

# Reduction of GHG Emissions Through Innovation and Development of Transforming Technologies

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# Outline

## Introduction

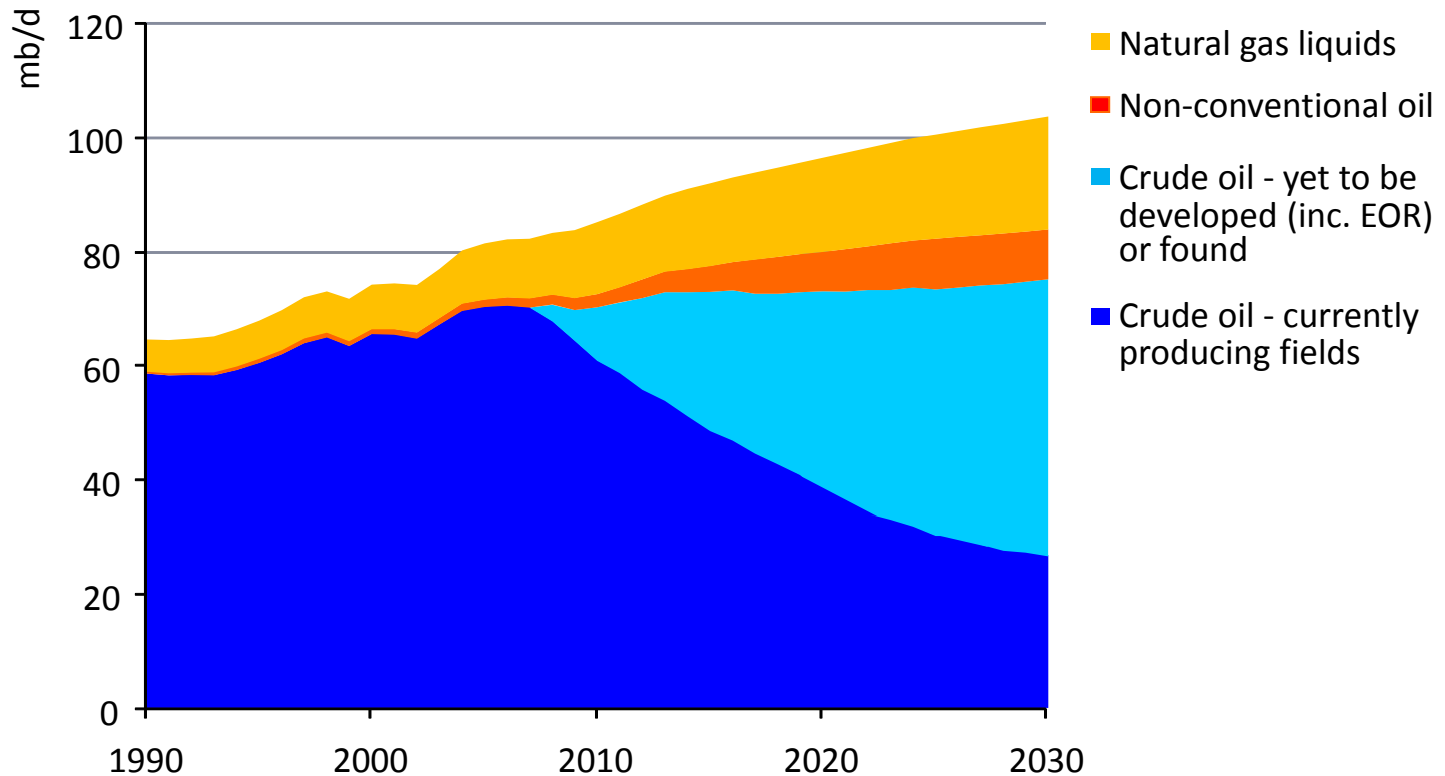
- **World Oil Demand Forecast**
- **Fossil Fuel GHG Emissions**
- **Emerging Eco-Efficiency Technologies**
- **Canada's World Class Hydrocarbon Resources**

## PTAC Collaborative Model

- **Innovation Funnels**
- **Networks**
- **R&D activities**
- **Virtual Centre for Commercialization of Technologies**
- **PTAC Collaborative R&D Eco-Efficiency/Fugitive Methane Emission Reduction Projects**



## World Oil Production by Source

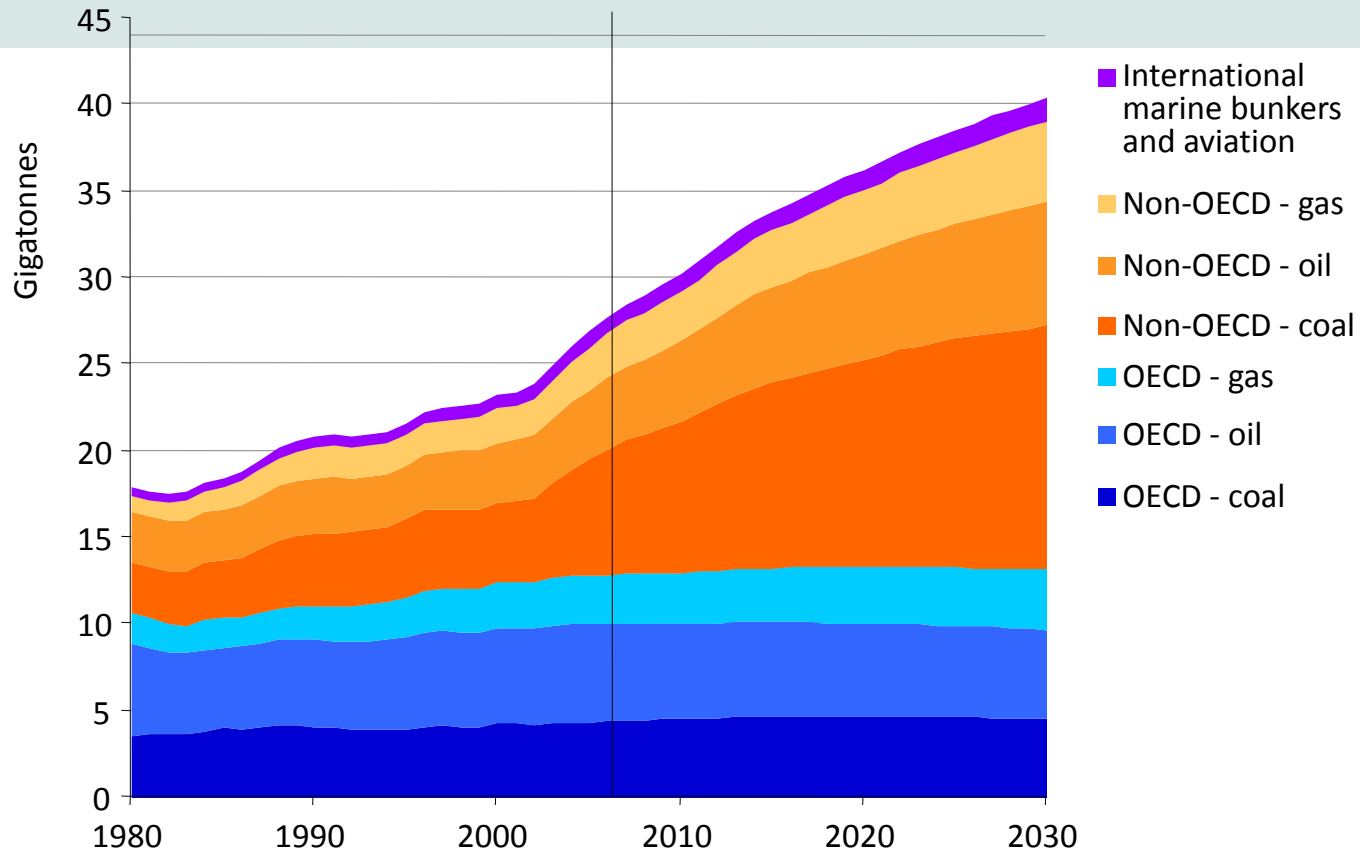


**Source IEA**

*64 mb/d of gross capacity needs to be installed between now and 2030 to meet demand growth & offset decline*



## Energy-Related CO<sub>2</sub> Emissions

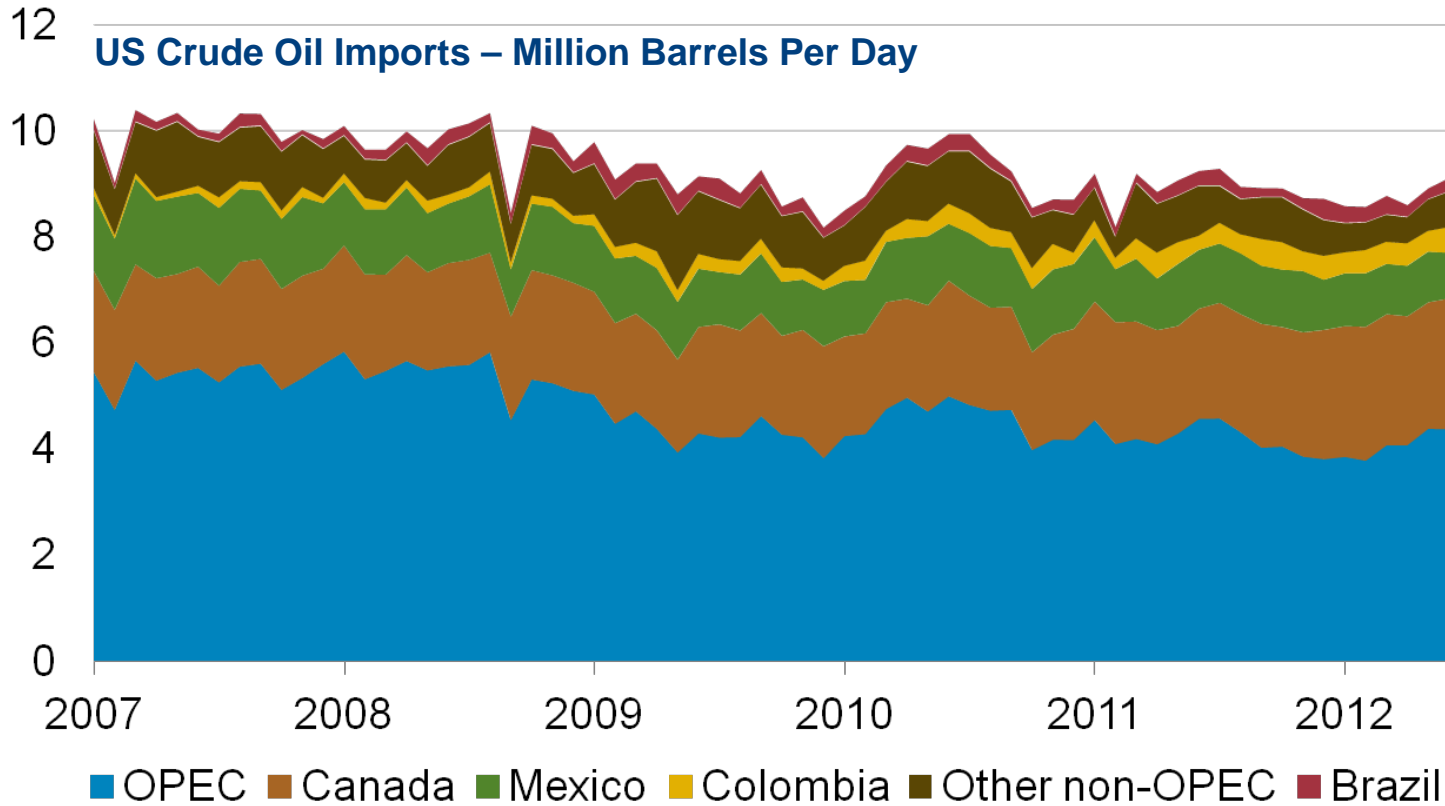


**Source IEA**

*97% of the projected increase in emissions between now & 2030 comes from non-OECD countries – three-quarters from China, India & the Middle East alone*



# Technologies Profoundly Impact Global Oil Supply and Demand



**Source**

U.S. Energy Information Administration through June 2012







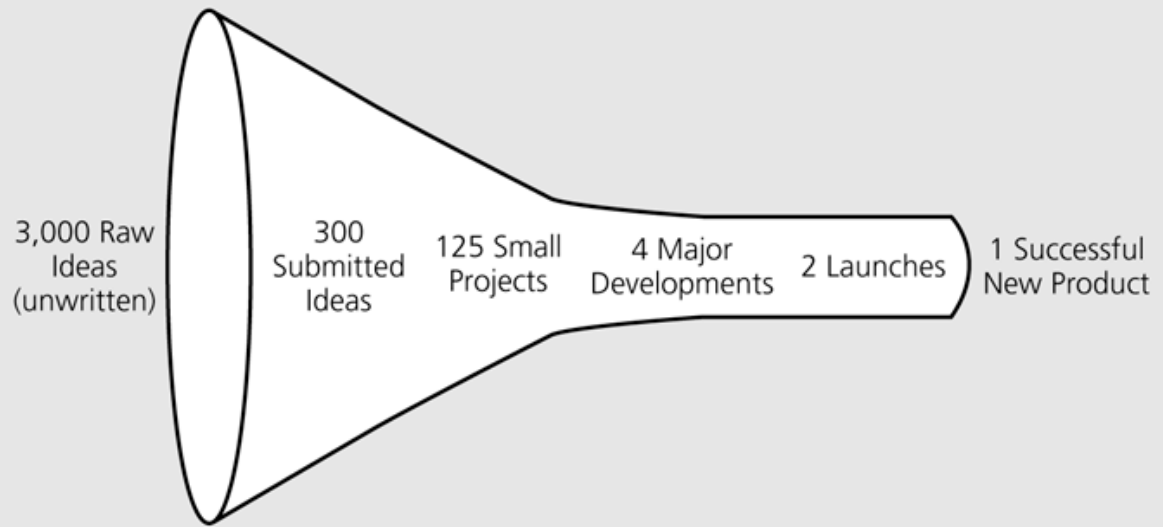
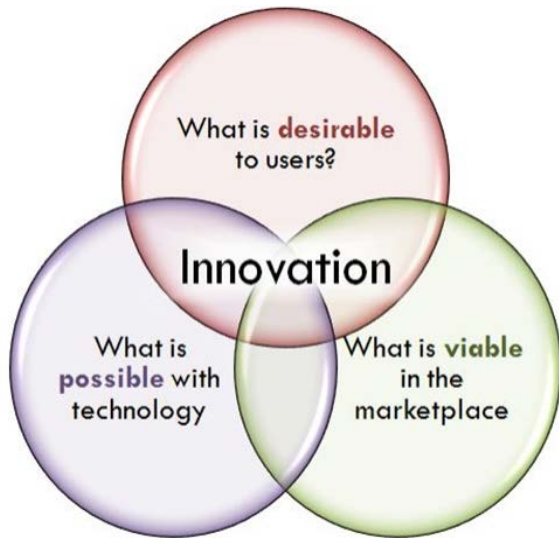
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## **PTAC Collaborative Model**



# The Innovation Funnel





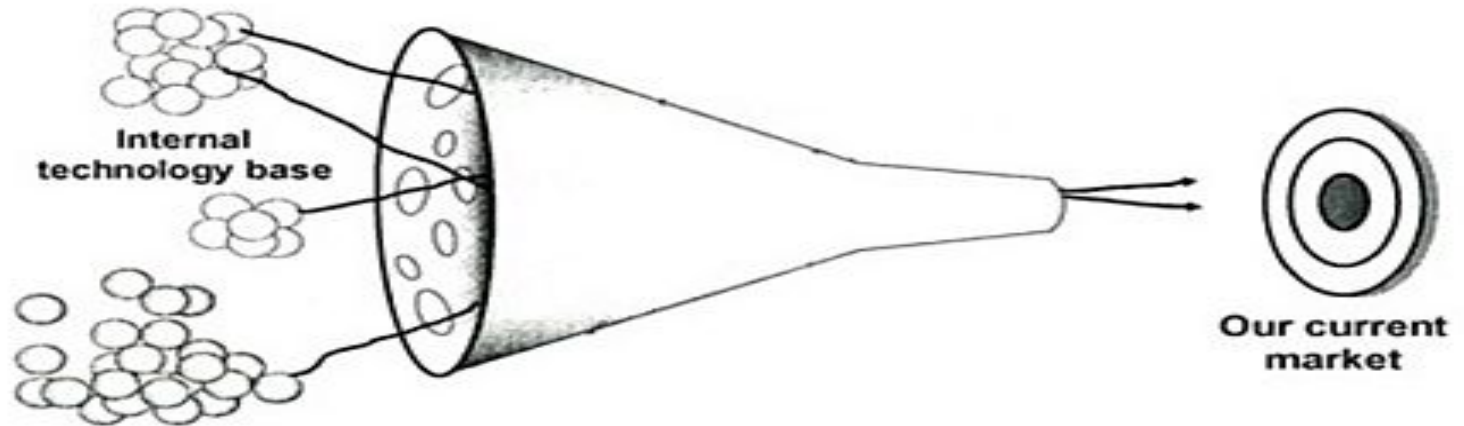


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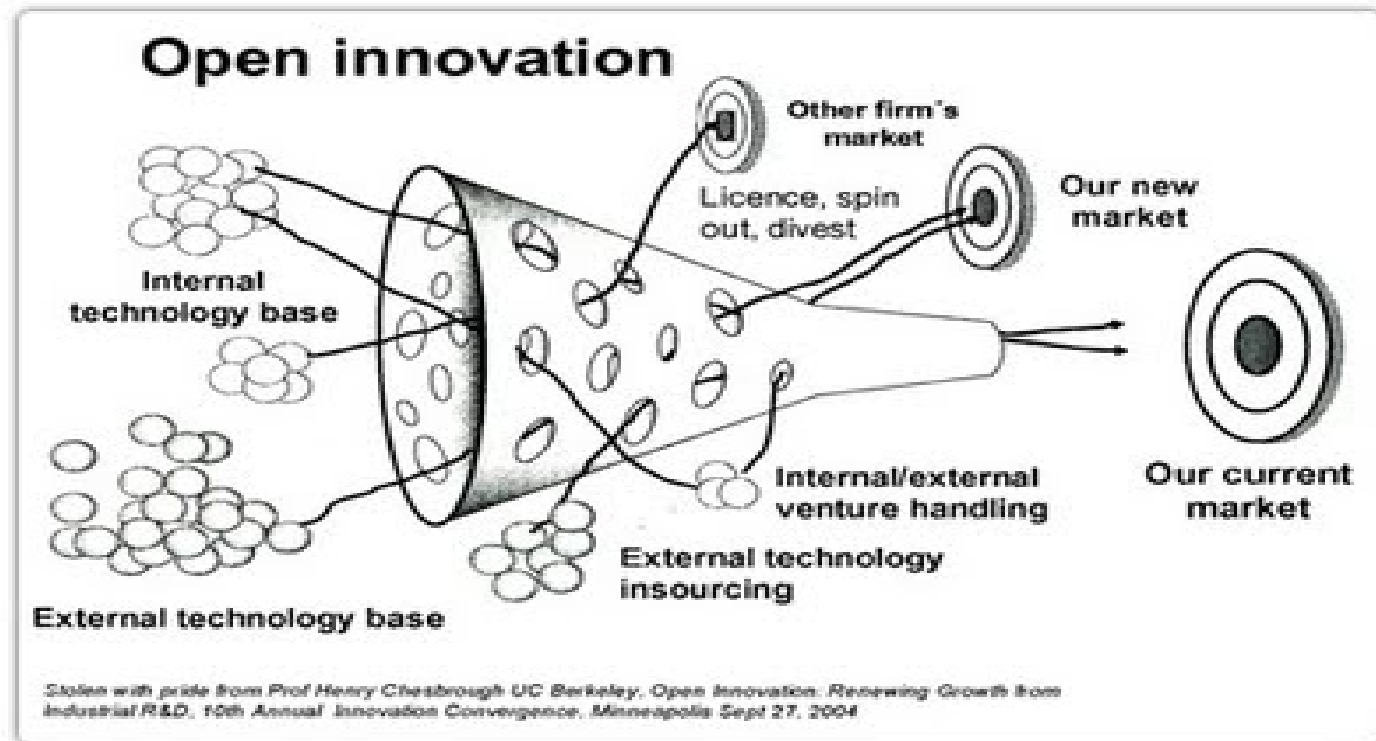
# Closed Innovation Funnel

## Closed Innovation



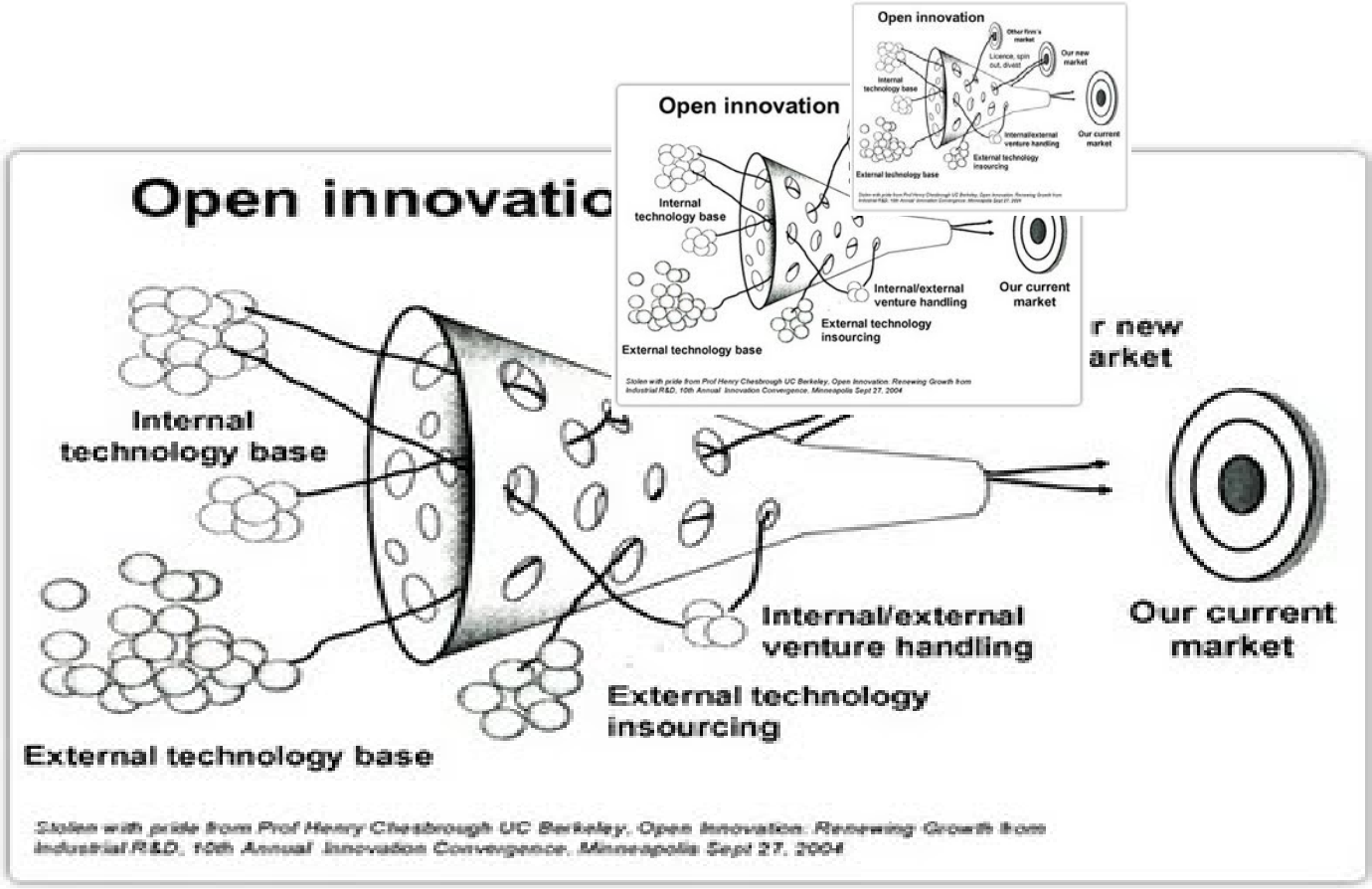


# Open Innovation Funnel





# PTAC Collaborate Model





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## **Cultivating a Culture of Innovation Through Technology Action Plans**

**CBTAP**

**REMTAP**

**TOGTAP**

**ARTAP**

**HOTAP**



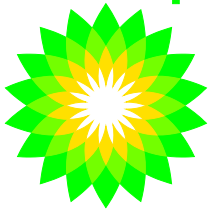
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# Collaboration has been Key to Implementation of the Clean Bitumen Technology Action Plan



bp



Freedom To Create.  
Spirit To Achieve.





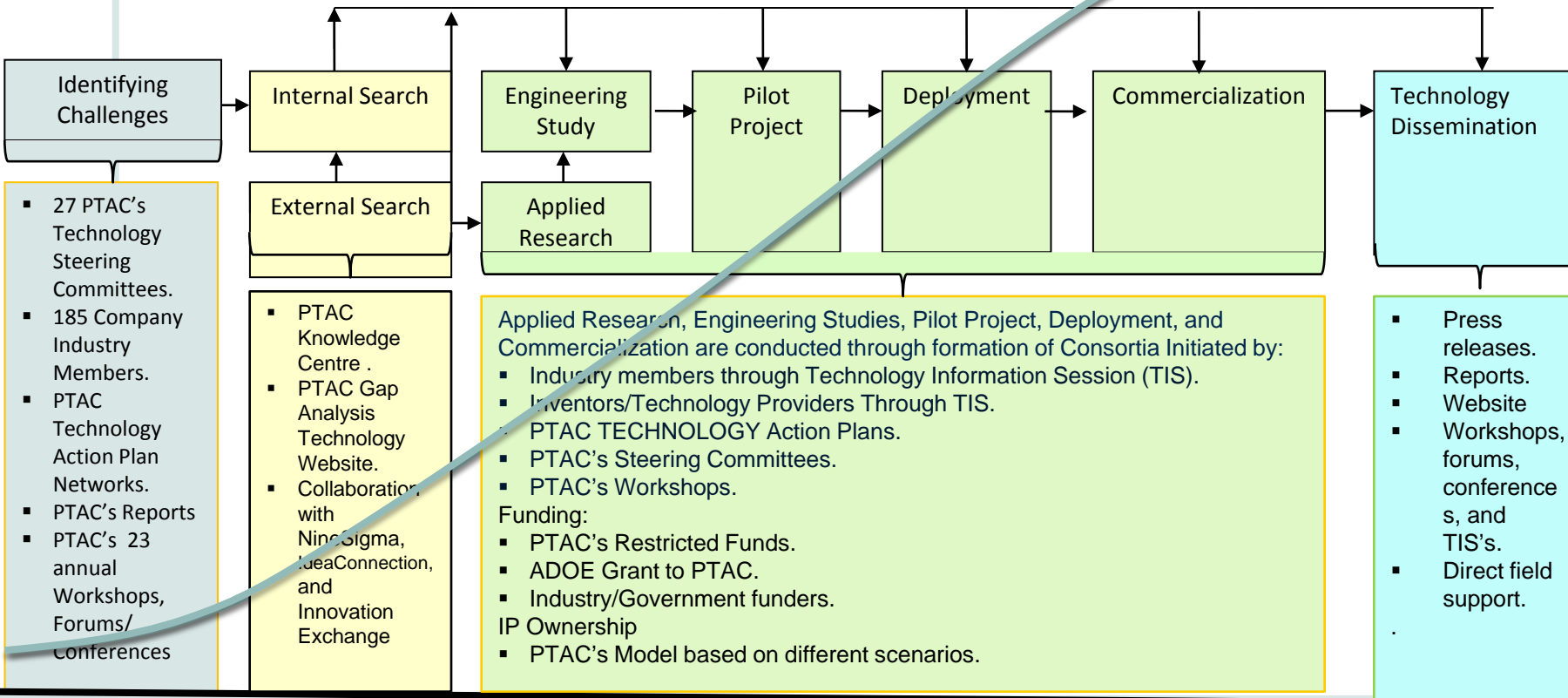
# PTAC Collaborative Model

## Innovation Spectrum

Collaboration

Competition

R&D Risks, Investments / Business Complexity



Time



# PTAC Collaborative Model

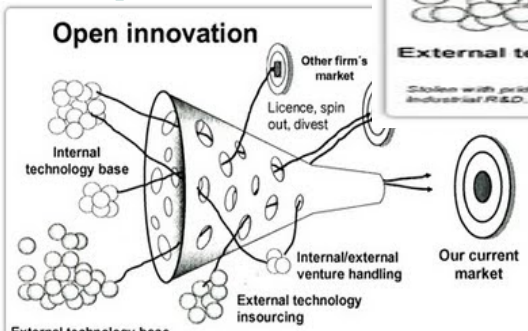
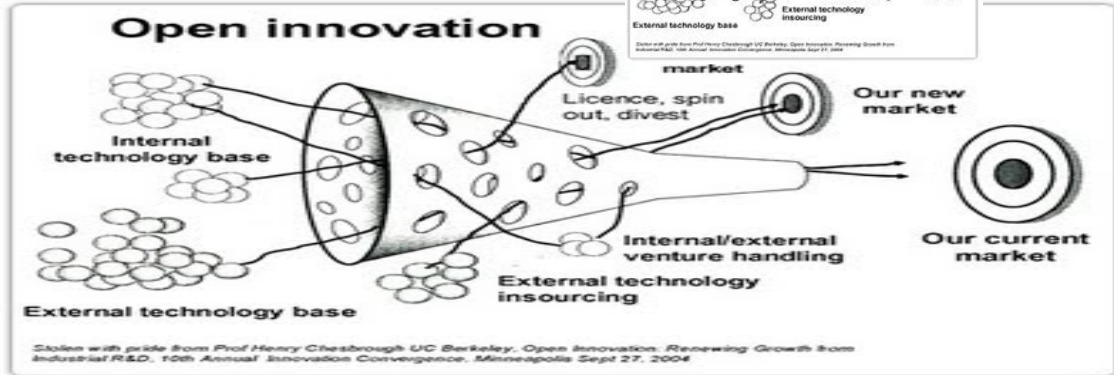
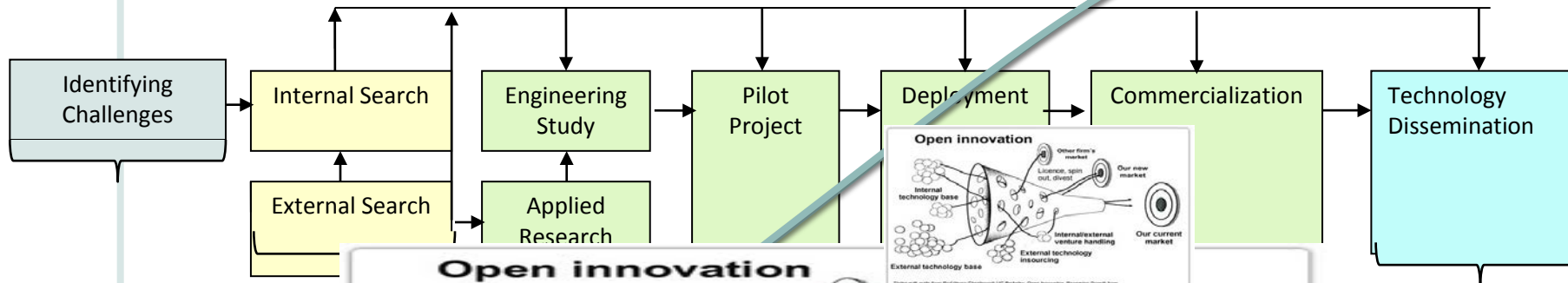
## Innovation Spectrum

Collaboration



Competition

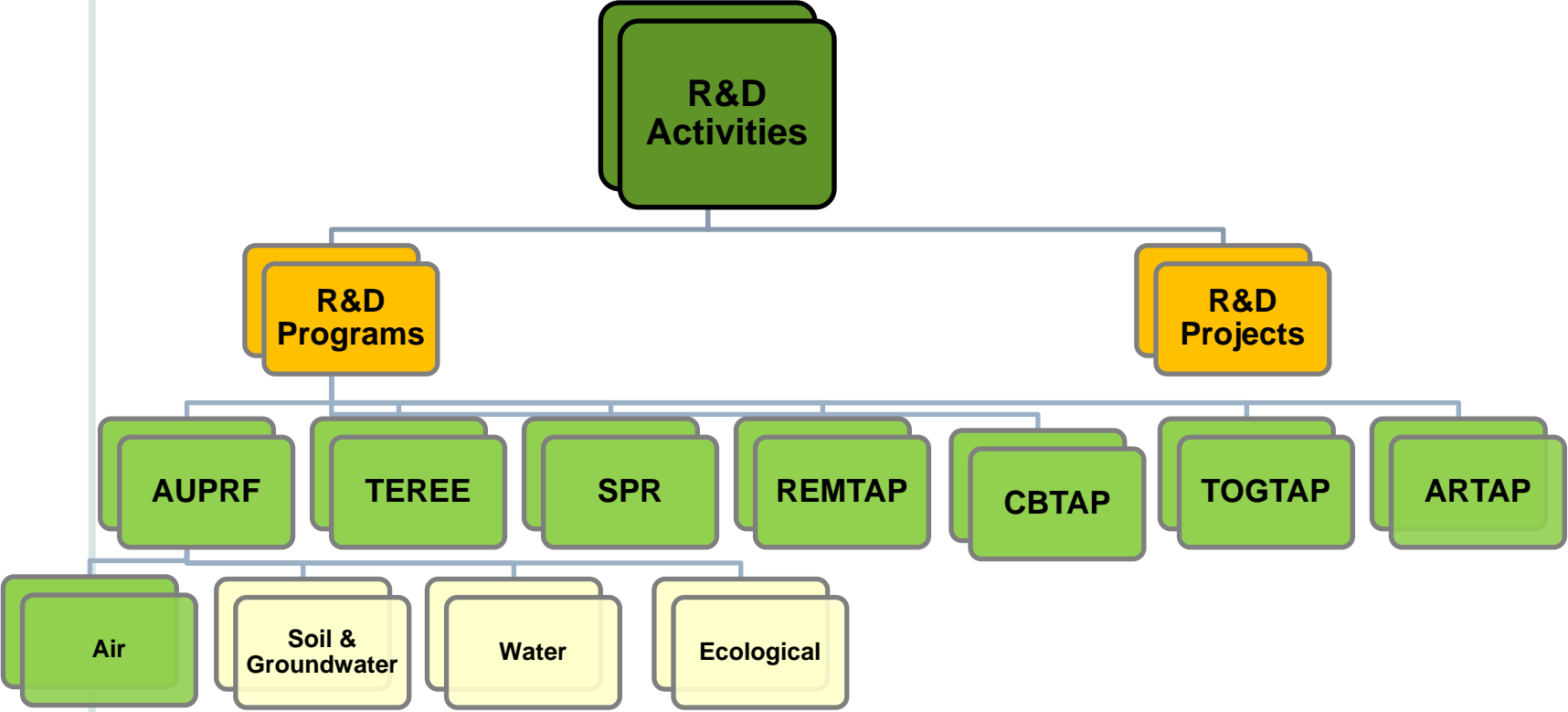
R&D Risks, Investments / Business Complexity



Time



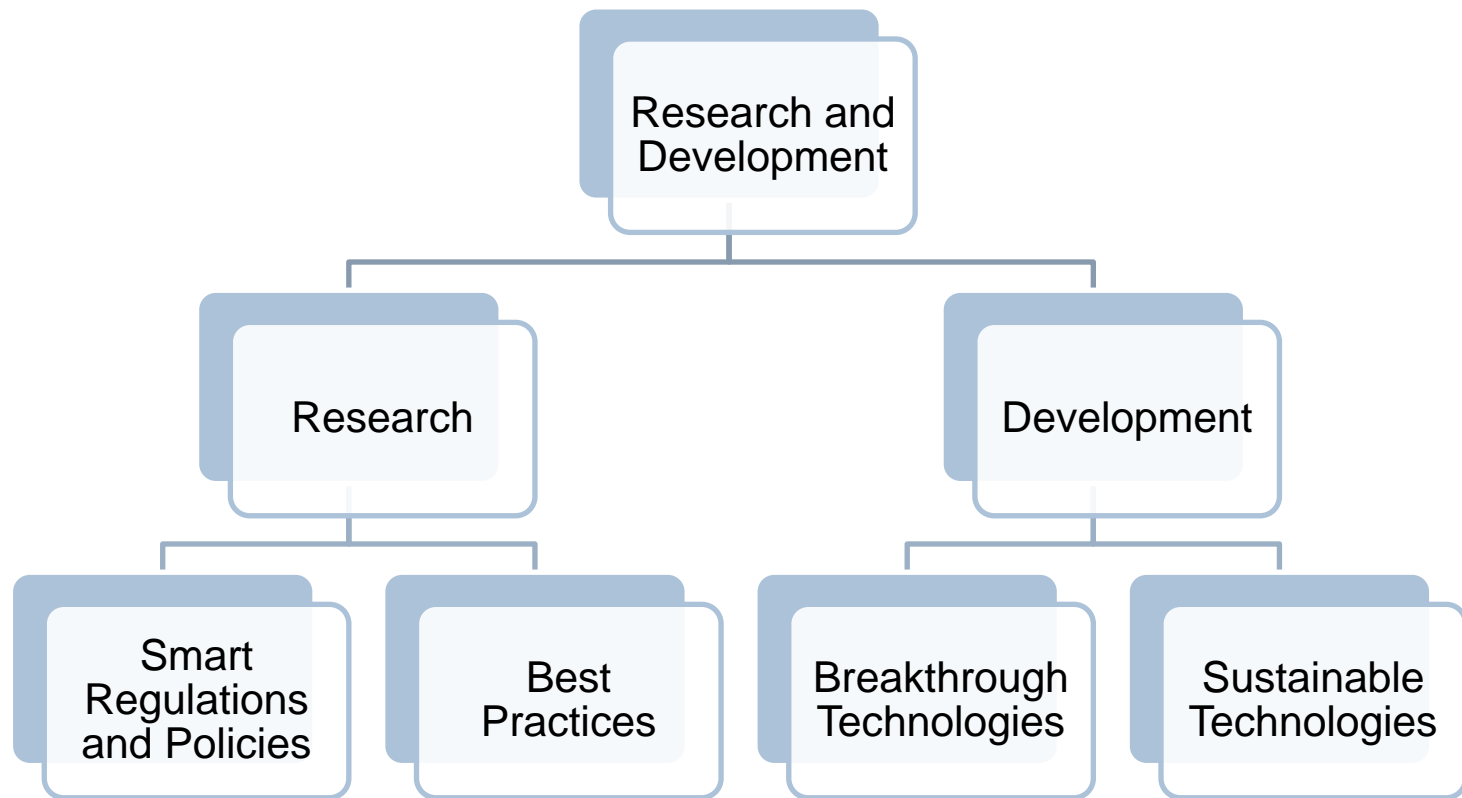
# PTAC R&D Activities







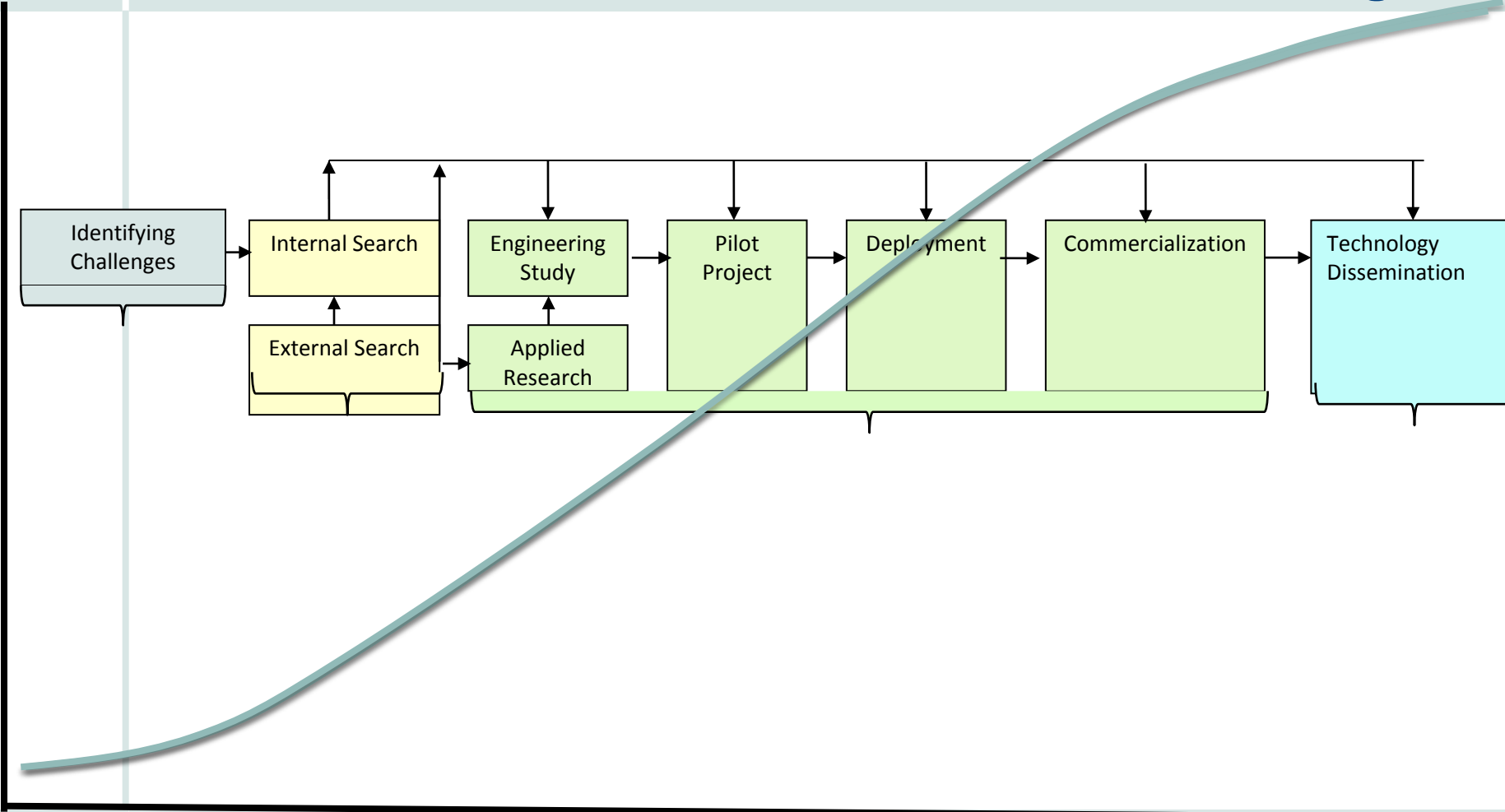
## Research and Development





# Virtual Centre for Commercialization of Technologies

R&D Risks, Investments / Business Complexity



Time



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# **PTAC Collaborative Eco-efficiency Technology Projects**



## **NAMA Projects**

**Collaborations among:**

**Environment Canada, NRCan, Ecopetrol, Pemex, Clearstone Engineering, and PTAC for the following objectives:**

- **Determination of baseline**
  
- **Quantification of emission reduction opportunities**
  
- **Development and transfer of knowledge, policies, best practices, and clean energy technologies**



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## **PTAC Technology Development Projects**

- **LDAR (Leak Detection and Repair) - Optimizing leak detection methods.**
- **Variable Pitch Fan Installations.**
- **Improving Immersion Heaters – Design Guide.**
- **Hydrogen Fuel Injection in Diesel Engines.**
- **Reducing GHG Emissions Through Methane Capture and Energy Efficiency Measures.**

# REMVue SlipStream Industry Impact Assessment and Validation

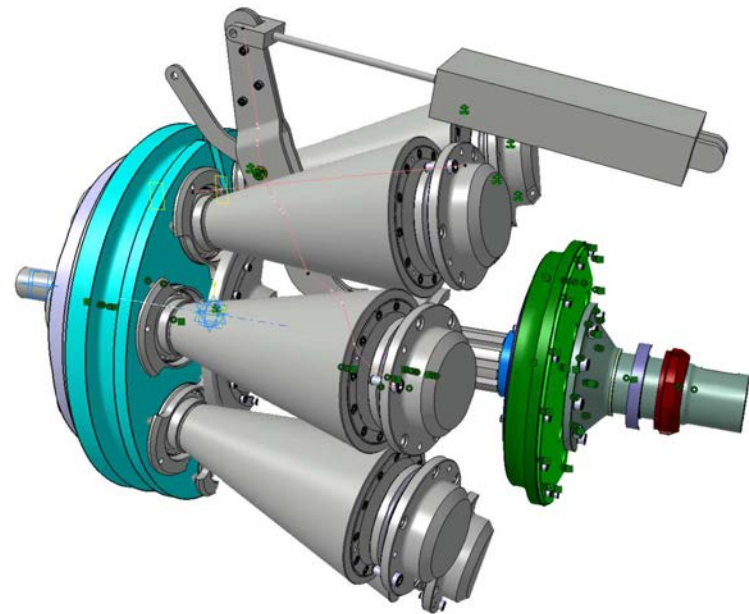


Unit 2 – Waukesha 9390 GSI with **REMVue**<sup>®</sup> Rich-to-Lean AFR



## Variable Speed Pump Jacks

- **Speed adjustments improve energy efficiency and increase production**





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## Highly Efficient Motors for Wellsites

- Highly efficient motors for actuators, pumps, and compressors, and powered by solar energy.
- For a Zero Emissions Wellsite





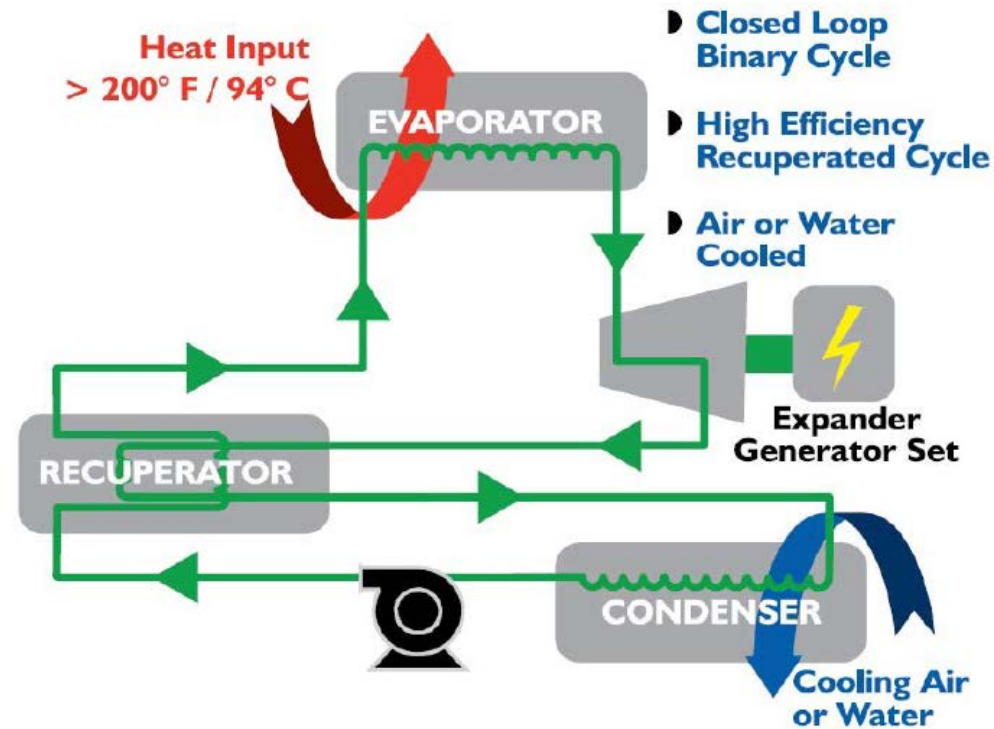
## Generation of Electric Power from Waste Heat





## Oil Sands

- Waste heat to useful energy
- Advanced Organic Rankine Cycle





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## Novel steam generation and water treatment

- **Immersed combustion heating**





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# PTAC Collaborative Research Projects in the areas of Reducing GHG Emissions



## **PTAC Research Projects**

- **Improved Flare Source Parameters for CALPUFF and AERMOD Dispersion Models**
- **Evaluation of VOC Emissions from Crude Oil and Condensate Storage Tanks**
- **Evaluation of Convective Mixing Losses in aboveground Storage Tanks**
- **Emissions from Flares with Non-hydrocarbon Liquids in the Flare Stream**

## **PTAC Research Projects**

- **Understanding and Improving Management of VOCs from the Upstream Oil and Gas Industry**
- **Evaluation of Air Emissions Associated with Hydraulic Fracturing**
- **Field Measurement of Black Carbon Emissions from Flares**
- **Development of an Updated Screening Model and Method for Routine and Non-Routine Flaring Spreadsheet**



## Summary

- **The energy demand will increase due to the world population increase and expected economic growth.**
- **Supply of easy oil cannot keep up with the increase in demand.**
- **Oil will stay as the main source of transportation fuel in the foreseeable future.**
- **Globally, development of expensive remote unconventional oil and gas will increase, resulting in higher GHG emissions.**
- **Innovation, and emerging technologies are the most effective approach in achieving sustainable development of challenging unconventional resources.**