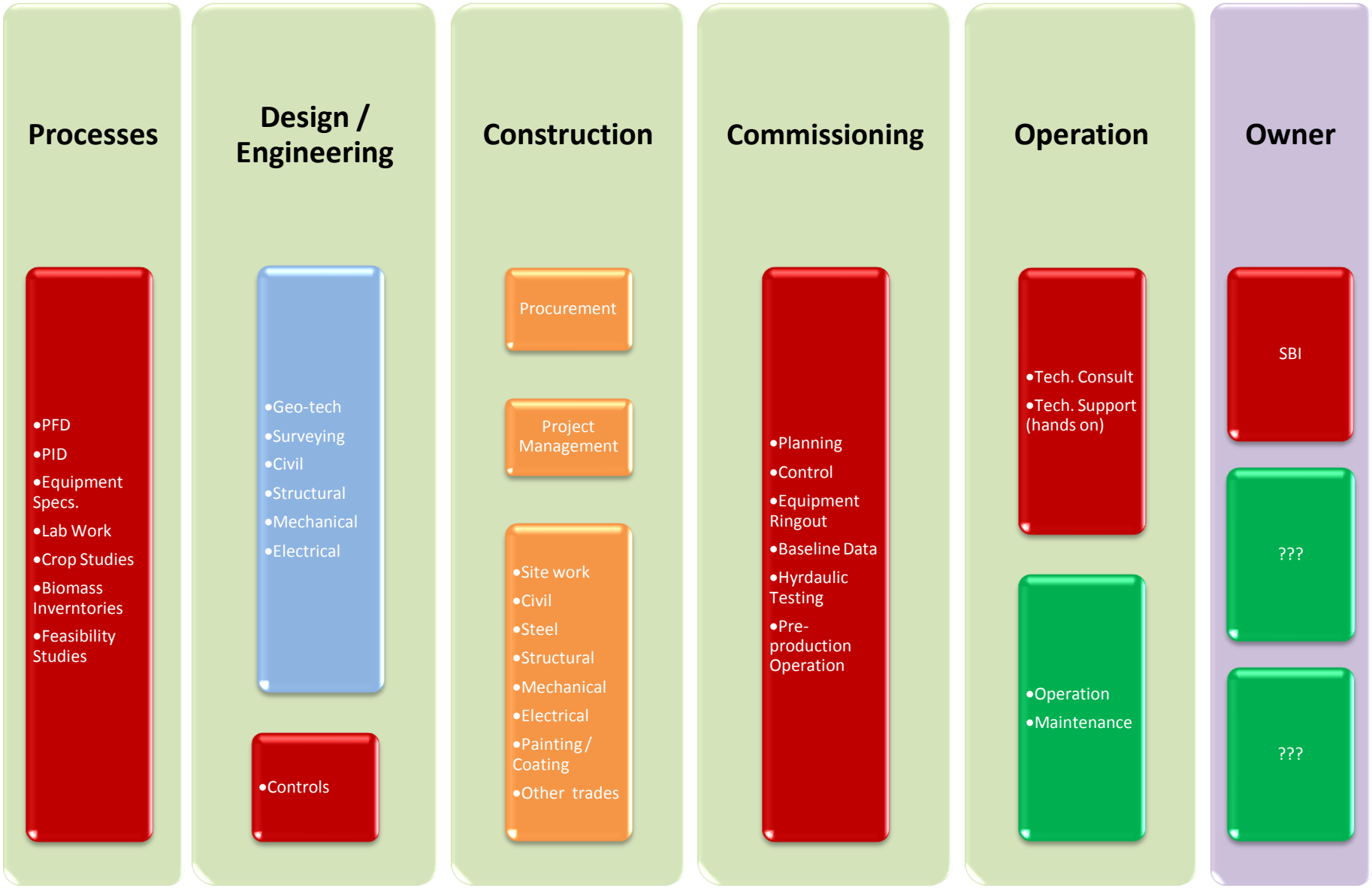

Execution Model – Core Business

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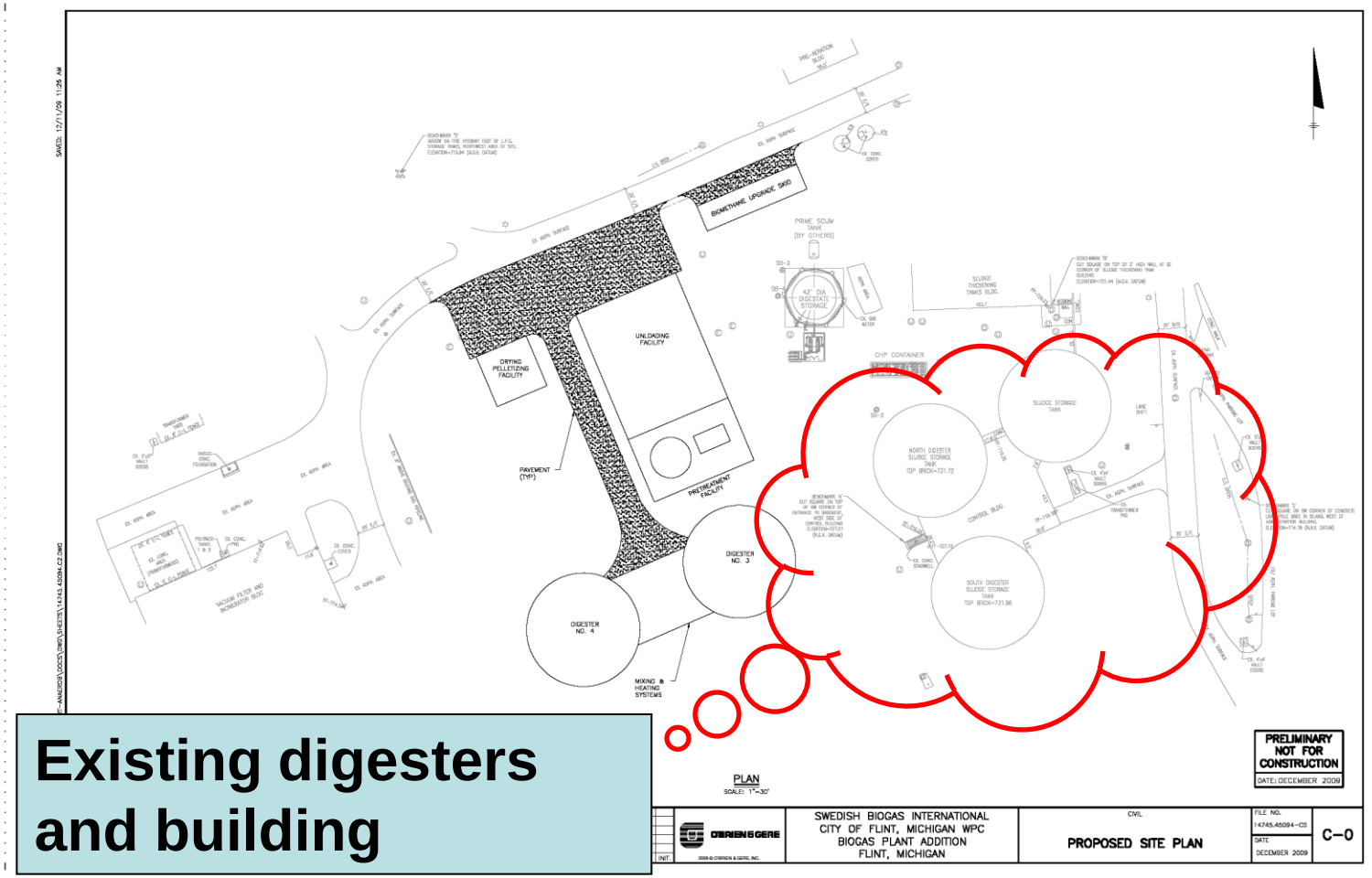

Existing digesters and building

Reduce, **Reuse**, Recycle

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Flint WPC Construction - 2010

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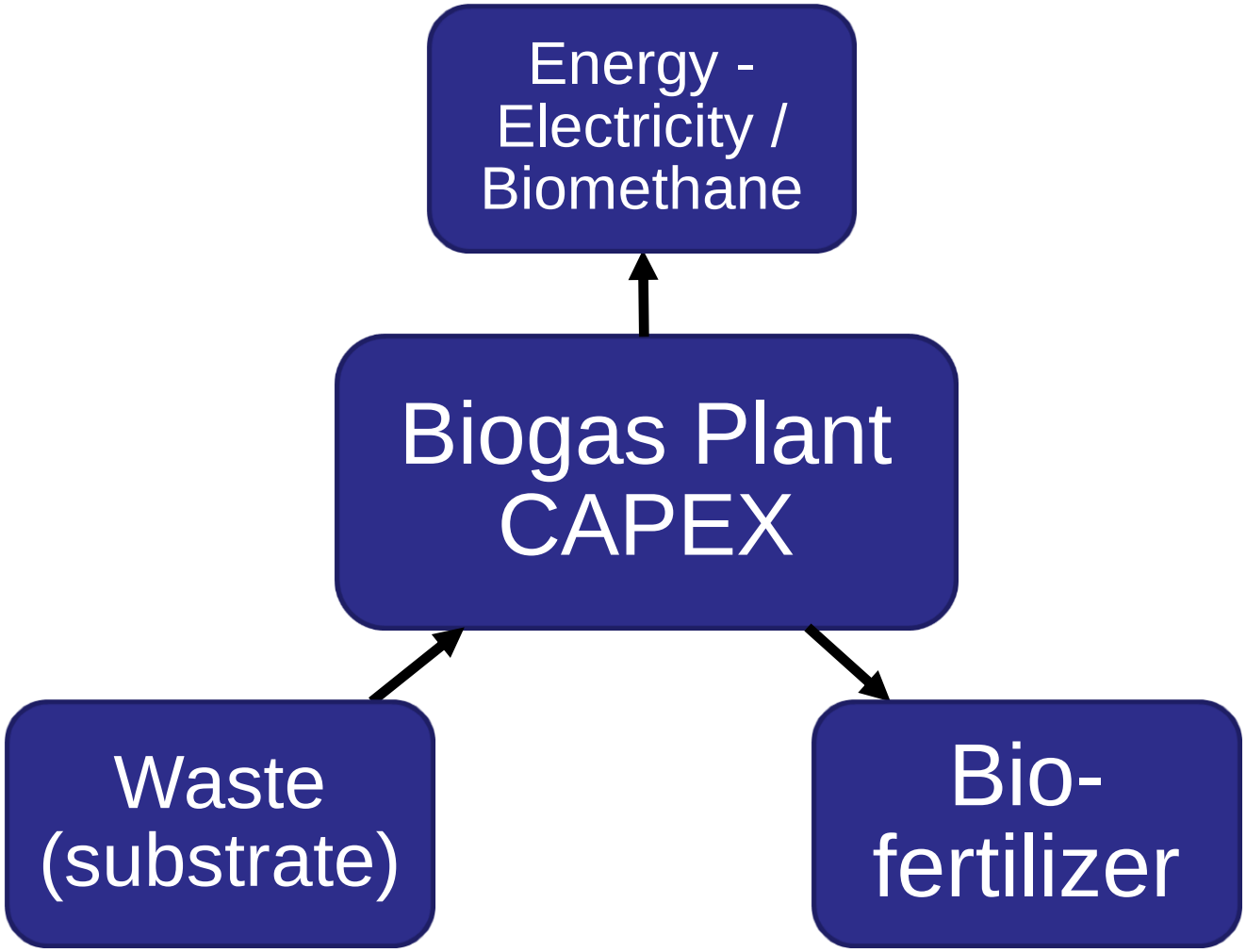

Economic Model

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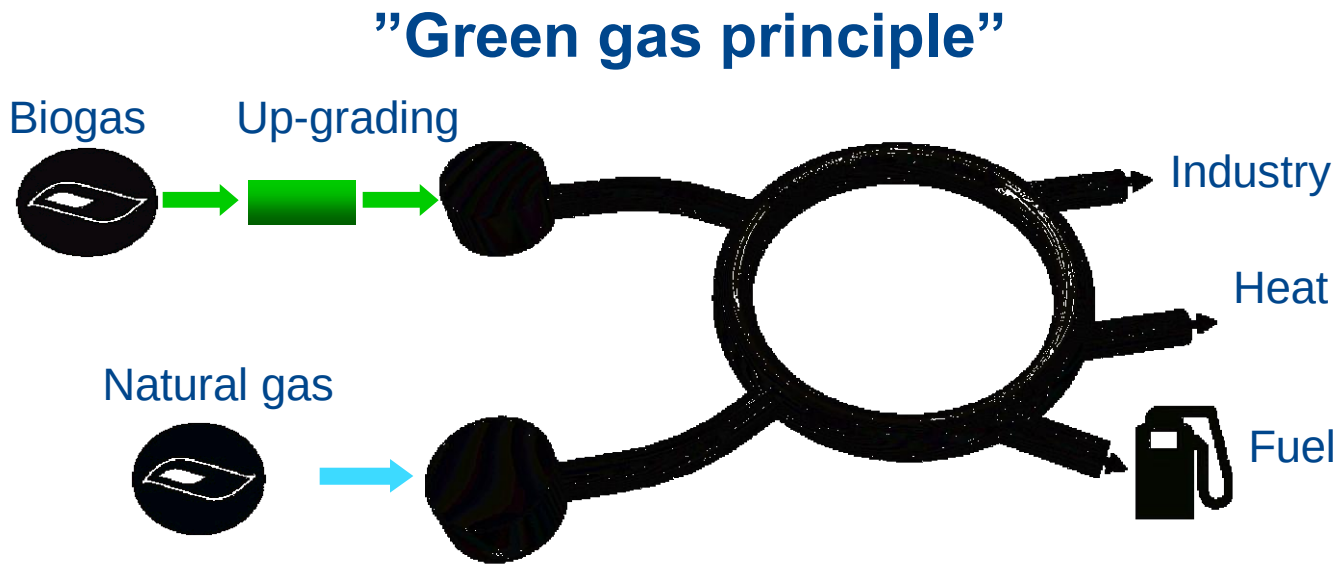
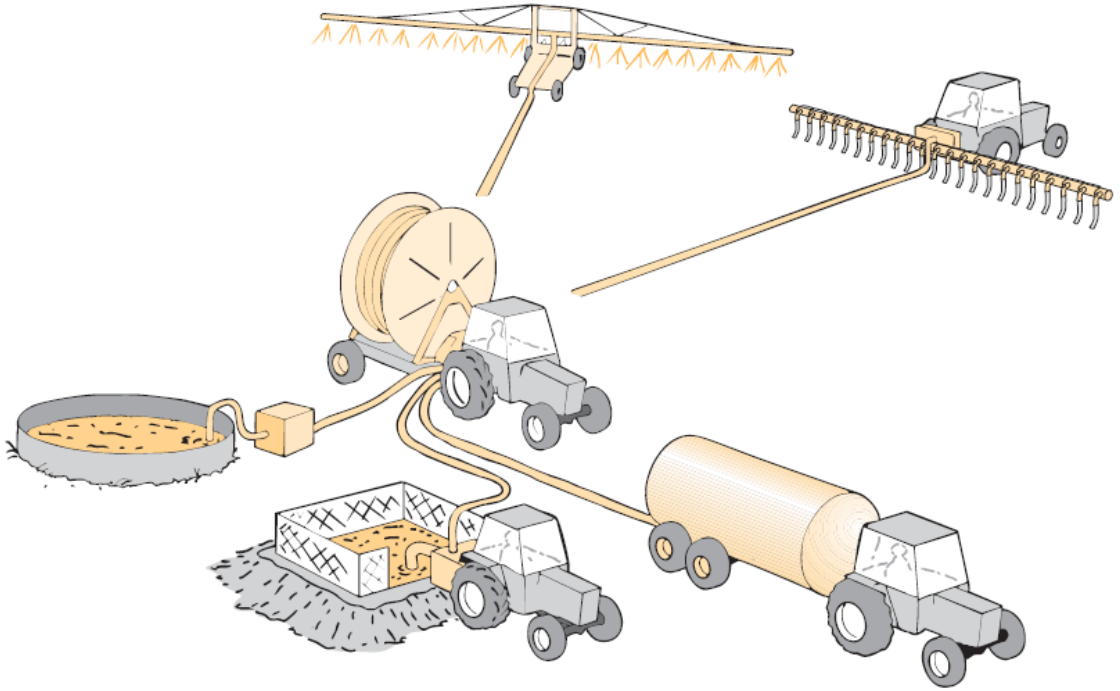
- Synergies with cooperation between BioMethane and Natural gas
- Build a market through Natural Gas and gradually switch to BioMethane





- No dewatering needed
- 4-6 % Total Solids
- Has more nutrients/ kg TS than dewatered bio-fertilizer
- Conventional equipment could be used (pipelines could also be used)
- Preferable applied spring to autumn

Liquid Bio-fertilizer

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- Storage of the Bio-fertilizer at the farm
- SBI handles the transportation to the farmer
- Contract between SBI and farmers to ensure volumes for both parties

Distribution Network

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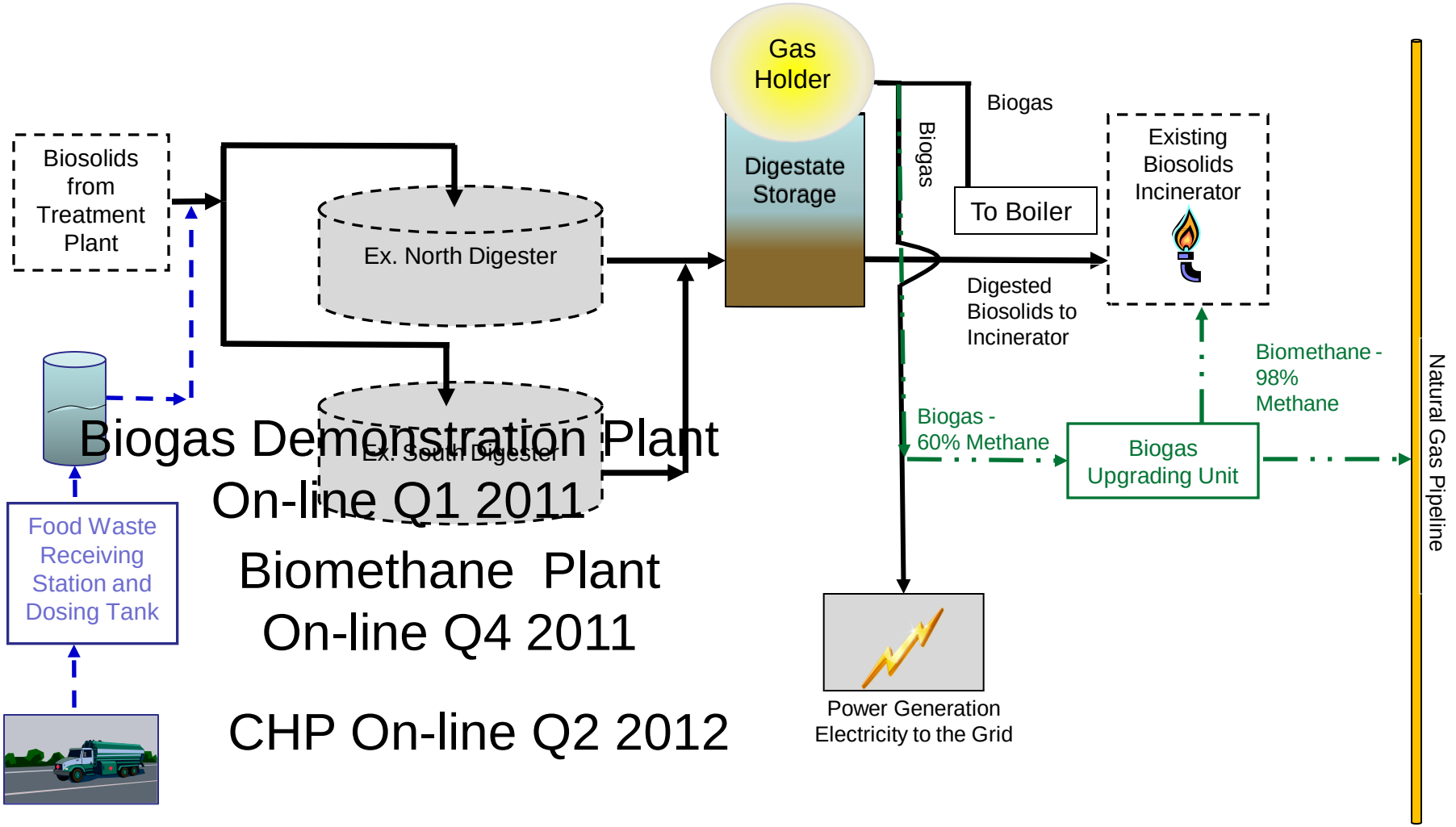
Flint Energy Output – 3.0 MW



Flint Biogas Plant Evolution

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	BENIFICIAL	HARMFUL
INTERNAL (Michigan)	STRENGTHS • Michigan has technical workforce seeking new job opportunities in “green economy” • Michigan requires 10% renewable energy by 2015; Renewable Portfolio Standard (RPS) in place • Michigan has ample resources of food waste for AD processes. • Strong support from MEDC and MDA • Michigan has ample farm land and woodlands to support development of bio-fertilizers (digestate from AD) • Existing infrastructure (AD systems) at WWTP (abandoned and operating) can be leveraged for co-digestion • Good natural gas network to support distribution of biomethane	WEAKNESSES • Regulations cross multiple jurisdiction and are not written specifically for stand-alone AD system • Net-metering rules offers no advantage for alternative energy producers • Negotiating Power Purchase Agreements (PPA) through utilities is onerous and time consuming for small businesses • Utility rates that support AD development will end when RPS is fulfilled • Low cost electricity rates
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Can we improve the environment and grow our economy?

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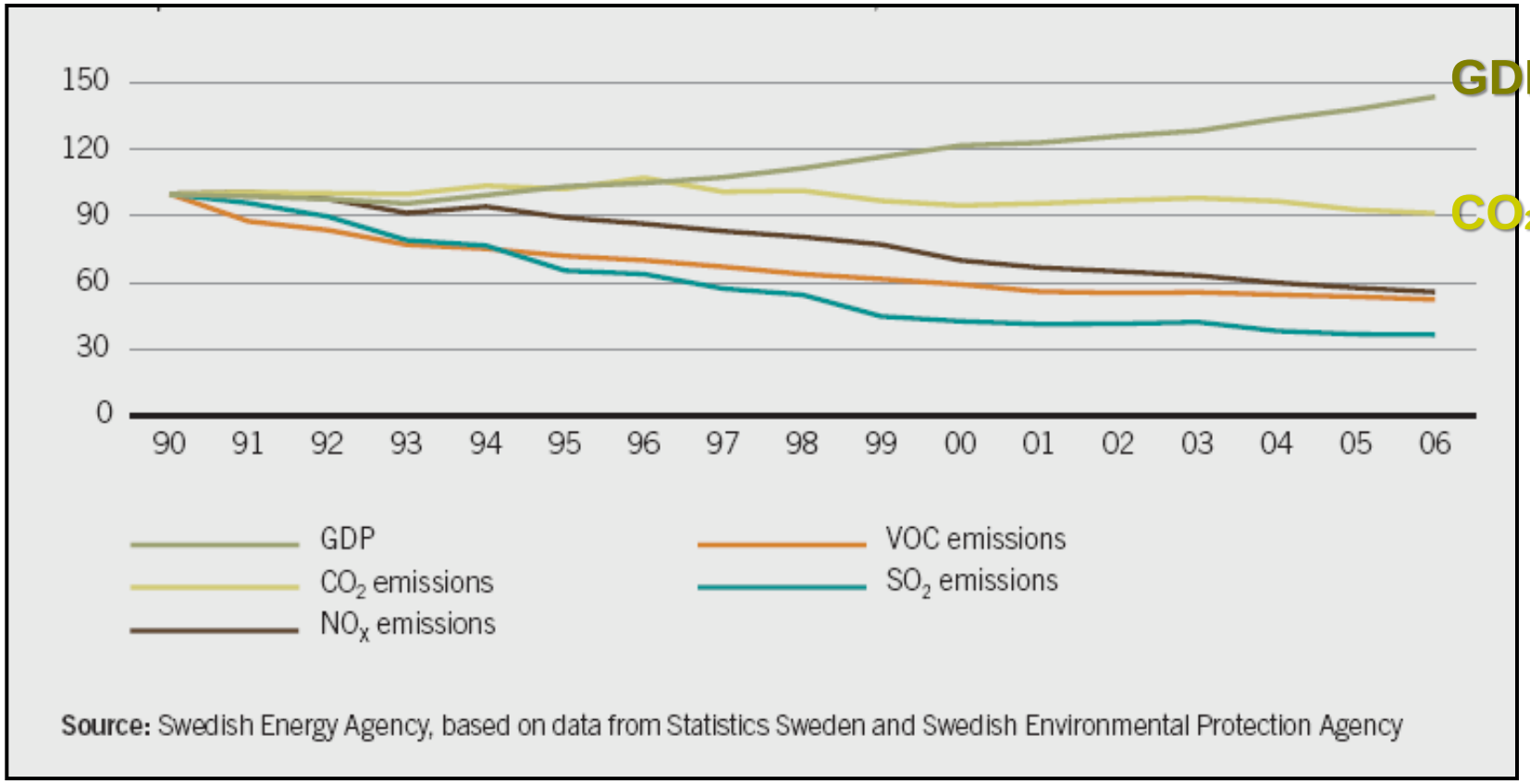
Sweden: A Path Forward?



Source: Swedish Energy Agency, based on data from Statistics Sweden and Swedish Environmental Protection Agency

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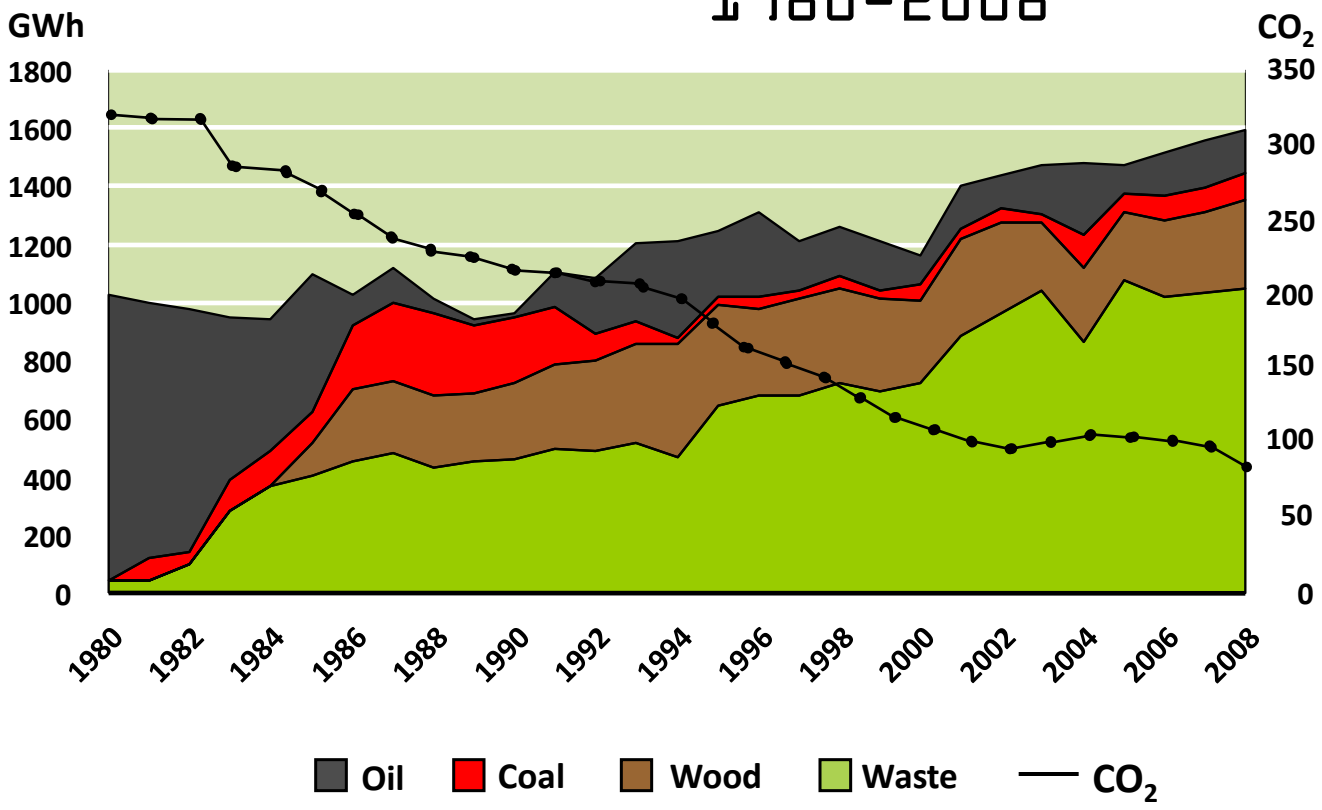
Replacement of fossil fuels for energy

- The municipality of Linköping, Sweden 1980-2008



Thermal treatment of waste replaces large amounts of fossil fuels while simultaneously eliminating growing waste mountains and leaking landfills

Source: Tekniska Verken

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What does the future look like?

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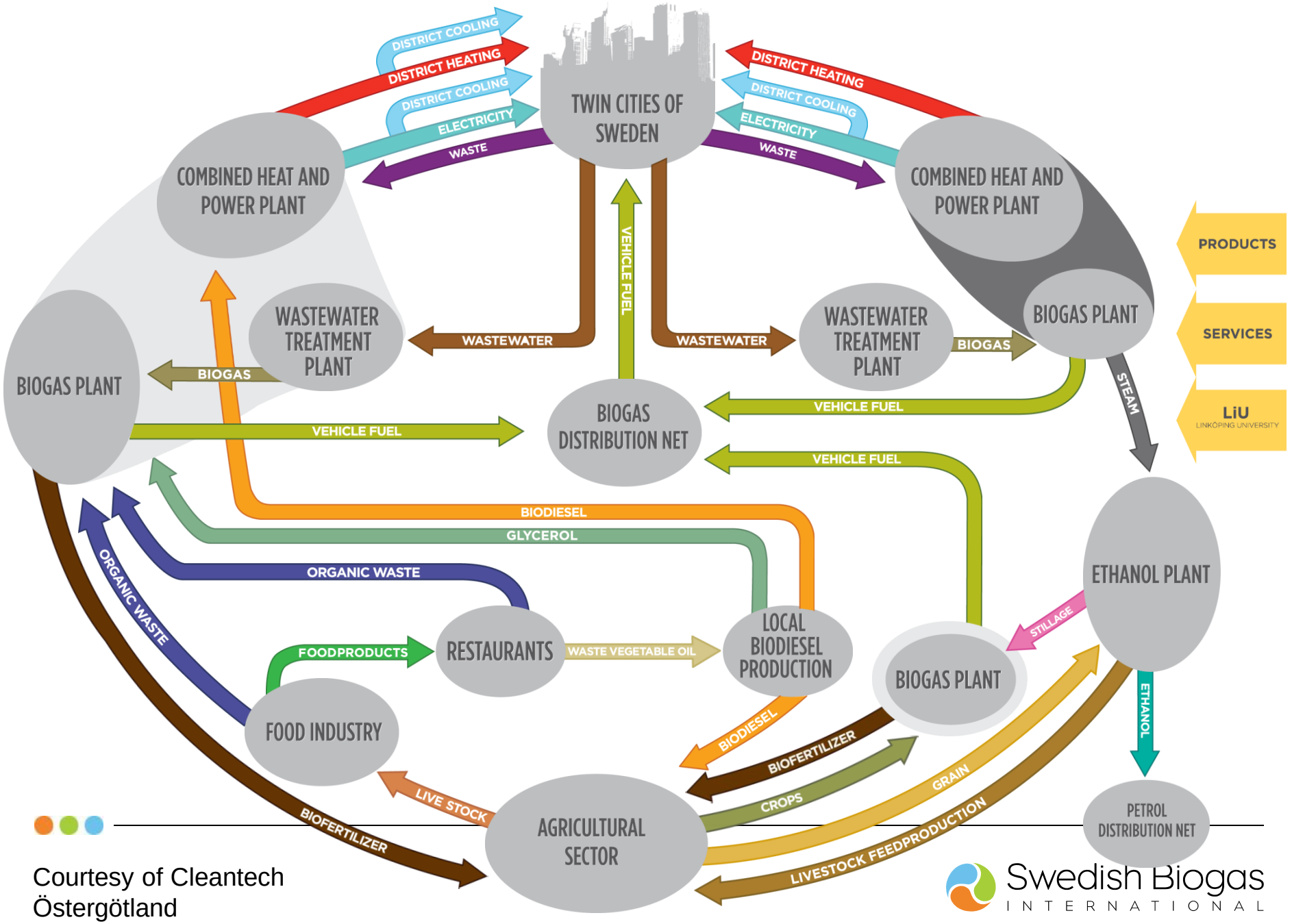

Courtesy of Cleantech Östergötland

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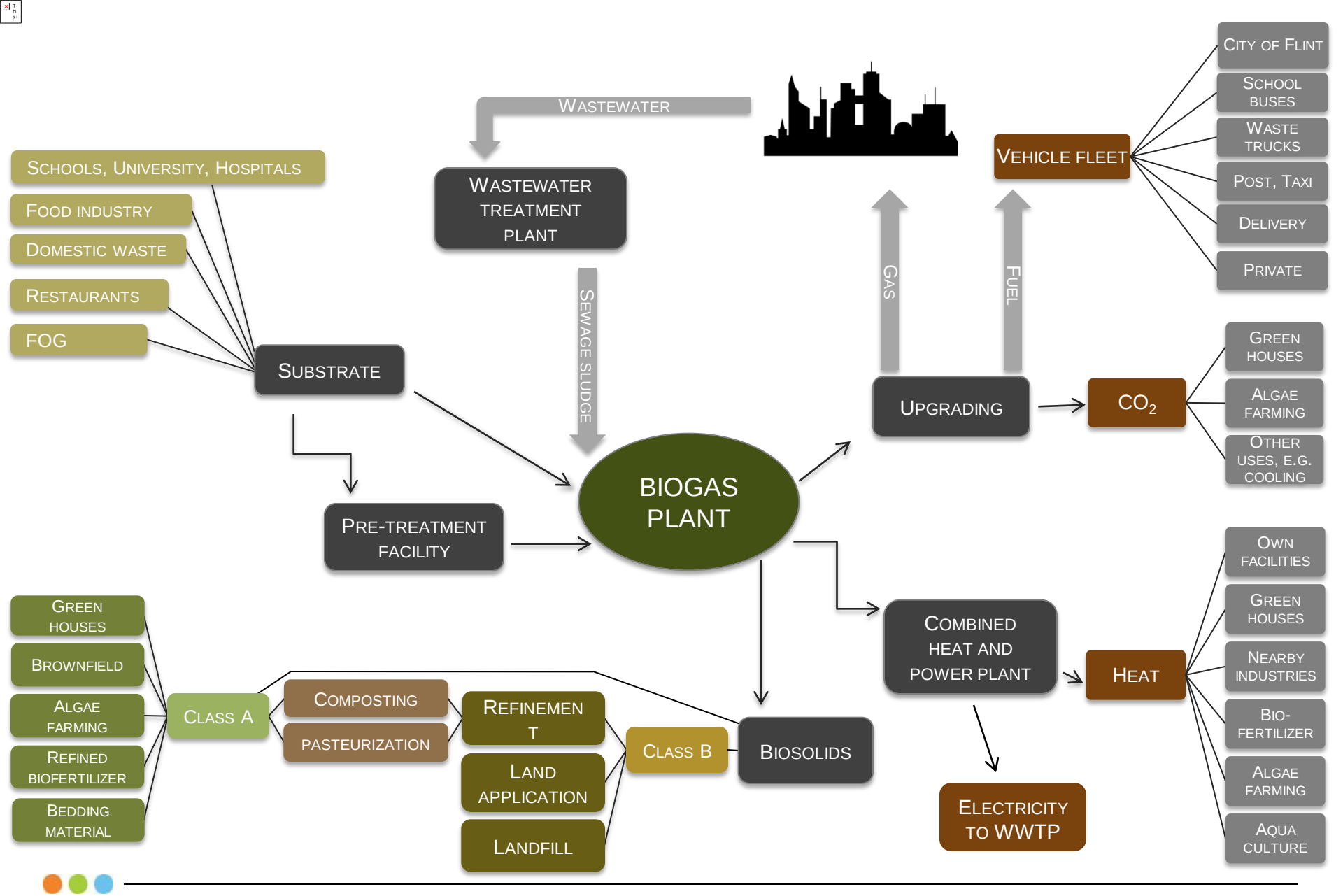

"Beyond Biogas"

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