Sustainability at Cornell

Sustainability

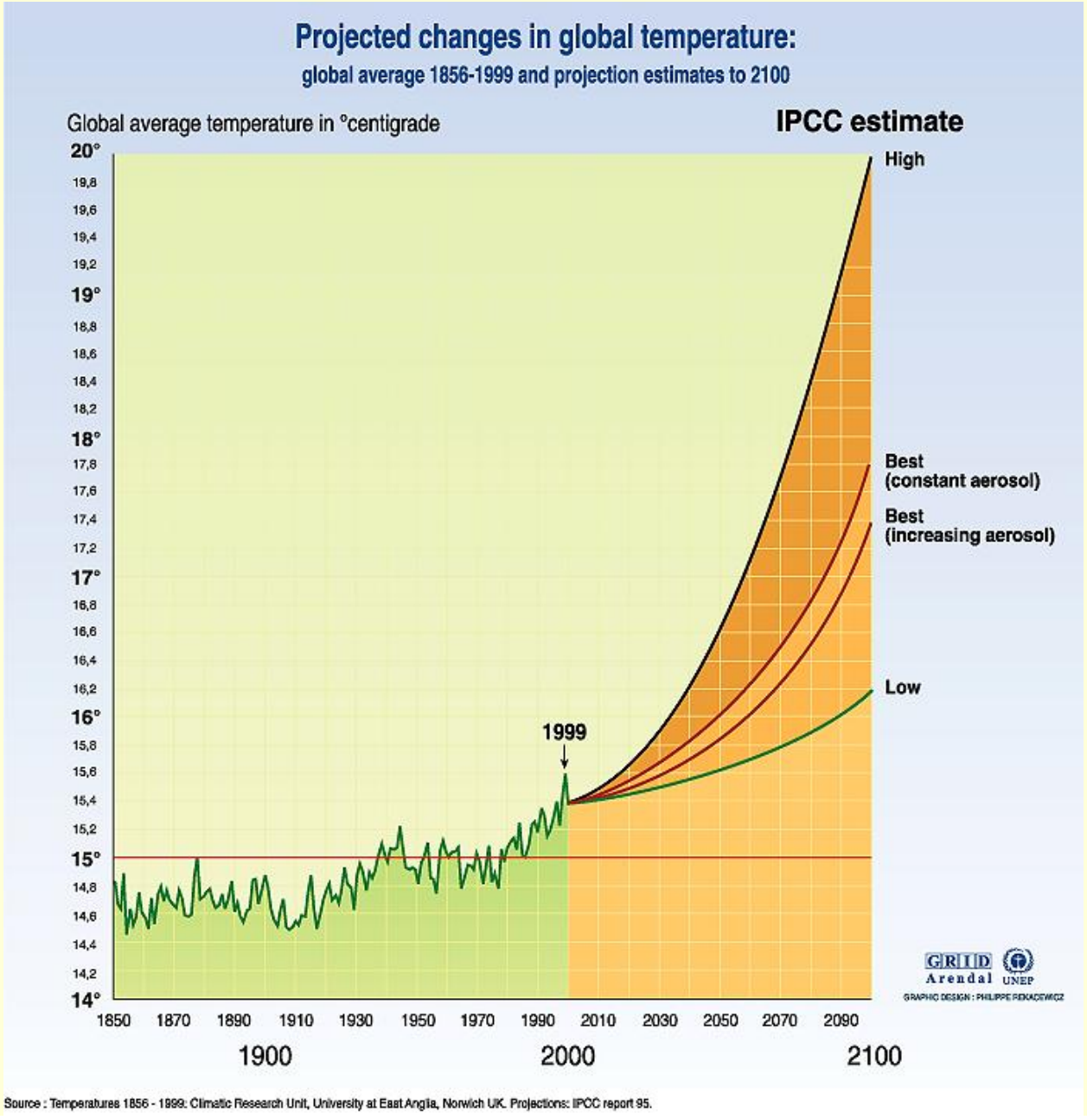
“Meeting the needs of the present without compromising the ability of future generations to meet their own needs”

UN Brundtland Report

Why Sustainability?

- **Global warming**
  - "We are all on trial"
- **Population**
  - 6 billion now, 9 billion 2050
- **A global community**
  - Social, economic, political stability

Global Warming



Source : Temperatures 1856 - 1999: Climatic Research Unit, University at East Anglia, Norwich UK. Projections: IPCC report 95.

Cornell University - Committed to Sustainability

- Cornell University is guided by a belief in balancing people, the planet, and prosperity.
- Cornell adopted the Kyoto Protocols to control or reduce CO2 emissions
- Cornell University President David Skorton has committed the University to Carbon Neutrality

www.cornell.edu/sustainability

Cornell University Committed to Sustainability

- Operations - Environ. Compliance & Sustainability Office
  - Reduce environmental footprint and enhance our local communities
  - Maximize operating efficiencies
  - Enhance environmental leadership and reputation
- Academic - Cornell Center for a Sustainable Future
  - Promotes and advances collaborations - internal and external
  - Leverages Cornell's resources to build a sustainable future
    - Academic Venture Fund
- Multitude of research, teaching & outreach programs

Cornell University - Committed to Sustainability

- LEED Buildings
- The lake source cooling system - saves more than 25 million Kwh/year
- Recycling efforts keep more than 2,000 tons of waste out of landfills/year
- Reduced number of parking permits by 25% and reduced commuting by 10 million miles/year
- Flex work schedules
- Combined Heat and Power
  - 75% Electricity
  - 50% Heat
- We are leagues ahead

The Cornell University

Agricultural Experiment Station (CUAES)

- A living laboratory -

- >10,000 acres - forests, farms, natural areas, streams…“surrounding” campus
- 155,000 sq ft greenhouses
- Personnel (45)
- Buildings, offices
- Supports research, teaching & outreach

Adopting a Culture of Sustainability

- Holistic and ecologically-based
- Focus on economic, social, environmental benefits, especially carbon neutrality
- A change in culture, mindset
- A model

Culture of Sustainability

- Shared leadership model
- Staff empowered/engaged
- Advisory group (faculty, staff) formed
  - Human Resources
  - Economics, soils, ecology
  - Communications
  - Economic development
  - Farm and forest management
- Assistant Director of Sustainability

Sustainability Matrix

- Inventory of opportunities
  - Forests, farms, offices, plant growth facilities
- Measurables - environmental, economic, social impacts
- Document change over time
- Help set priorities
- A model for wide use

Sustainability Matrix

- Examples -

- Best management practices for soils and pests
- No-till soil management
- Sustainable forests – carbon sequestration
- Native trees, grass feedstocks as bird habitat
- Landscapes - new turfgrass, shade trees
- Flex time, 4 day work week
- Energy conservation/efficiency
- Renewable energy (CURBI)

Matrix Example
Plant Growth Facilities
- Energy Conservation -

	Opport.	Environ. (kWh)	Econ. $/yr	C.U. Investm.	Payback Yrs.
Green - houses	Sealing cracks	15K	$55K	$277K	5
	New controls	200K	$178K	$720K	4
	Modify lighting	1,158K	$116K	$656K	6
Growth Chambers	*Lights, controls*	*Total 391 units*	*100 units @ $25K ea.*	*Ancient, poorly managed*	

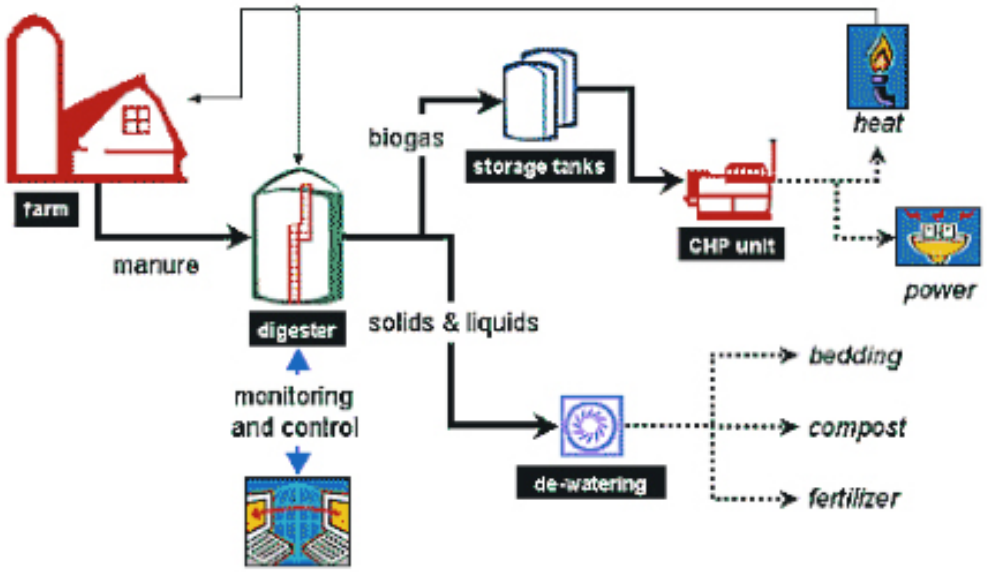
Culture of Sustainability

Cornell University Renewable Bioenergy Initiative (CURBI)

- Renewable energy from local biomass
  - Farms, forests, wastes…
- Complimentary technologies
  - Anaerobic digestion
  - Pyrolysis
  - Direct combustion
  - Biodiesel
- Teaching, research, outreach - living laboratory
- Model(s) with wide application
- Feasibility study phase

Composting 7500T/yr - dining hall and animal wastes

Anaerobic Digester Facility



- Methane from animal & food wastes, bio crops

- 60-80% biomass conversion (fermentation) to methane
- Widely used in Europe

Biogas Plant Stricker 500 kW

Anaerobic Digestion

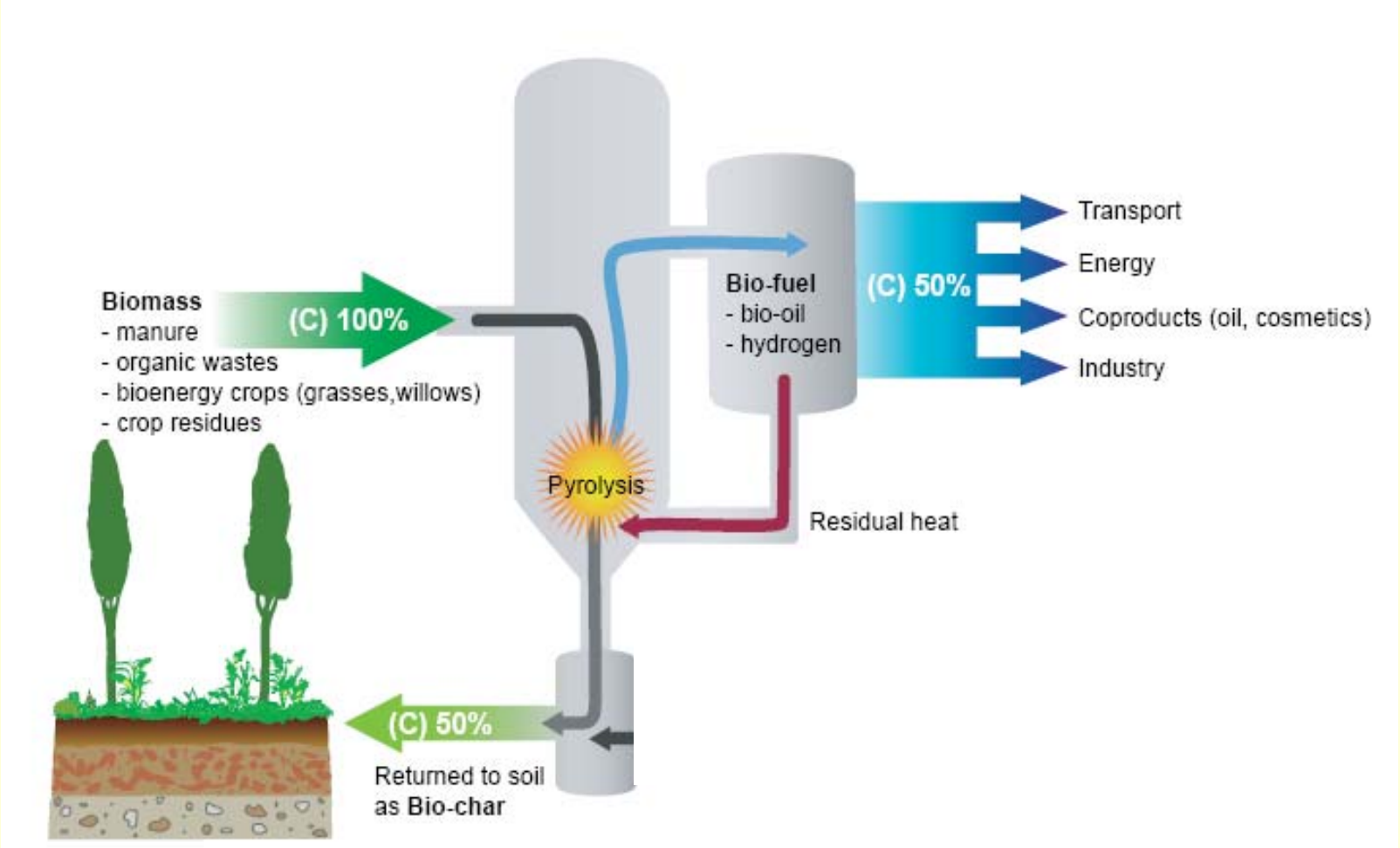
- 7500 tons/yr, 20 tons/day
  - = 120,000 cf methane/day, 365/yr
  - = 1-3% baseline CCHP needs
  - – Transportation fuel
    - 100g/day
  - – Expandable
- Faculty, Utilities & Energy Management

Anaerobic Digestion
Potential for wider adoption

- Towns, cities, farms -

- Waste streams
  - Restaurants
  - Supermarkets
  - Schools
  - Dairy, other animal waste
  - Carcasses
  - Grasses/field crops
  - Hospitals, Nursing homes
  - Food processing industry

Slow Pyrolysis



Lehmann, 2007, *Frontiers in Ecology and the Environment* 7, 381-387

Lehmann, 2007, *Nature* 447, 143-144

Slow Pyrolysis

- Range of wastes - urban, ag, forest, recycled organics (local inputs from Cornell)
- Scalable - subsistence farmer > large scale
  - Global potential
- Carbon negative

Biochar

- Pyrolysis retains 50% of carbon as biochar
- Excellent soil amendment
  - Enhanced plant growth
  - Reduces soil acidity
  - Increased retention of nutrients
  - 100’s - 1000’s of years - sequestration
- Marketable product/carbon offset credits
- Potential to offset fossil fuel emissions
- Research questions - economics
- Johannes Lehmann

Direct Combustion

Direct Combustion

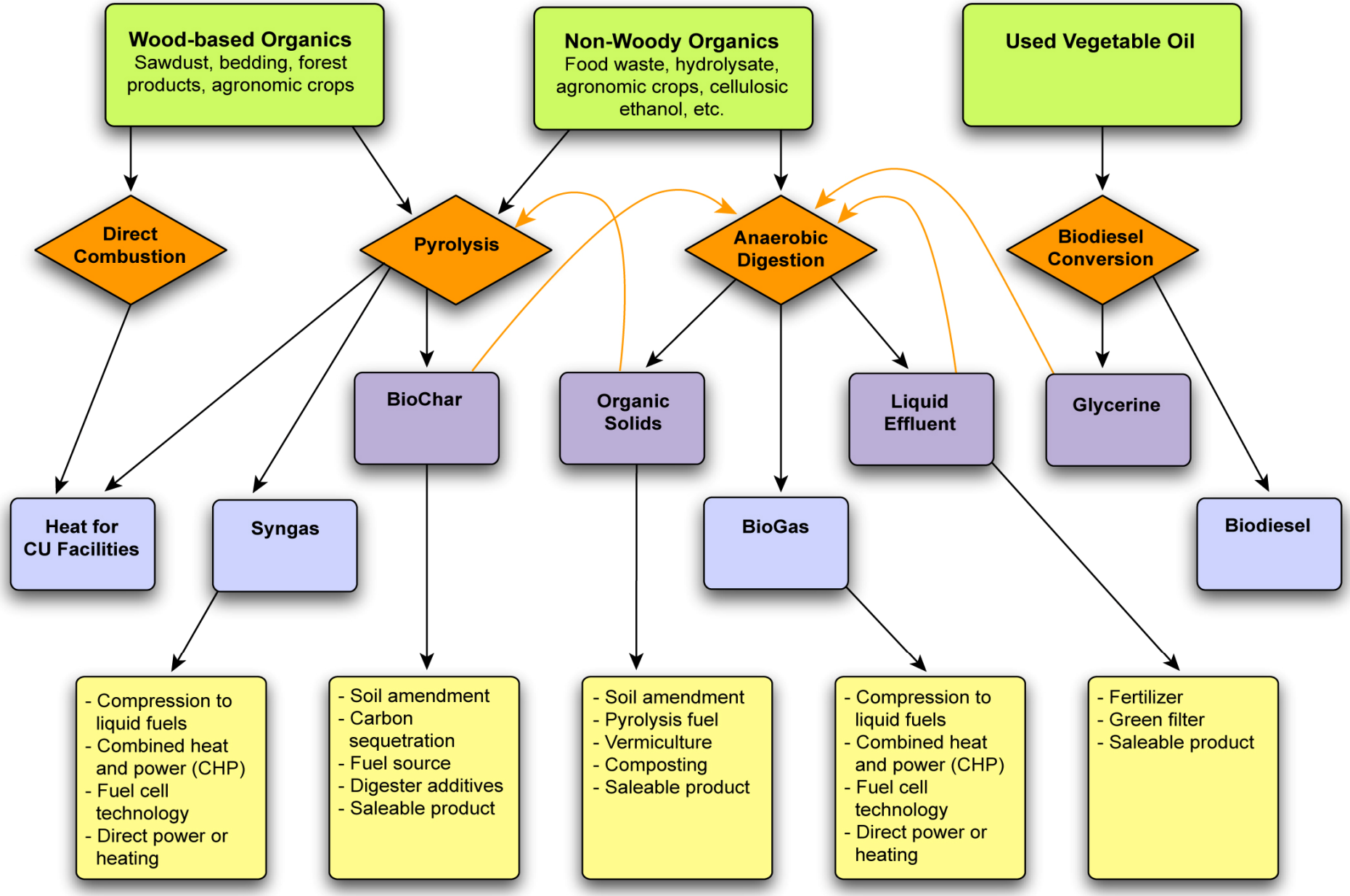
- Wood, grasses, ag. biomass
  - Local sources
- High efficiency
- Technology available
- Wide application
  - Homes, schools, dormitories…

- Jerry Cherney

McOil to McTractor

- 6000 gal waste veg oil/yr (Cornell dining facilities)
- Conversion to biodiesel = 40% CUAES needs
- Return on investment <12 mo
- Potential wide use - schools, communities…

Cornell University Renewable Bioenergy Initiative - CURBI
Operating System



Culture of Sustainability

- Unlimited Opportunities -

- We have a vision and think big
- Offers unlimited research, teaching, outreach, economic development opportunities
- A model with wide application, scalable
- Enthusiastic response - public, private sector
- High profile
- Admin., academics, operations engaged and supportive
- It is the right thing to do, the right time
- High probability of success