

# LCRI Decision Support Tool for Assessment of EH&S Impacts Along the Low-Carbon Energy Value Chain



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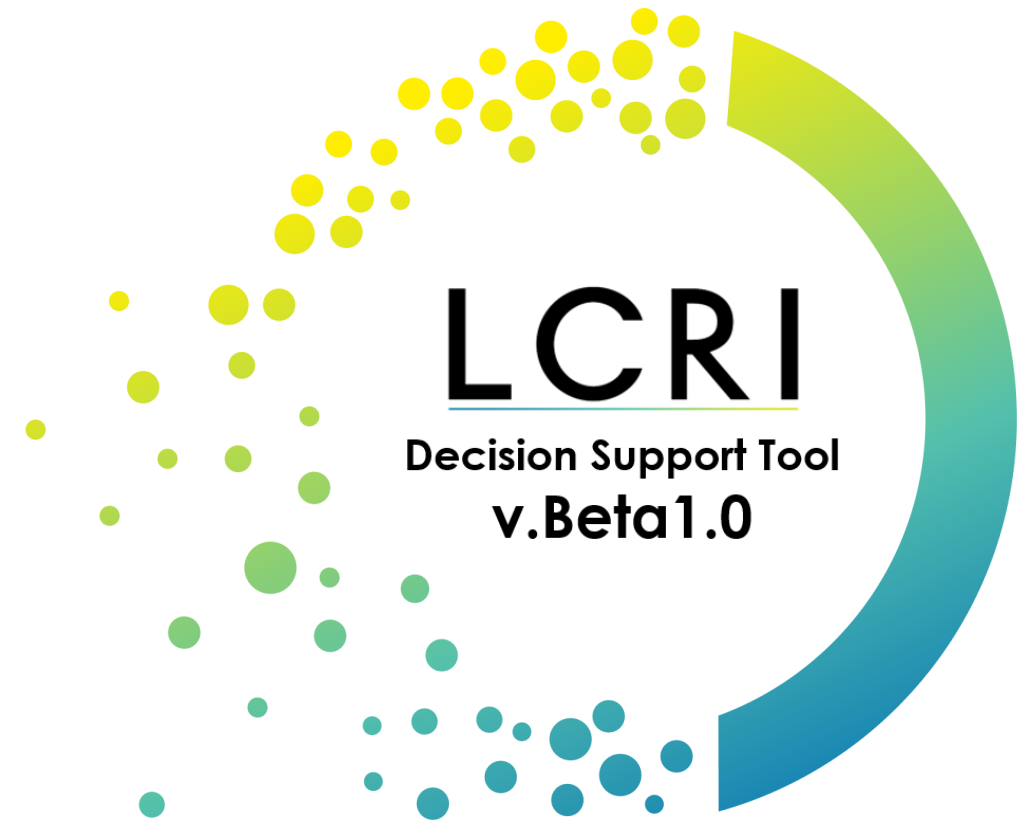
Annette Rohr



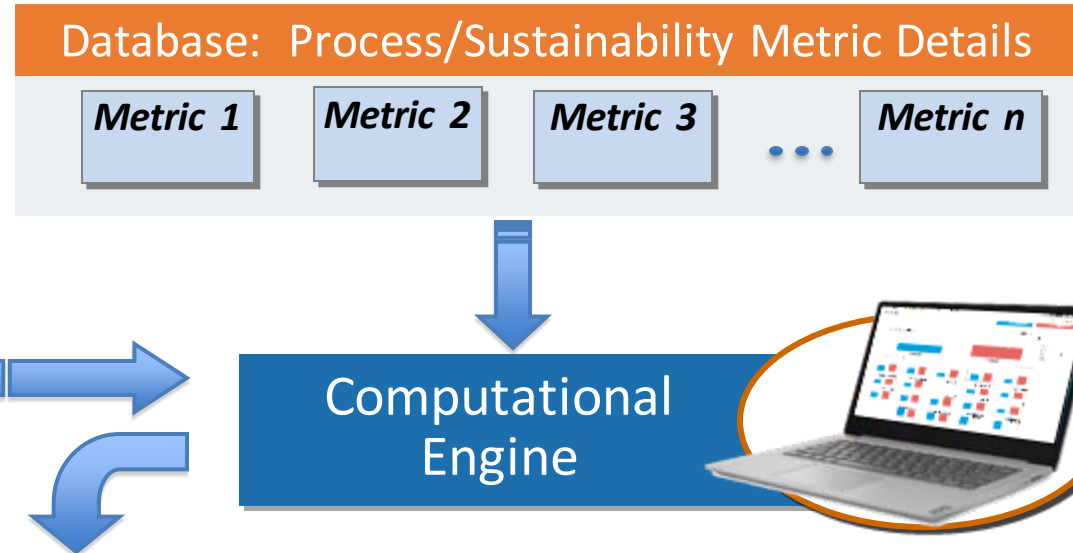
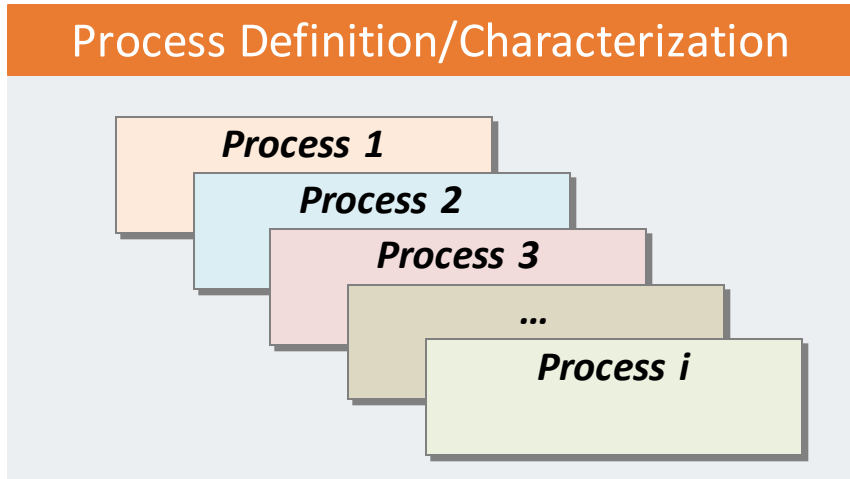
## › Objectives

- Evaluate and compare *key performance indicators* (KPIs) related to sustainability across alternative energy development and delivery pathways
- Identify opportunities to minimize negative impacts
- Address localized, often varied stakeholder concerns
- Maximize possible sustainability improvements

- › **Product:** Beta software prototype for select KPI's and low-carbon energy technologies



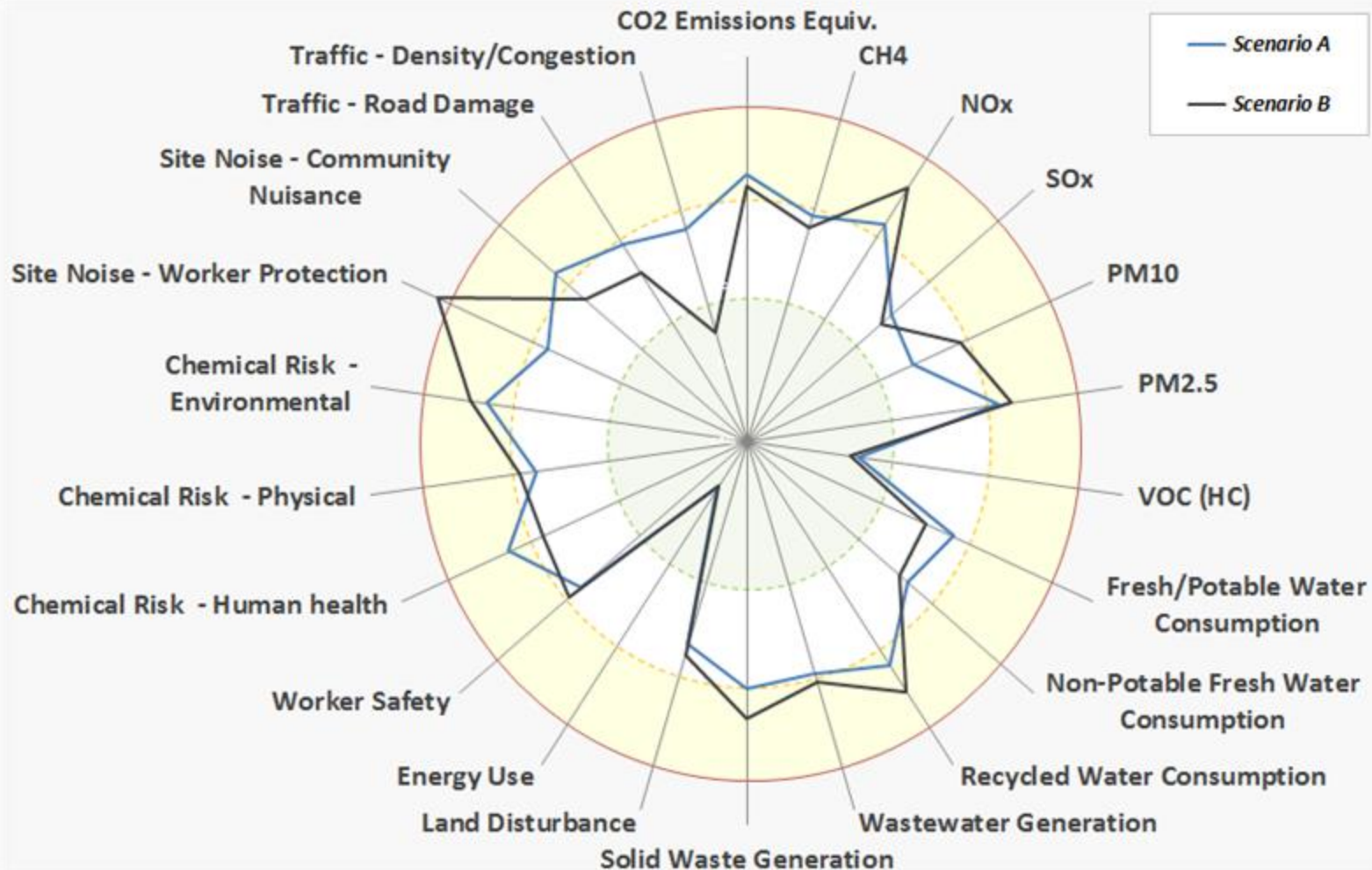
# Systematic Evaluation Approach



**Output for Sustainability Metrics: Key Performance Indicators (KPIs)**

<b>Example KPIs</b>	<b>Process 1</b>	<b>Process 2</b>	<b>Process 3</b>	<b>...</b>	<b>Process i</b>	<b>TOTAL</b>
<i>Carbon Intensity</i>	#	#	#	#	#	#
<i>Energy Intensity / Efficiency</i>	#	#	#	#	#	#
<i>Water Intensity</i>	#	#	#	#	#	#
<i>Health &amp; Safety</i>	#	#	#	#	#	#
...	#	#	#	#	#	#

# Scenario Footprint Comparison



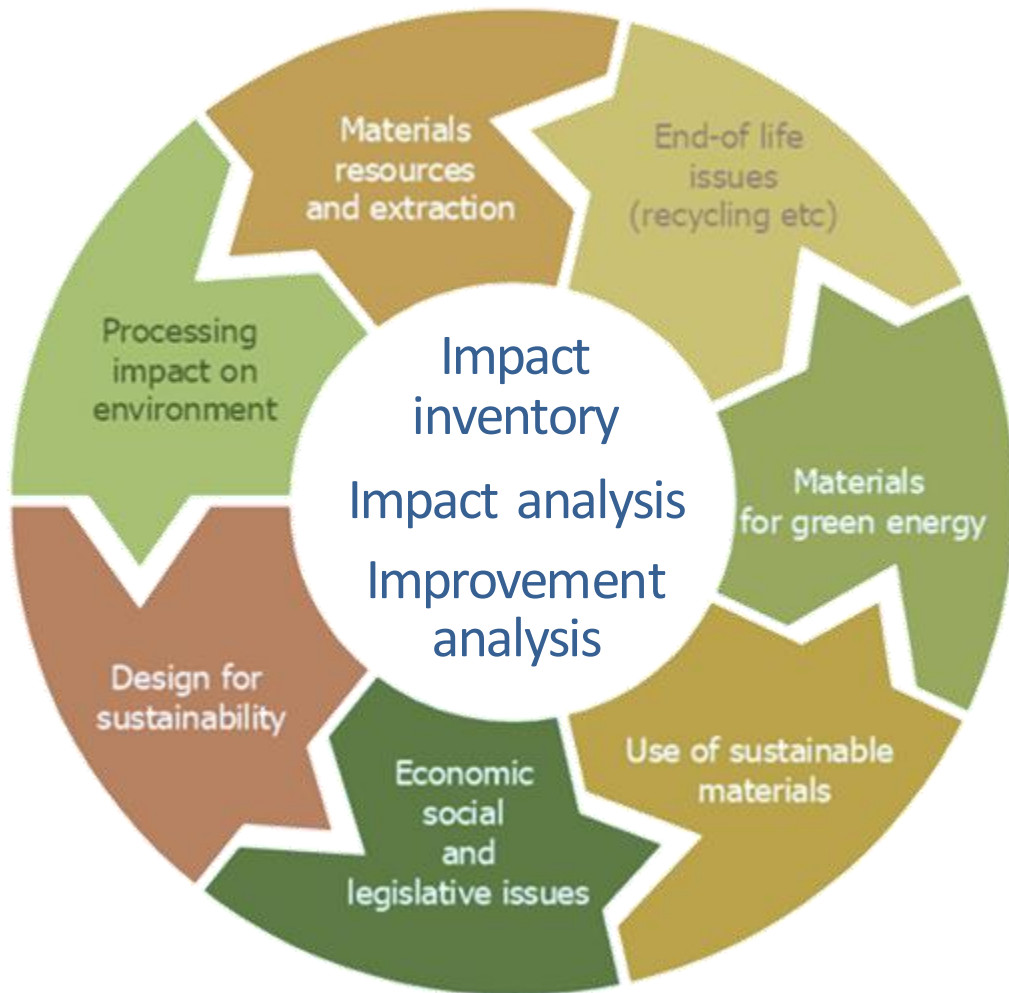
## Key Considerations

- › Target levels (goals, limits)
- › Relative scales
- › Weighting factors
- › Trade-offs
- › Competing interests/concerns



# Conventional LCA vs. KPI Analysis

## Common Considerations



Life Cycle Analysis (LCA)	Sustainability KPI Analysis
Exhaustive, <b>cradle-to-grave analysis</b> of product or material	<b>Limited analysis within defined process boundaries</b>
<b>Highly detailed</b> analysis of specific product, material, or process application (often very well defined).	<b>More generic</b> , screening-level comparison of alternative process or technology use scenarios (often more hypothetical)
Better for more “accurate” KPI quantification in <b>absolute</b> terms	Good for reasonable KPI comparison in <b>relative</b> terms
<b>Extensive data input requirements</b>	<b>Minimal data input requirements</b>
Fewer assumptions	More assumptions
<b>High level of effort/cost</b>	<b>Minimal effort/cost</b>

**KEY POINT:** High level of detail, effort, and cost associated with conventional LCAs often not needed to effectively screen promising low-carbon technologies



# Key Performance Indicators (KPI)

Interest / Concern		Sustainability Issue / Example KPIs	
Environment	Climate change	Carbon intensity	CO <sub>2</sub> and CO <sub>2</sub> -equivalent emissions
			Methane emissions
	Air/water quality	Air quality	Hazardous air pollutant emissions
			Particulate emissions
		Water quality	Surface water discharges
	Resource conservation	Ecological protection	Chemical spill hazards (aquatic)
		Land use/disturbance	Physical hazards to wildlife
		Energy intensity	Environmental resour. service value
		Water intensity/ consumptive use	Energy use, efficiency, loss
			Fresh/potable water
Waste management		Non-potable water	
		Wastewater/recycling	
		Solid and hazardous waste	
Workers	Workplace safety		Radioactive waste
		Occupational health & safety	Chemical handling hazards
			Physical hazards to workers
Community	Public safety	Vehicle transport/ traffic	Road accidents/injuries
	Public nuisance		Road/infrastructure impacts; Traffic congestion
		Aesthetics	Noise, odor, visual impacts

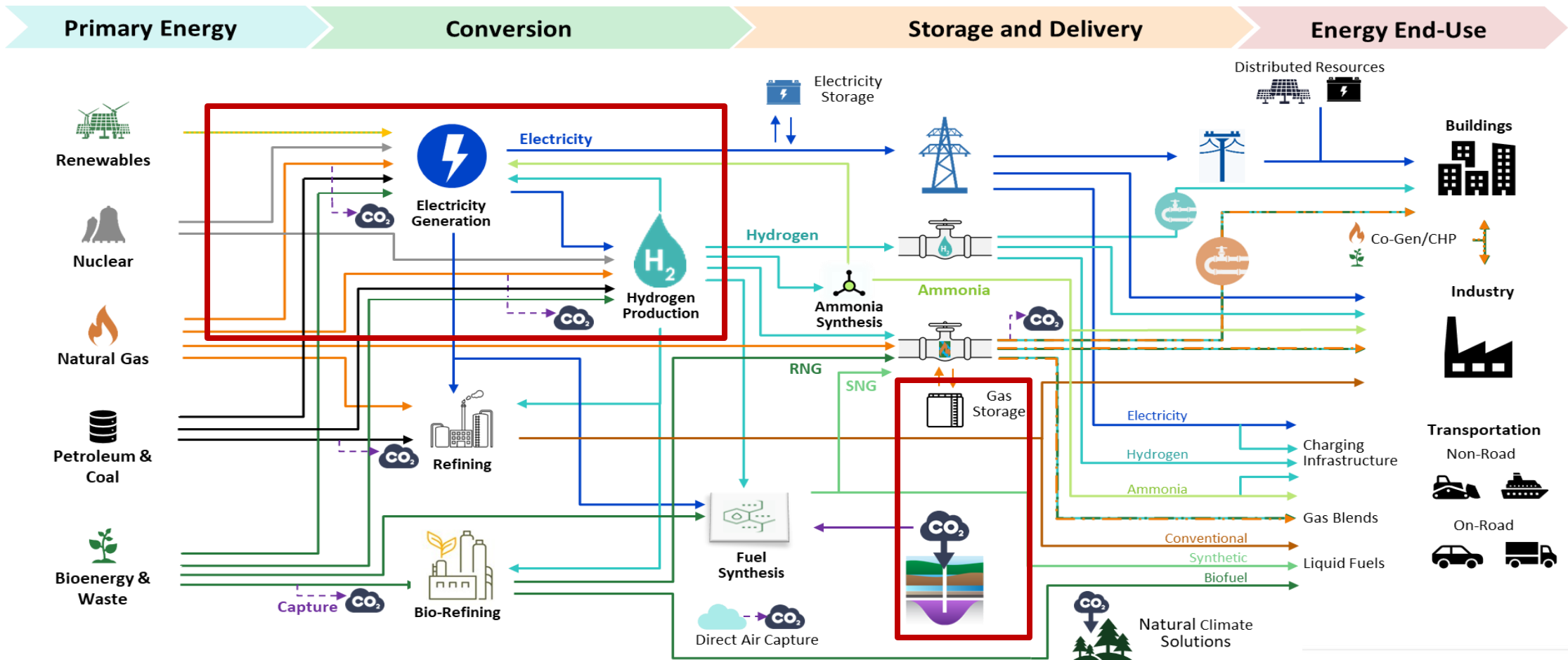
## Key Considerations

- › Who or what is affected?
- › Location of potential effects?
- › Nature/additivity of effects?



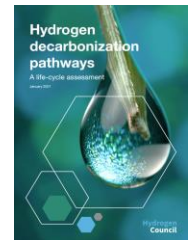
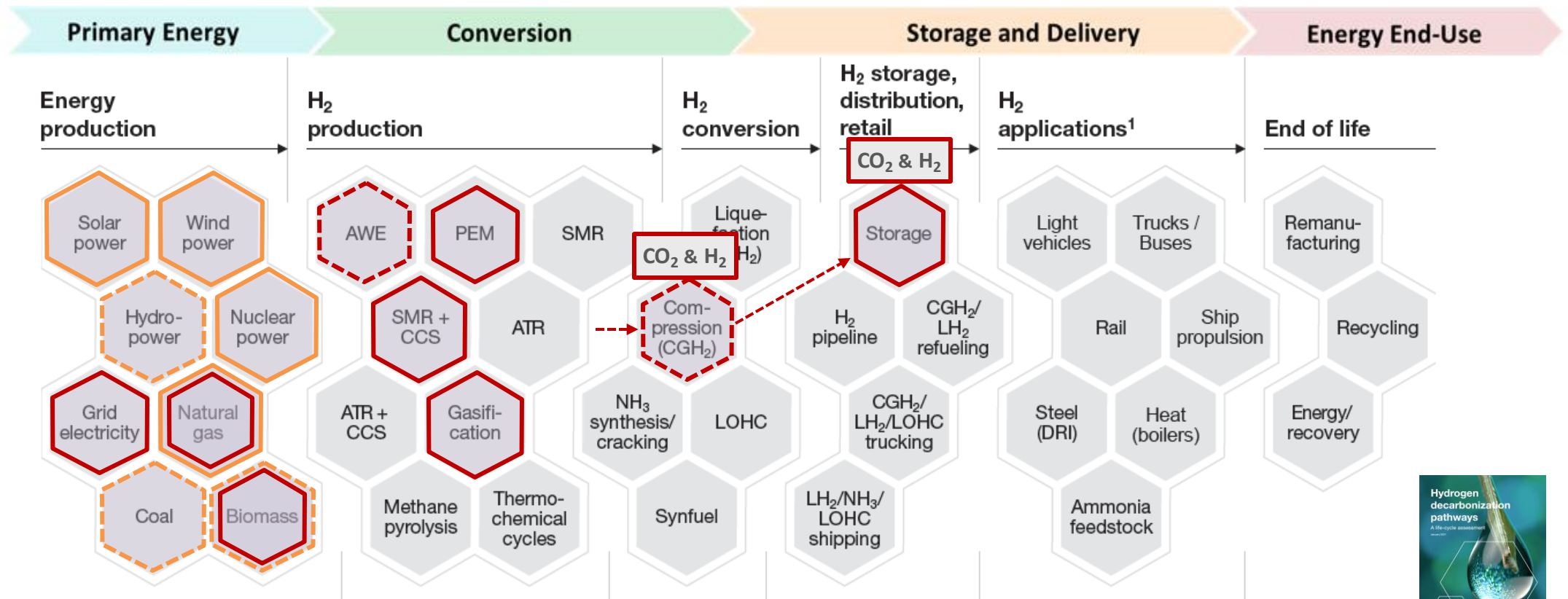
# Possible Low-Carbon Energy Pathways

**LCRI Tool - Phase 1 Process Focus**



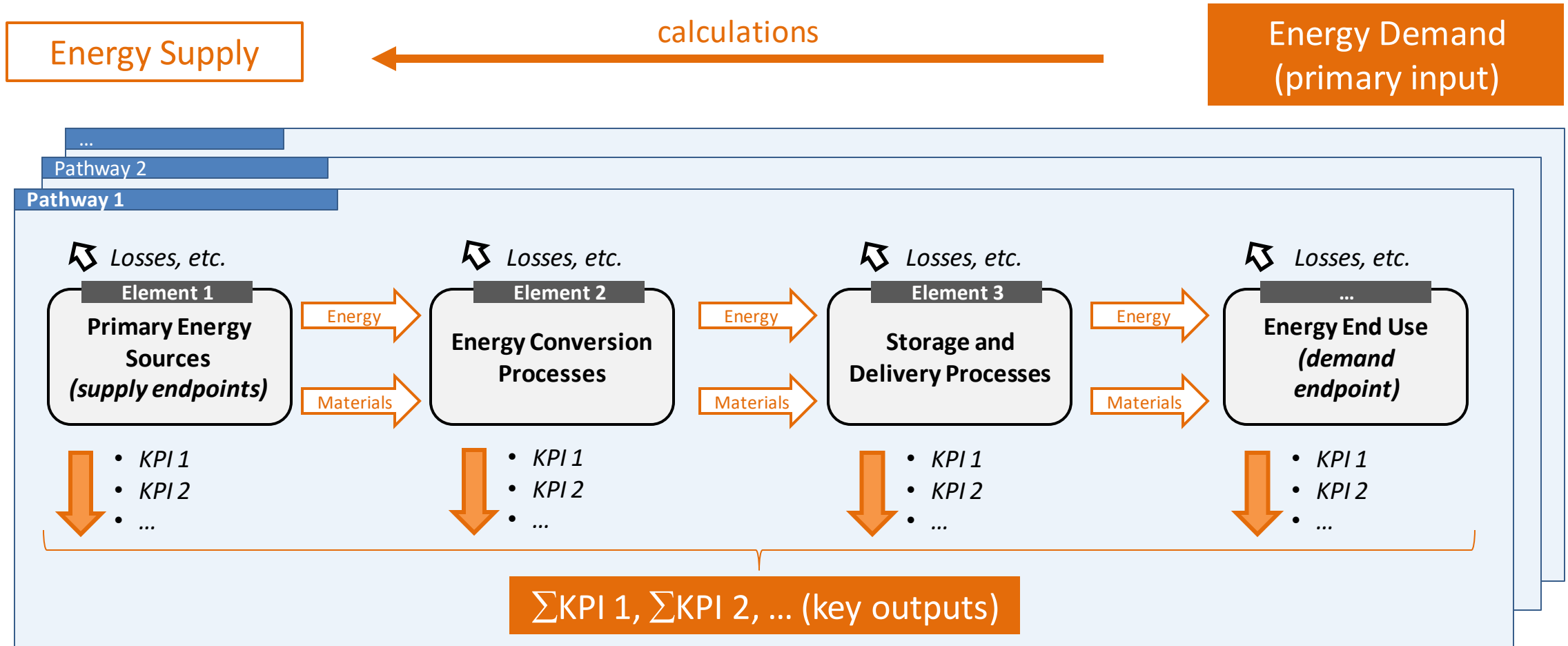
# Hydrogen Development Pathways

## LCRI Tool - Phase 1 Process Focus





# Modular Calculation Approach

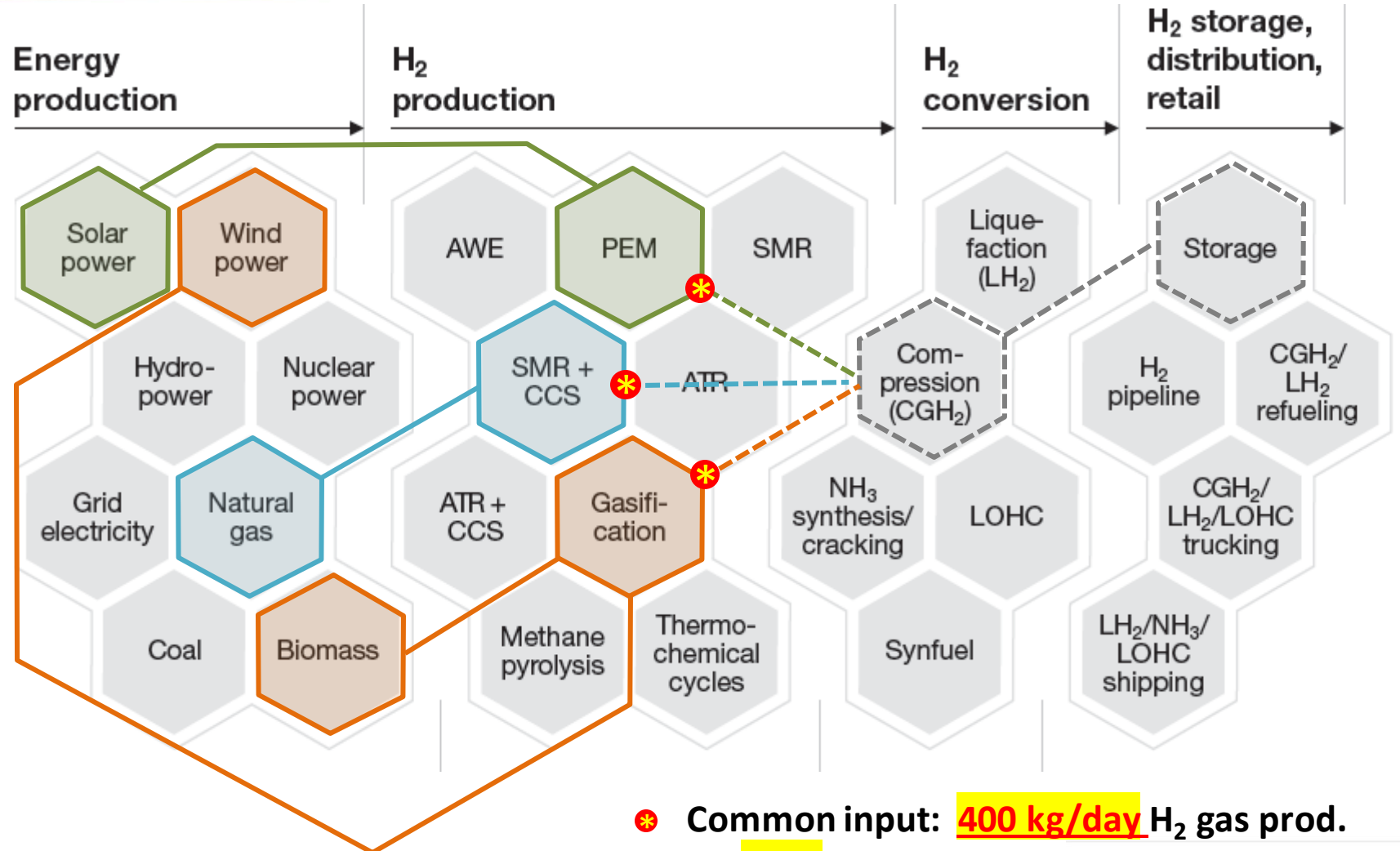


# Comparative Case Example

**Path A**  
Proton  
Exchange  
Membrane  
Electrolysis +  
Solar

**Path B**  
Steam  
Methane  
Reforming  
+CCS

**Path C**  
Bio-  
gasification  
+ Wind

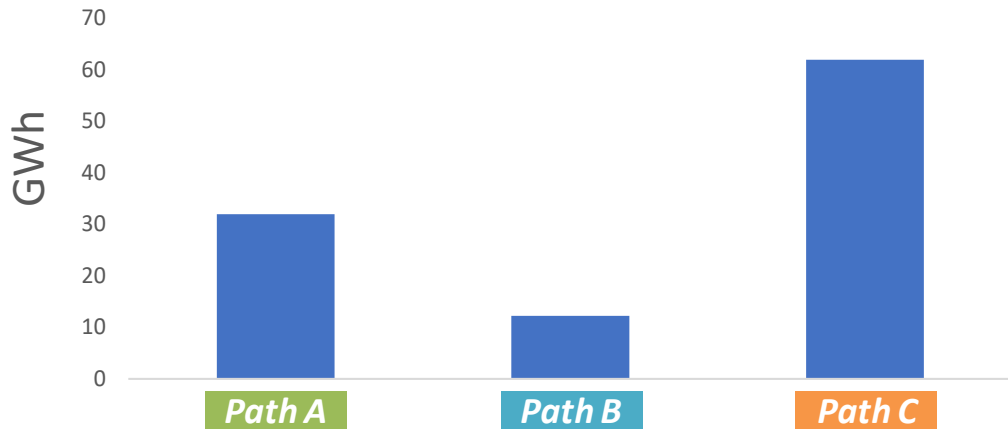


\* Common input: **400 kg/day** H<sub>2</sub> gas prod. for **10 yr**

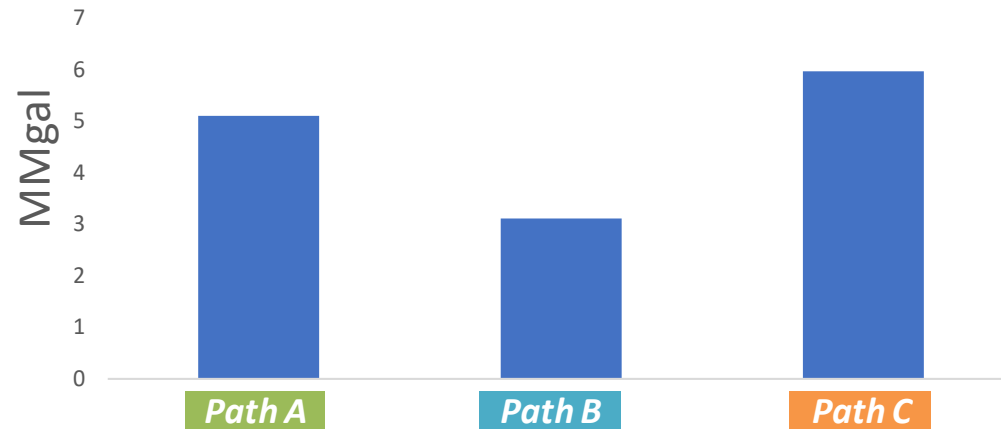
Preliminary

# Case Study Results Comparison

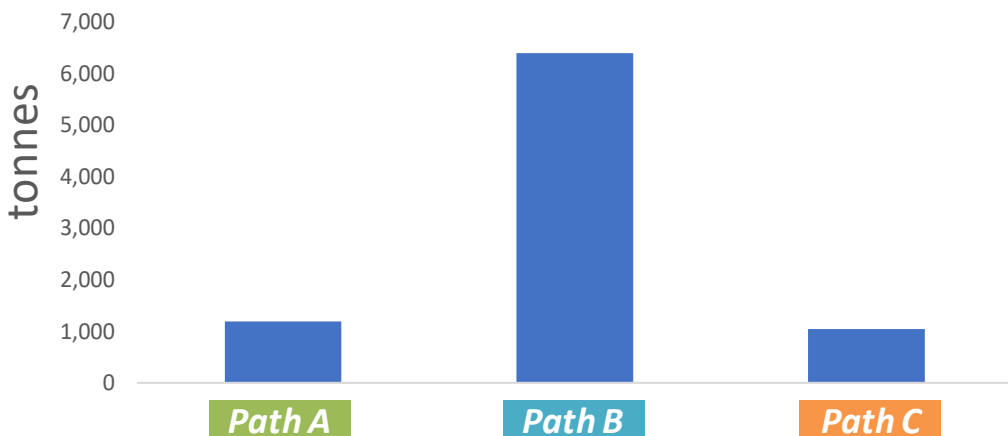
Net Energy Consumption/Loss



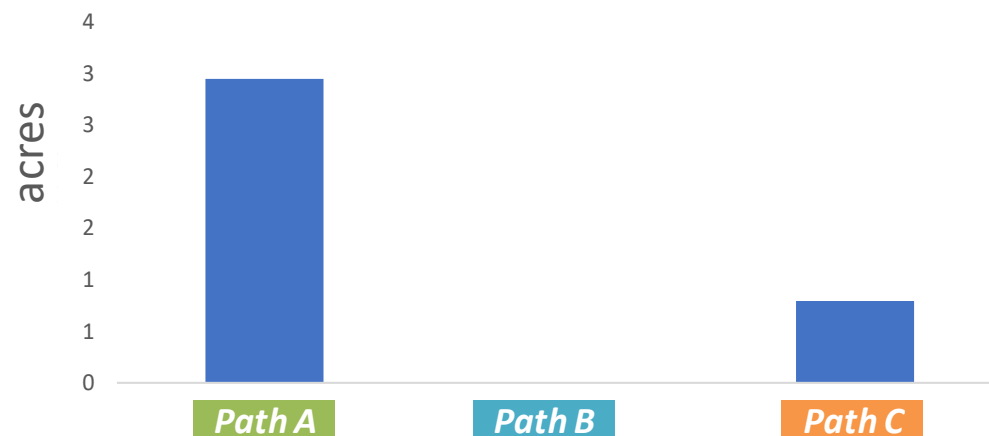
Net Water Consumption/Loss



CO2-equiv Emissions



Land Use



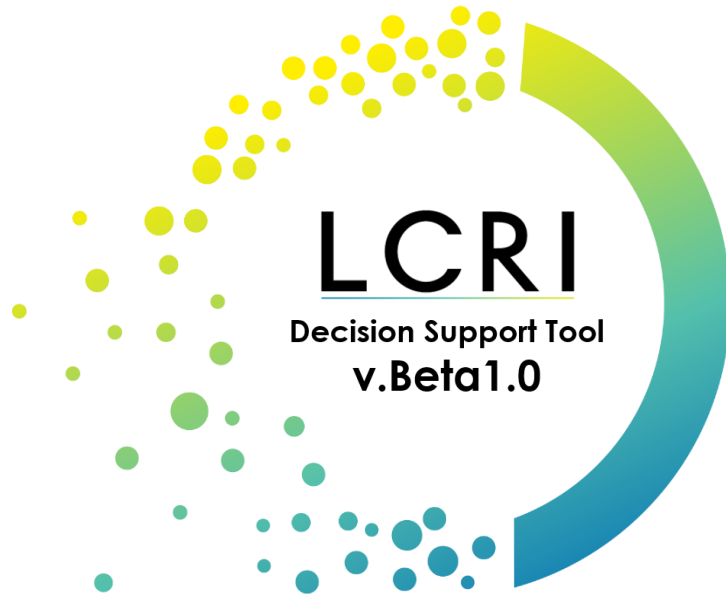
**Path A**  
PEM  
+ Solar

**Path B**  
SMR+CCS

**Path C**  
Bio-  
gasification  
+ Wind



# Thank you!



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## Questions?

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[www.lowcarbonLCRI.com](http://www.lowcarbonLCRI.com)

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