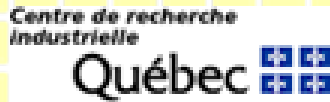


# Innoventures Canada (I-CAN)

## Carbon Algae Recycle System

Presentation to:  
BIOP 2008  
Montreal, Canada  
November 6, 2008

Marc Daigle, eng.  
Project Collaborator  
Innoventures Canada, CRIQ



# Overview

Innoventures Canada (I-CAN)

Research Project

Stage 1 Results

Stage 2 Work plan

# I-CAN

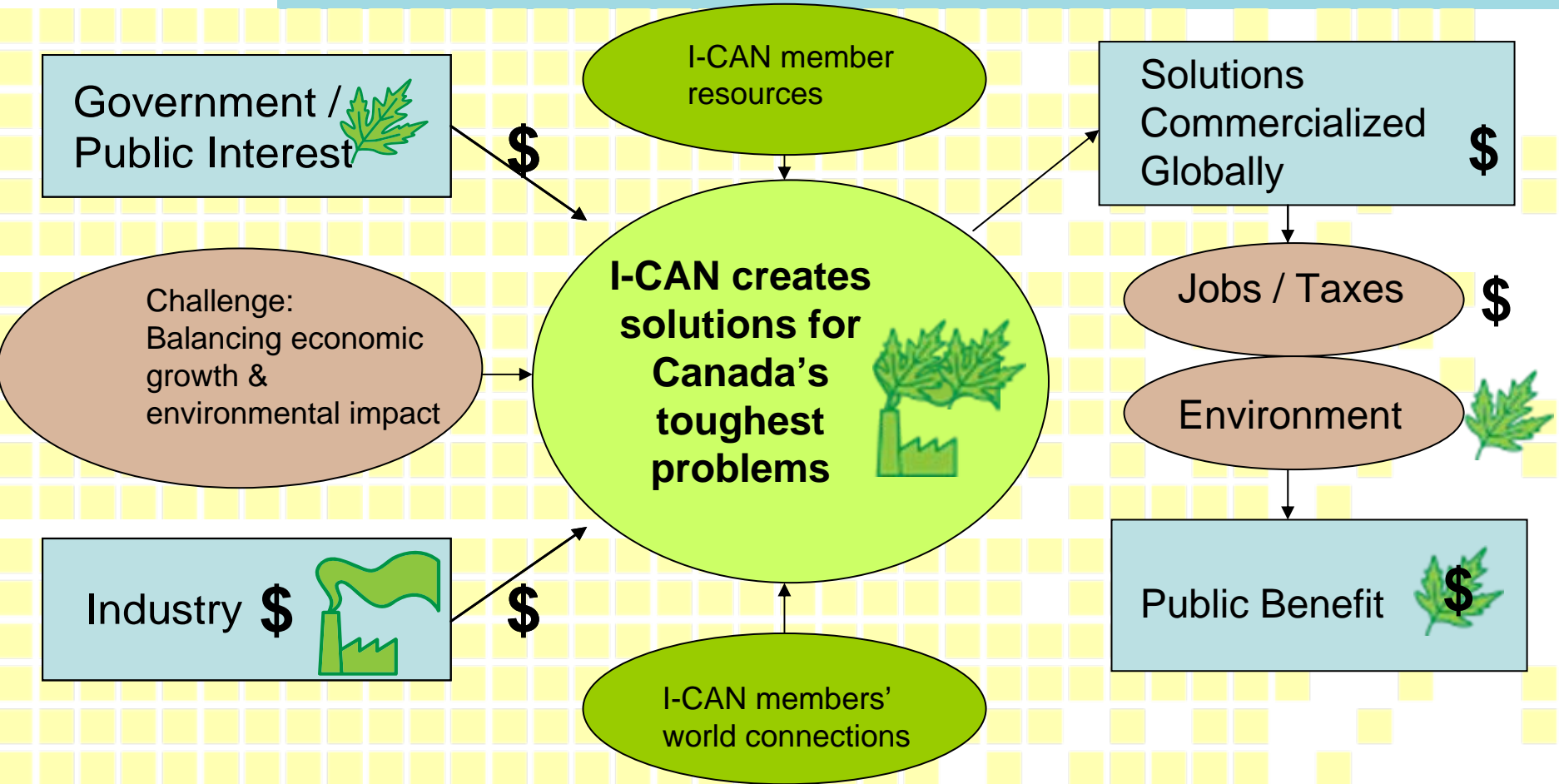
- Integrate existing expertise and facilities to address key national challenges:
  - 2,300 scientists, 20 communities, 8 provinces, 10 industrial member
- Drive research to reality quicker for our collective benefit
- Support companies through collective resources and connections

# I-CAN

How does it work?

- Specific project
- Select the expertise needed (team)
- Work plan
- Fund
- Project realization

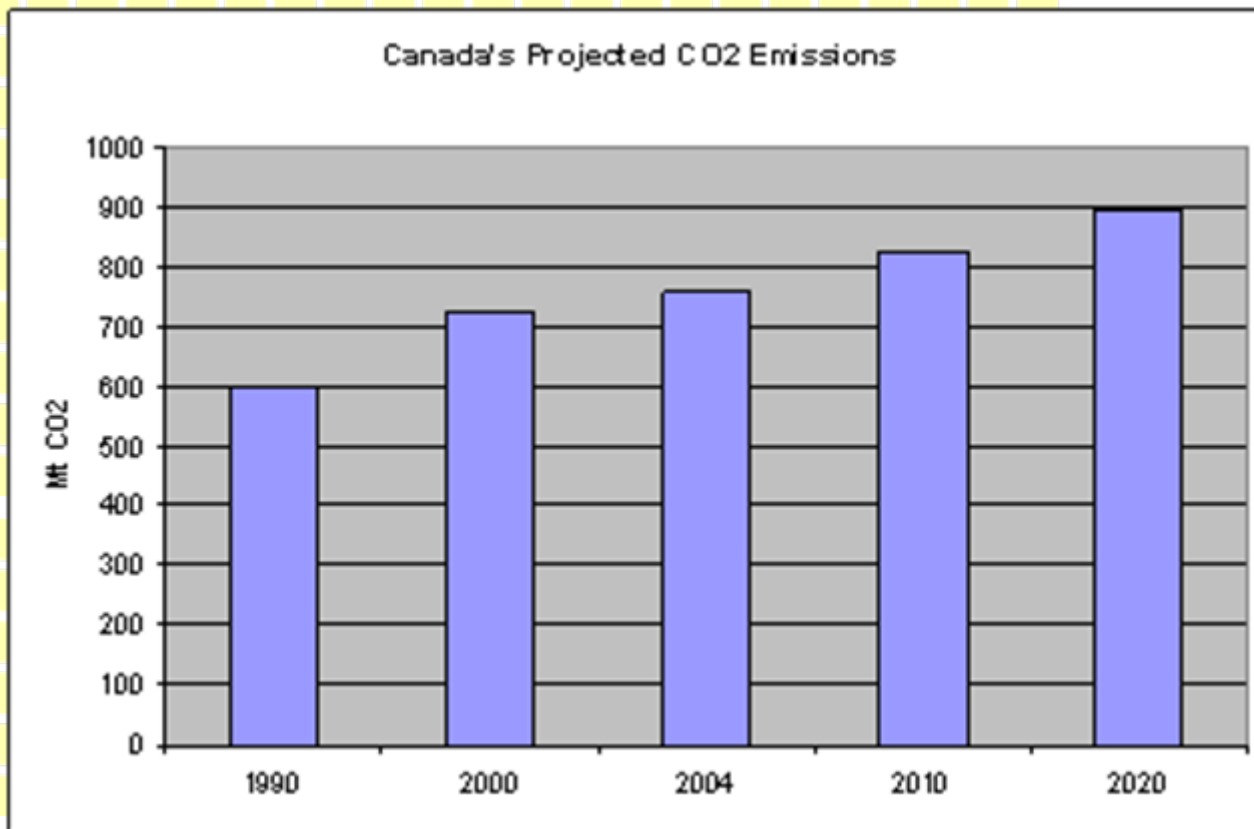
# I-CAN



# Research Project

Use of microalgae to  
transform carbon dioxide into  
value-added goods

# Research Project



# Research Project

- **Research Microalgae Photosynthesis**
  - Able to directly utilize flue gas
  - Fixation of CO<sub>2</sub> through algae photosynthesis
  - Adapt and speed up Mother Nature
- **Combines both CO<sub>2</sub> conversion and Biomass based energy production**

# Research Project

- **Research Microalgae Photosynthesis**
  - Able to directly utilize flue gas
  - Fixation of CO<sub>2</sub> through algae photosynthesis
  - Adapt and speed up Mother Nature

## Carbon Algae Recycling System

- **Combines both CO<sub>2</sub> conversion and Biomass based energy production**

# Research Project

## **Stage I (2007-2008)**

- Confirm “proof of concept” research for Canadian conditions
- Initial algae strain selection
- Economics
- Complete Project Plan for Stage II support

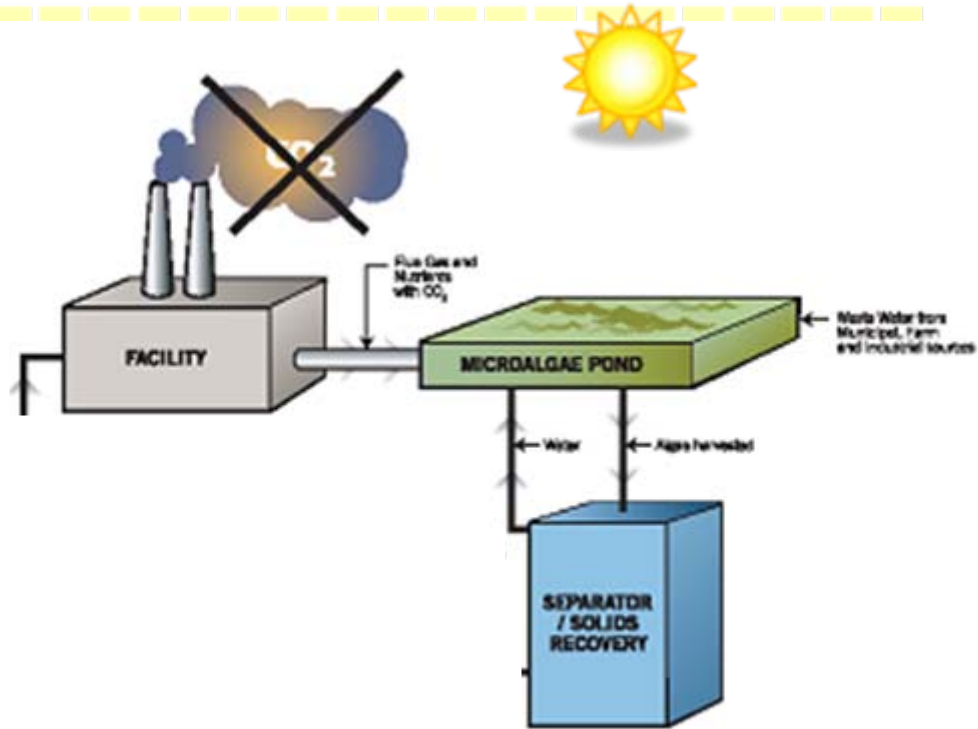
## **Stage II (2008-2010)**

- Construct lab-scale demonstration facility
- Ongoing research for optimizing production
- Conceptual engineering for a field pilot
- Build and operate demonstration facility

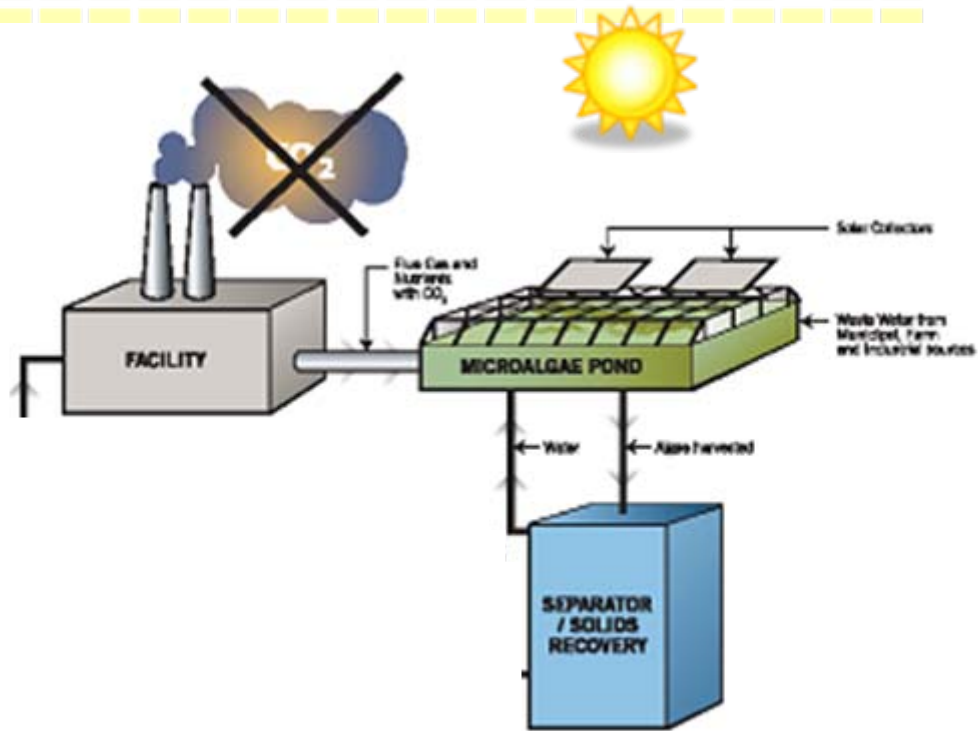
## **Stage III (2010 – 2012)**

- Phased R&D at field pilot facility
- Recommendations for scale-up to large demonstration facility
- Identify host and pursue financing for large demonstration

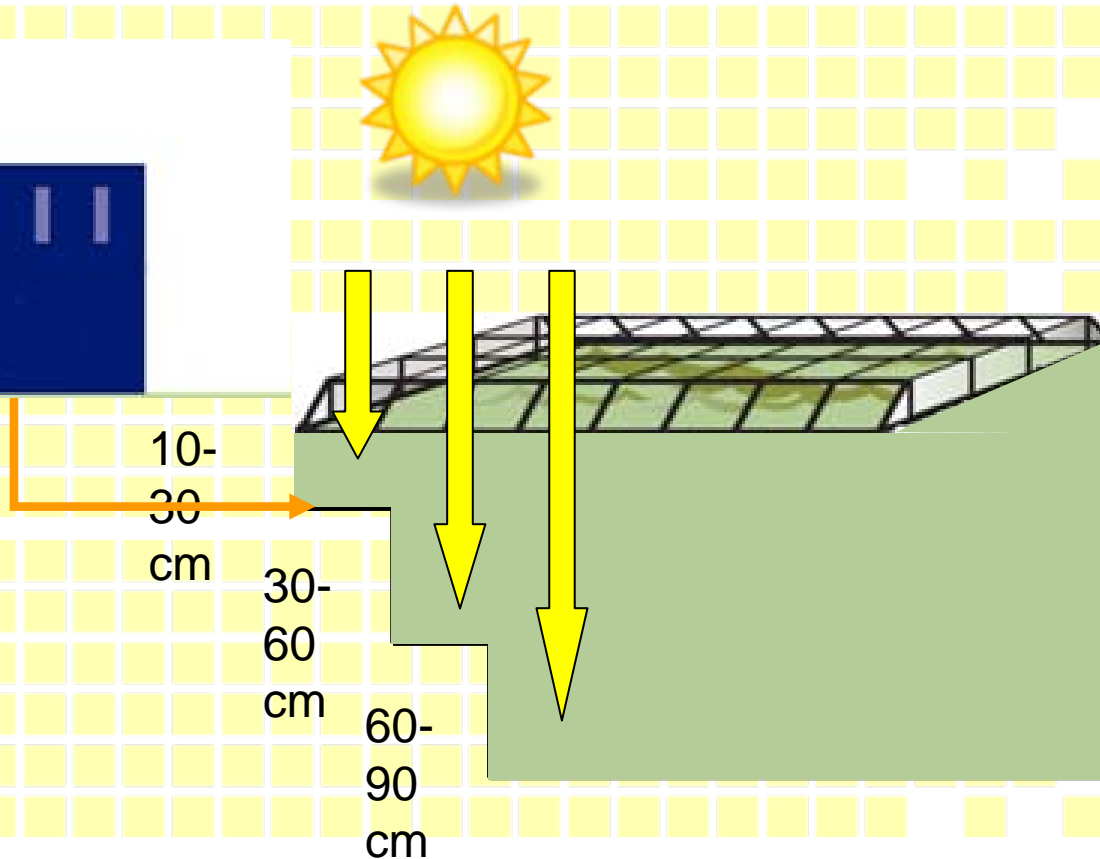
# Stage 1 Results



# Stage 1 Results

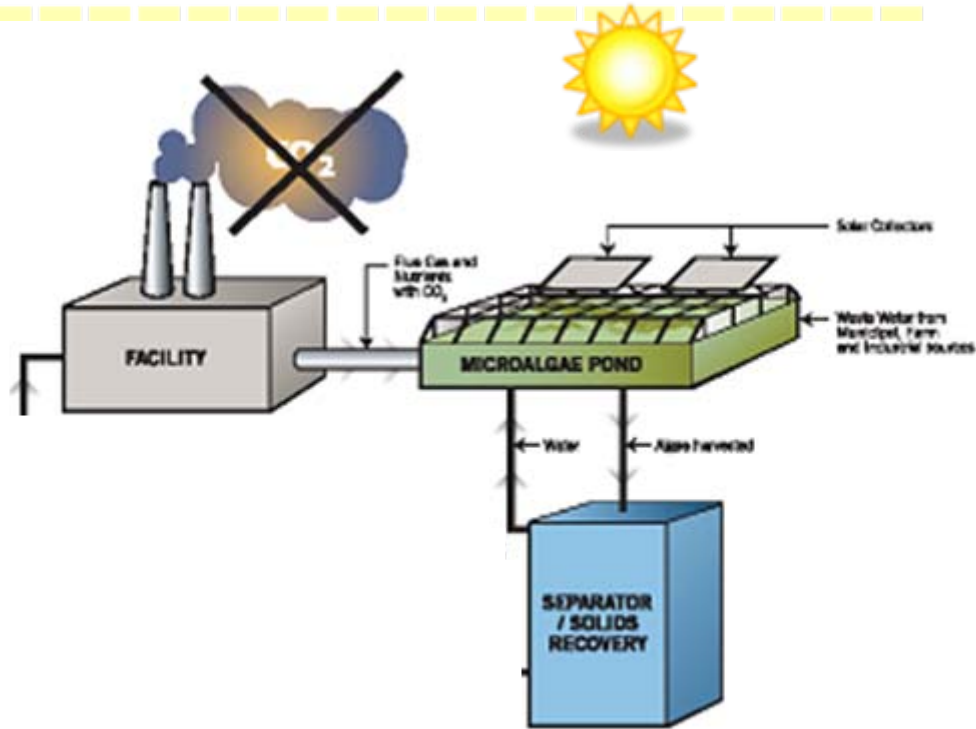


# Stage 1 Results

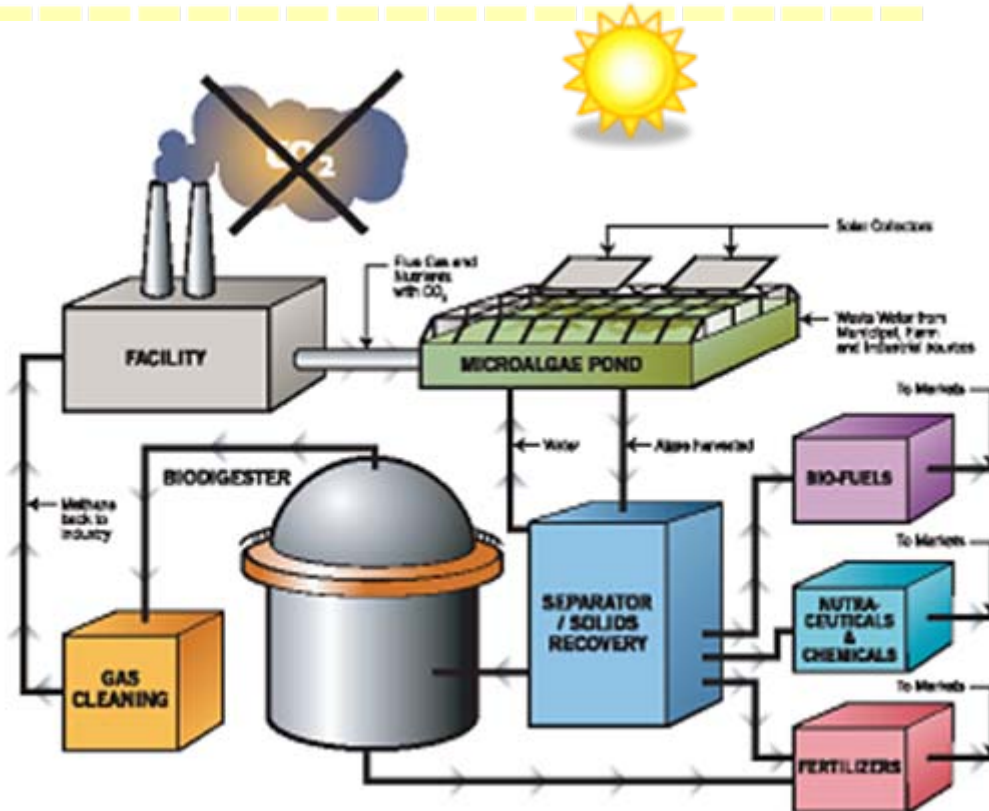


- Take light deeper into pond
- Goal – increase productivity per M<sup>2</sup> area
- More growth = more CO<sub>2</sub> absorbed
- Decrease footprint

# Stage 1 value-added goods



# Stage 1 Results



# Stage 1 : Economic assumptions

- Total algae pond system area : 400 ha
- Algae yield : 30 – 120 g/m<sup>2</sup>/day
- CO<sub>2</sub> captured : 77 500 – 310 500 tonnes/Year
- Algae oil = 3.5 barrels/tonne algae
- Carbon credit : 15 \$/tonne CO<sub>2</sub>

# Stage 1 : CARS Value Chain

**INDUSTRIAL FACILITY**  
(CO<sub>2</sub> and low grade waste heat)

Raw  
material  
supplier for  
CARS

## CARS FACILITY COSTS

Capital cost = 2,328,161 – 821,213 \$/ha  
Operating cost = 24,302 \$/ha

(Cost of CO<sub>2</sub> as a raw material = 185 - 742 \$/Tonne  
calculated after 100% loading of all other costs  
However, this is not the true cost of CO<sub>2</sub>)

## CARS REVENUE STREAMS

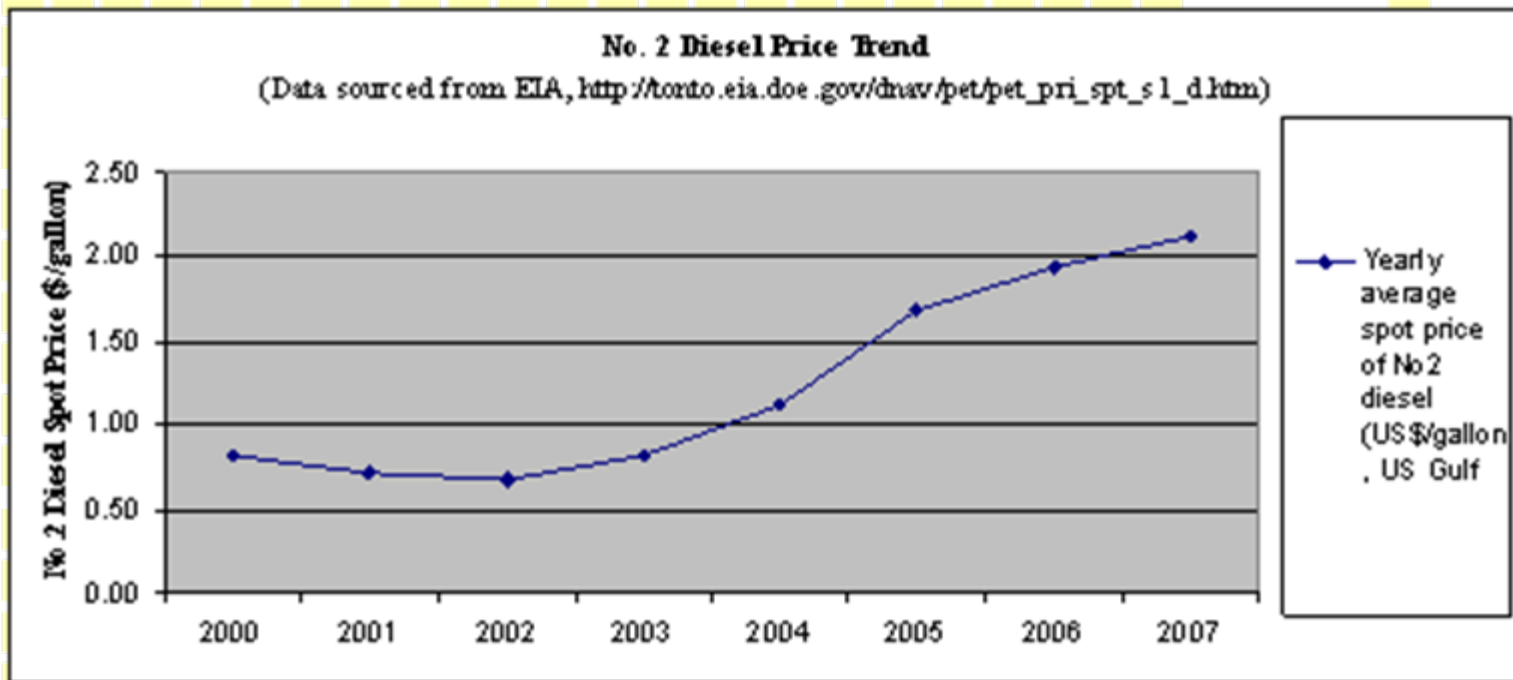
-Algae Diesel = 3.46 – 11.65 \$/gallon

Others (to be modeled)

- Animal, fish Feed ?
- Nitrogen Fertilizer ?
- Ethanol ?

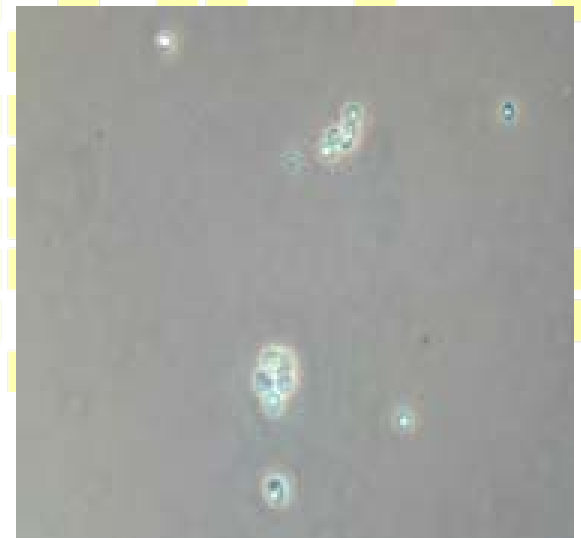
Payback for CARS Operator (based on diesel revenue stream only) = 6.86 years

# Diesel price trend



# Stage 2 Work plan

- Genetics and strain selection
- Engineering and production



## Stage 2: Genetics and strain selection

- Screen extreme algae (in existing collections)
- Sample and analysis of Canadian algae
- Identification of superior strains for various pond condition
- Growth rate and characterization (pond condition)

# Stage 2: Engineering and production

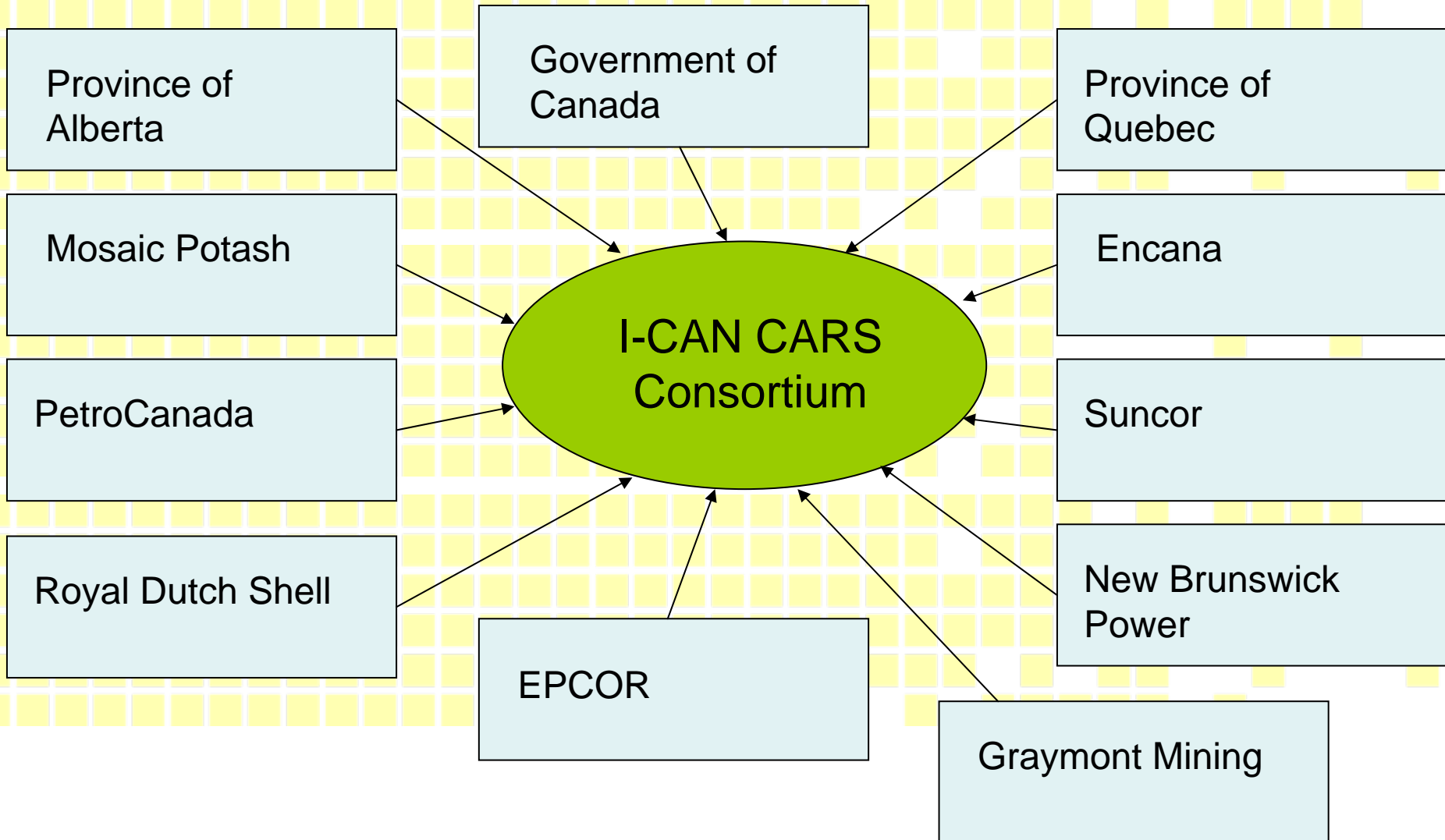
## First gate

<b>Hybrid pond (alpha)</b>	Pond design
	Light collector and distribution system
	Temperature maintenance

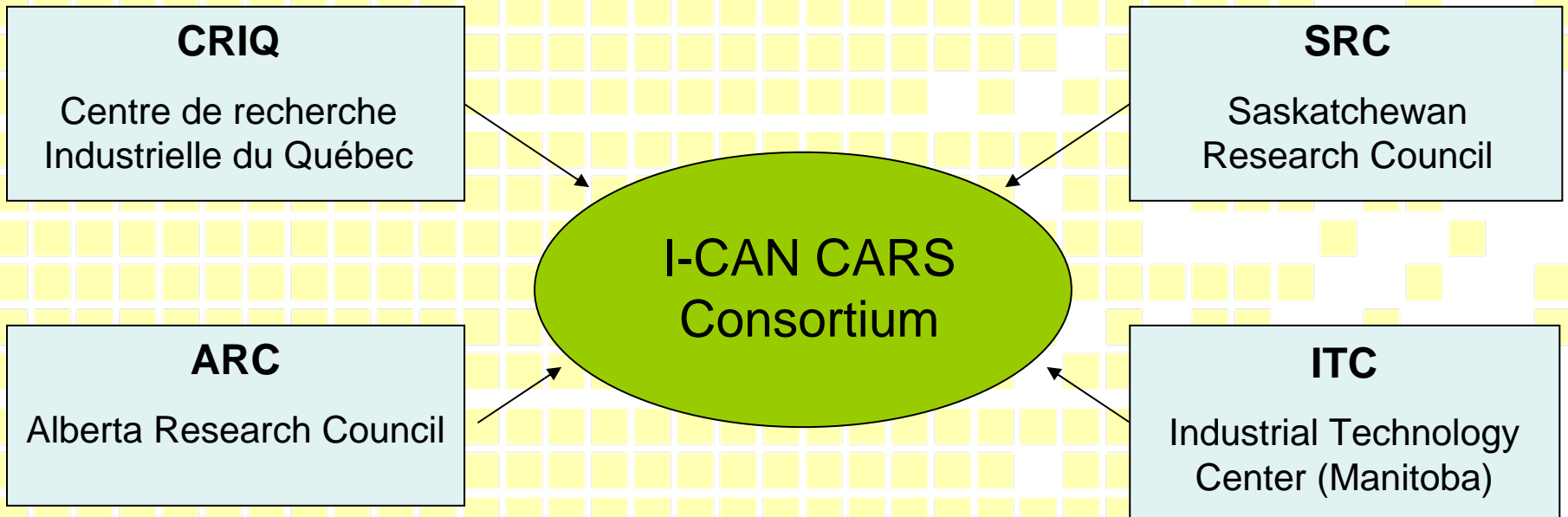
## Second gate

<b>Hybrid pond (beta)</b>	Pull all pieces together (further optimizing including harvesting)
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# Research Project



# Research Project



# CRIQ

- Created in 1969
- Two facilities : Quebec City and Montreal
- 260 employees
- 180 engineers, technicians, chemists and agronomy specialists
- 900 projects per year
- 700 clients on behalf

# CRIQ

- Mission : help industries in many ways
  - Manufacturing technologies (artificial vision, process modeling, machine design )
  - Environmental technologies (air – liquid – solid)
  - Industrial information (database, technological information)
  - Standard development, certification, ISO registration (BNQ)
  - Bench testing, safety certification (equipment and software)
  - Export services

# For More Information Contact

## **Innoventures Canada**

<http://www.i-can.ca/>

### **I-CAN Microalgae Project Leader**

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## **CRIQ**

<http://www.criq.qc.ca/>

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**Innoventures Canada**

**Questions?**