




# Sustainable Energy

*A Key to the Sustainability of  
Environmental Systems*

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# Outline and Motivation

- Scope
- Sustainability
- Energy sustainability
- Energy sustainability requirements
- Examples
- Closing thoughts



Scope



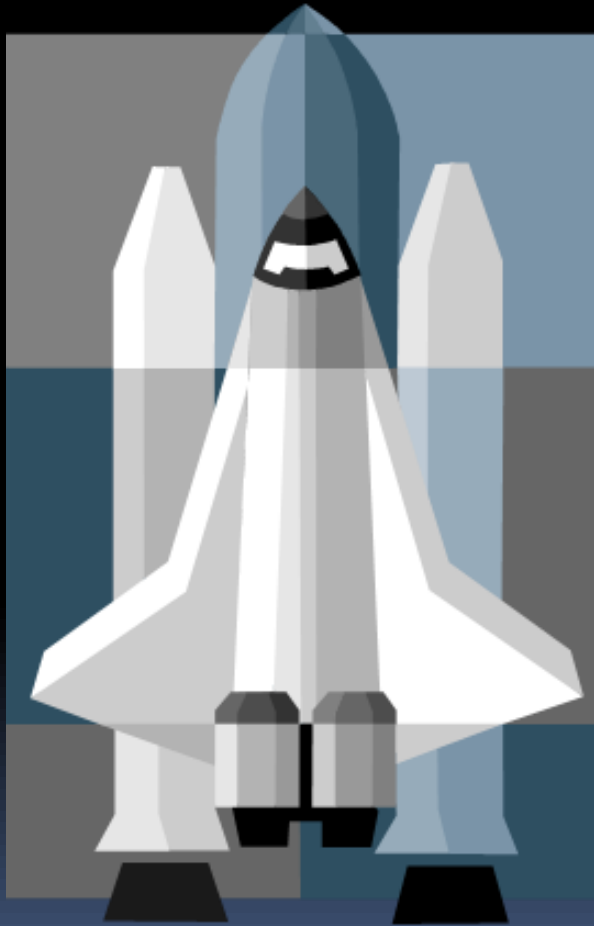
# Energy: Affects Many Things



# Energy: Impact is Global



# Approach



- Engineering
- Beyond engineering

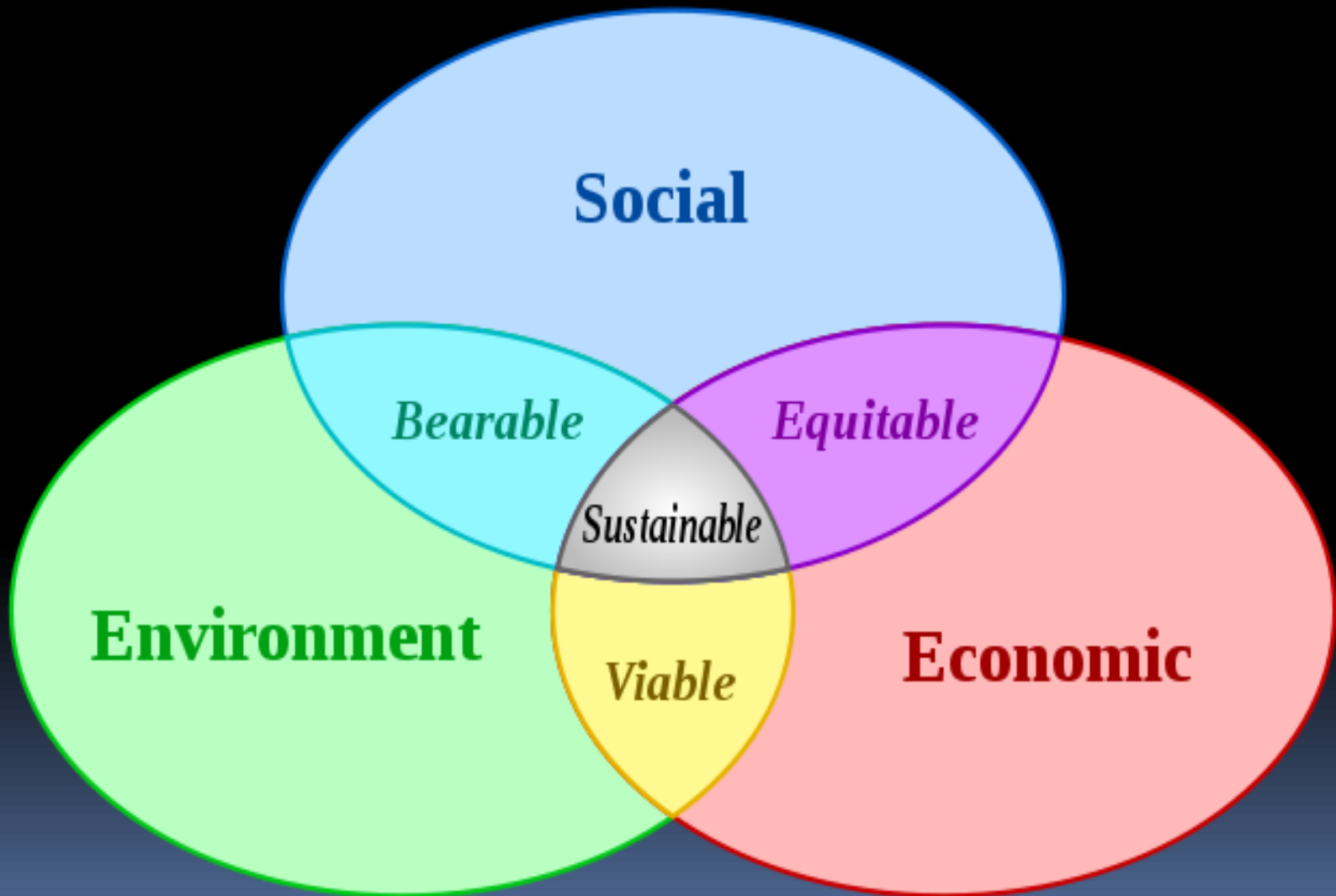




# Sustainability



# Sustainability





# Importance

- EIC Vision
  - Engineering, for a prosperous, safe and sustainable Canada



The Engineering Institute of Canada

SINCE 1887

# Growing Interest



International,  
multidisciplinary,  
open access  
journal



# Energy Sustainability



# Energy Sustainability

*Provision of energy services  
in a sustainable manner*

- Sufficient for necessities
- Affordable
- Environmentally benign
- Acceptable





# Energy Sustainability Requirements



# Energy Sustainability Requirements

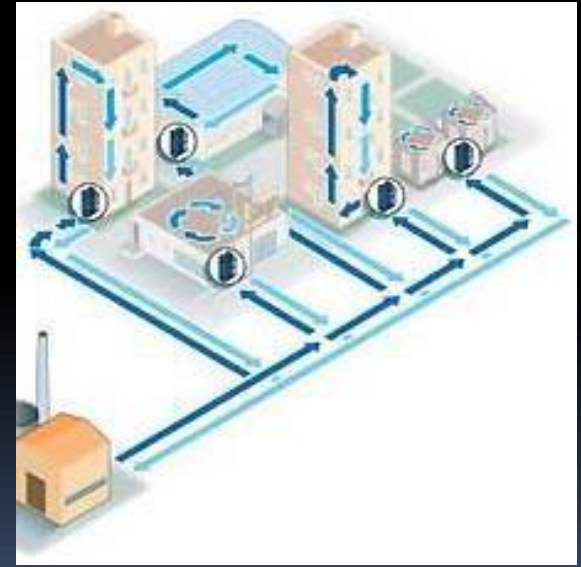
## 1. Sustainable energy sources





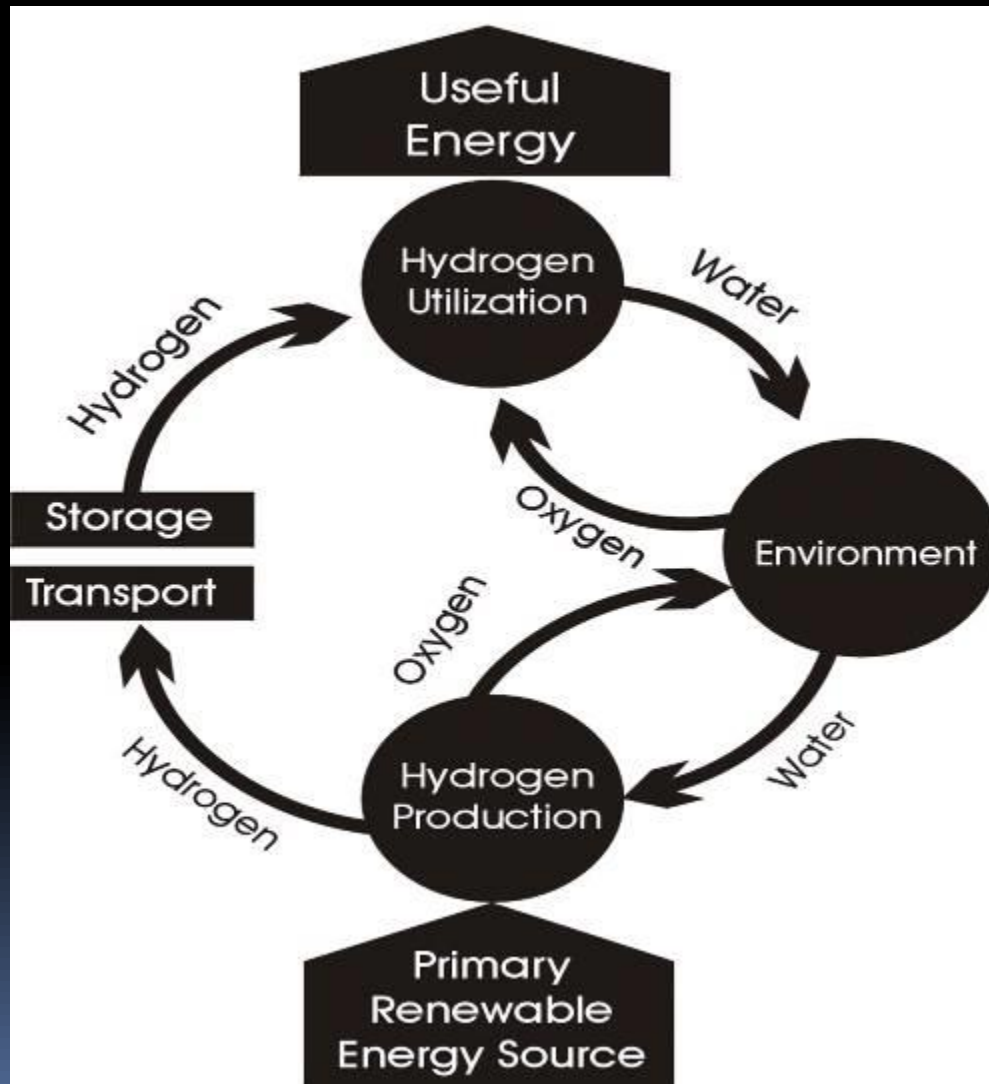
# Energy Sustainability Requirements

1. Sustainable energy sources
2. **Appropriate energy carriers**





# Hydrogen Economy



# Energy Sustainability Requirements

1. Sustainable energy sources
2. Appropriate energy carriers
3. Increased efficiency

Design systems for efficiency

Integration

Matching supply and end use

Energy management

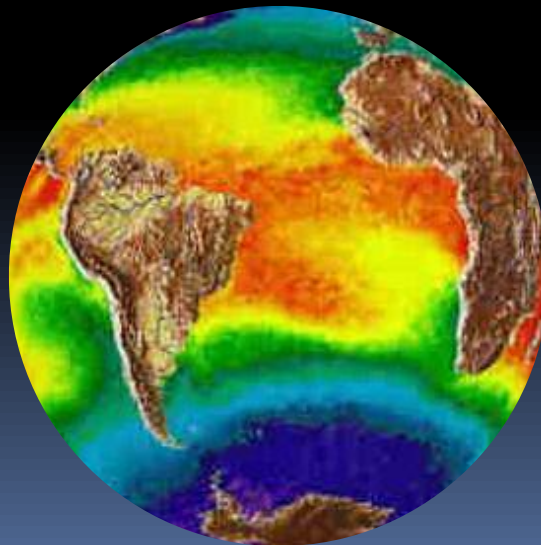
System efficiency

Device efficiency

# Energy Sustainability Requirements

1. Sustainable energy sources
2. Appropriate energy carriers
3. Increased efficiency
4. Reduced environmental impact

LCA



CCS

# Energy Sustainability Requirements

1. Sustainable energy sources
2. Appropriate energy carriers
3. Increased efficiency
4. Reduced environmental impact
5. Satisfy other facets of energy sustainability

Ethics  
Economics  
Societal concerns  
Policies  
Laws  
Health  
Culture  
Education  
Attitudes  
Lifestyle  
Living standards

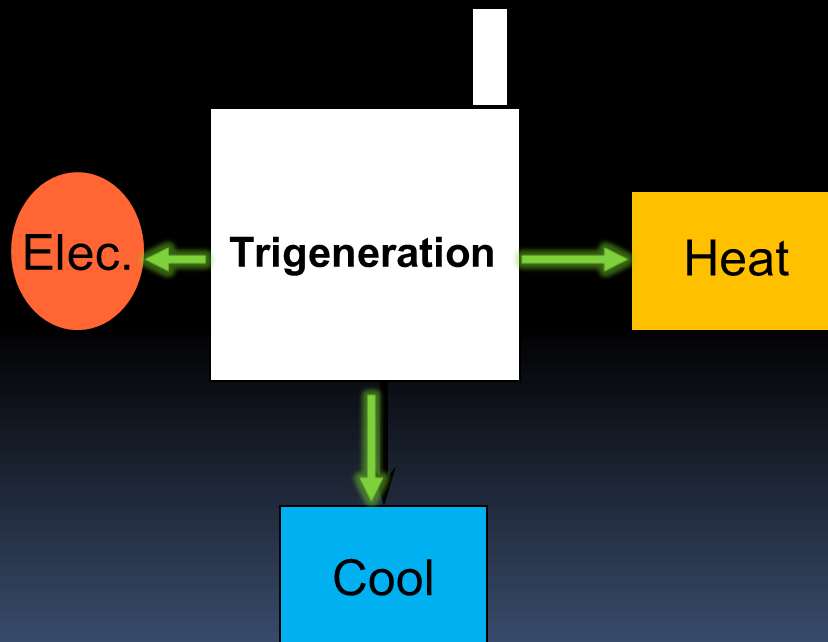


# Examples

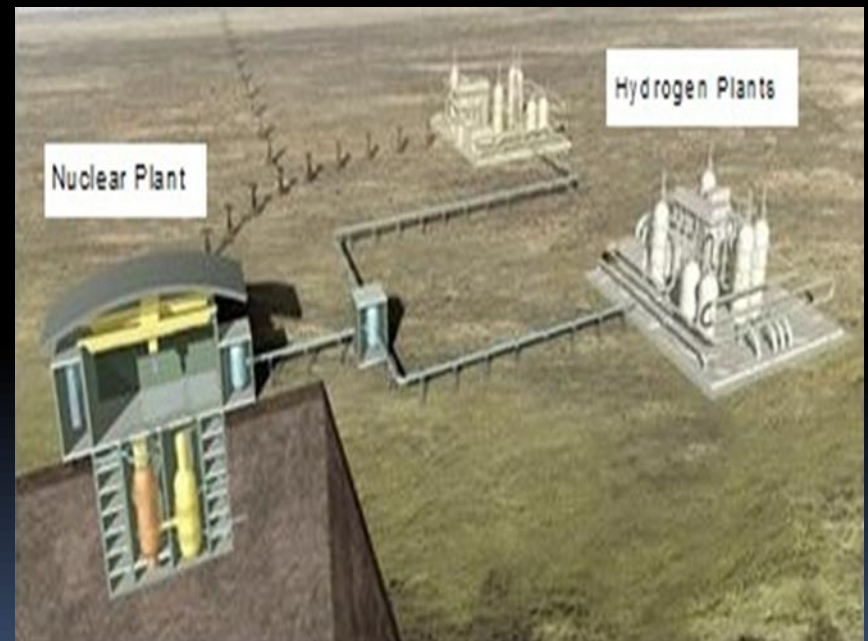


# Energy Production

## Trigeneration and polygeneration



## Clean hydrogen production





# Energy Tools

Energy storage

Exergy methods and efficiency

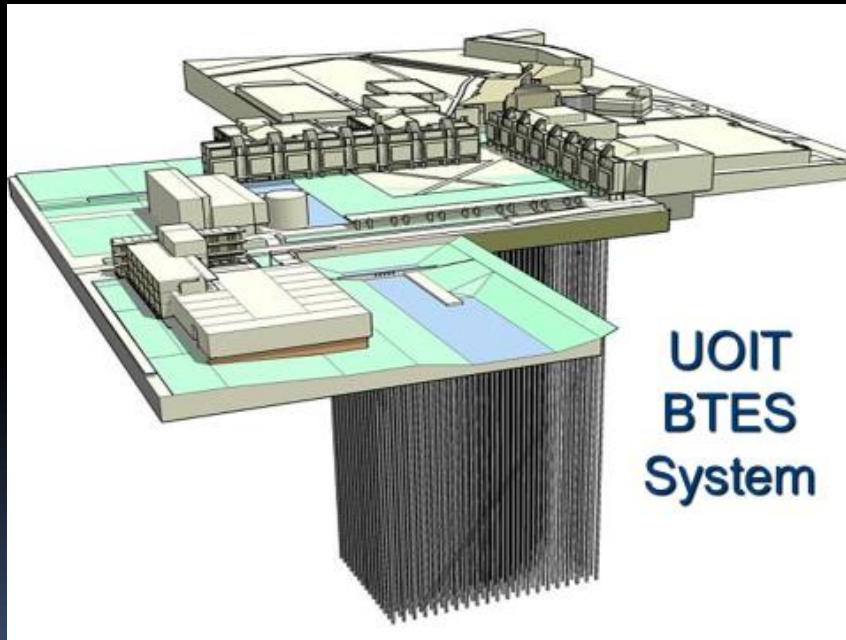


the ~~EN~~ERGY crisis



# Energy Users

## Net-zero energy buildings



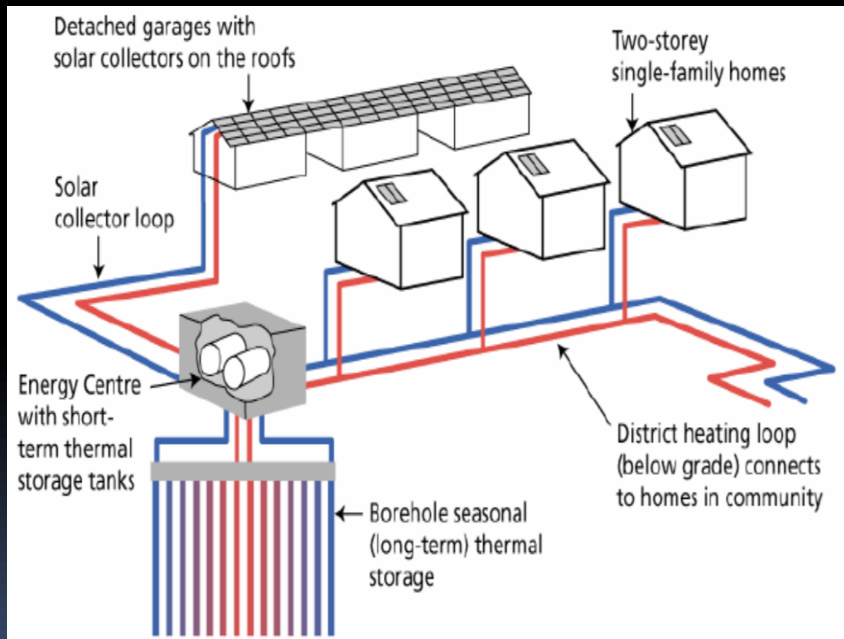
## Sustainable cities



# Energy Users

## Community energy systems

## Drake Landing Solar Community, Alberta, Canada



52 homes, 90% solar fraction

# Integrated Energy Systems

**Dockside Green, Victoria,  
BC, Canada**



**Deep Lake Water Cooling,  
Toronto, Ontario, Canada**





# Closing Thoughts



# Closure

Sustainability: Essential



Energy sustainability: A critical quest



Responsibility: Environmental, societal, economic



# UN Sustainable Development Goals (2015-30)

