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Introduction: Why Hydrogen?

Advantages and disadvantages of hydrogen implementation for decarbonization

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Why consider hydrogen?

Goals of Decarbonization

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Goals of Decarbonization

Why explore pathways for hydrogen implementation?

Searching for energy systems that are:

- Sustainable
- Versatile
- Equitable
- Economic

Currently numerous alternatives

Advantages of Hydrogen

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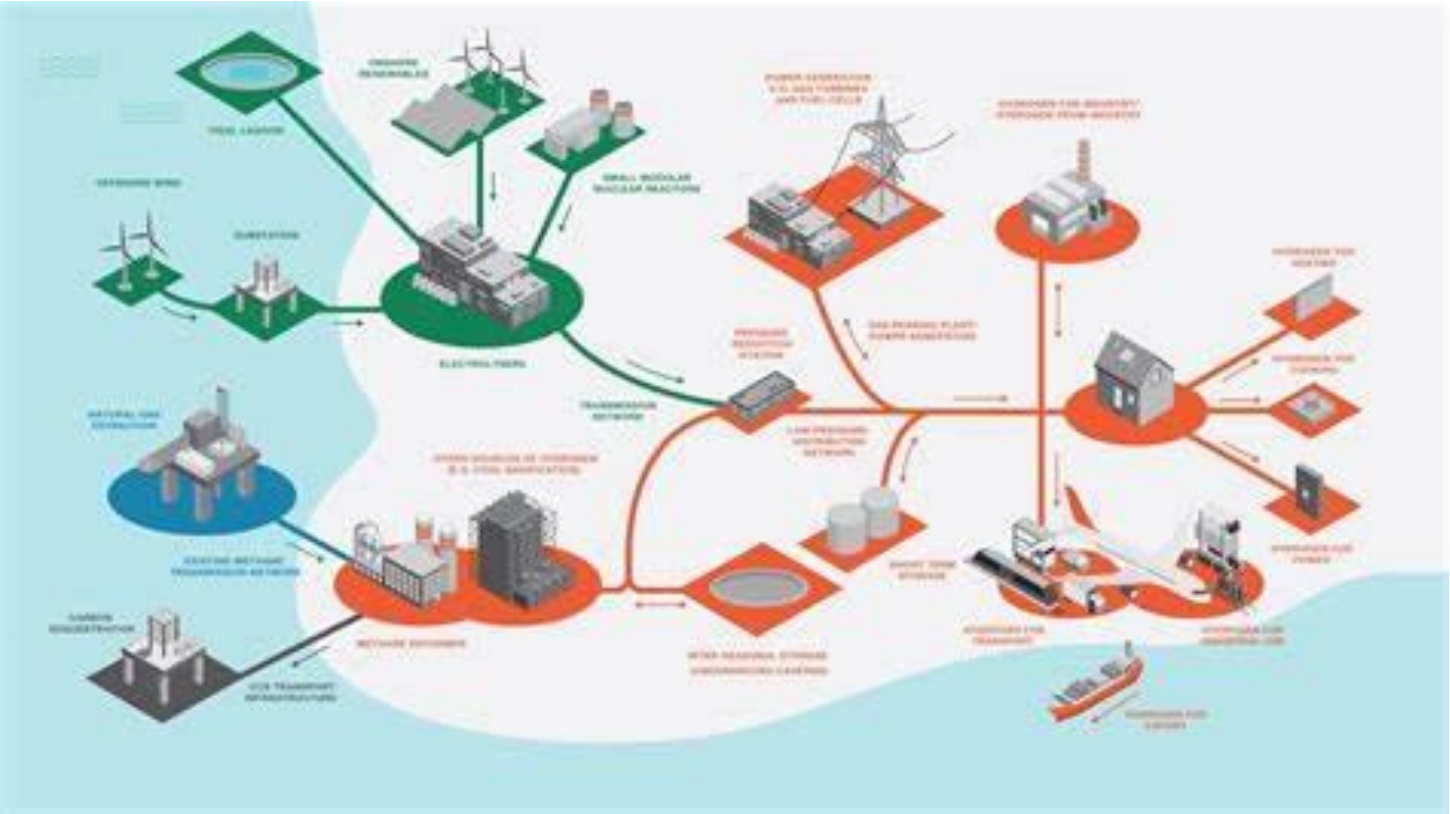
Advantages of Hydrogen

What makes hydrogen valuable?

- Versatile
- Sustainable
- Scalable
- Resilient



Disadvantages of Hydrogen

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Disadvantages of Hydrogen?

What makes hydrogen difficult?

- Inefficient
- Capital intensive
- Operationally difficult
- Potentially hazardous

What makes hydrogen work?

Nuances

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Why consider Hydrogen?

What makes hydrogen work?

- Geography
- Natural resources
- Specific needs
- Suitability of alternatives

Hydrogen can work

Pathways for Implementation

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Pathways to hydrogen-based transportation

Decarbonization of existing fuels

Hydrogen can be used to lower the carbon intensity of fuels for existing ICE fleets or to replace hydrocarbon fuels completely

Mass transportation & Heavy-duty vehicles

Point based heavy-duty transportation systems requiring longer run times and heavier loads can be facilitated with hydrogen

Medium & light duty vehicle

With the advent of broader re-fueling facilities the introduction of lighter vehicles to provide enhanced capabilities and equitable fueling

Pathways for Implementation

Existing Systems

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Conversion of existing systems

What can we do today?

Existing fuels systems can be decarbonized:

- Lower carbon intensity
- Negative carbon intensity
- Preserves existing fleet and assets
- Equitable solution

Pathways for Implementation

New Systems

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Development of new systems

Where can we go?

Fuel cell and HCEs

Mass transportation

Industrial transportation

Personal transportation

Pathways for Implementation

Other Systems

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Non-transportation systems

What else can we do?

Steel production

Cement production

Fertilizer Produciton

Energy storage

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Strategic Actions and Takeaways

Strategic Actions

Leadership, Vision, & Planning

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Set the direction, lead the way

Set the vision

The purpose for changing transportation systems must be clearly elucidated to provide a purpose

Plan Implementation

Hydrogen systems require a complete value chain to be effective. Planning the links is vital

Lead development

Taking the first steps to establish the economy and to demonstrate feasibility is critical

Strategic Actions

Enablers

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Hydrogen Economy Enablers

How to make it work?

Incentives

Subsidies

Legislation

Financing Support

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Conclusions

- Hydrogen has great potential as a decarbonization tool
- Successful deployment of hydrogen must be based on the nuances of the specific situation being considered
  - Consider the alternatives
- Planning and support are critical for success

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