# A FRAMEWORK TO ASSESS TECHNOLOGIES UNDER FES

Eskinder Gemechu[1], Amit Kumar[1] and Evan Davies[2]

## BACKGROUND

The project aspires to assess technologies under FES both from renewable and non-renewable sources. It is based on a life cycle thinking that considers the whole life cycle: from the extraction, processing, conversion, transportation and utilization of different energy forms. Life cycle sustainability assessment (LCSA) will be used as a methodological approach to identify and evaluate environmental sustainability, economical viability and social acceptability of technologies developed under FES. Solar, wind, geothermal, biomass, carbon capture utilization & storage, heavy oil, smart grids, non-electric infrastructure and land & water would be the key focus of this project.

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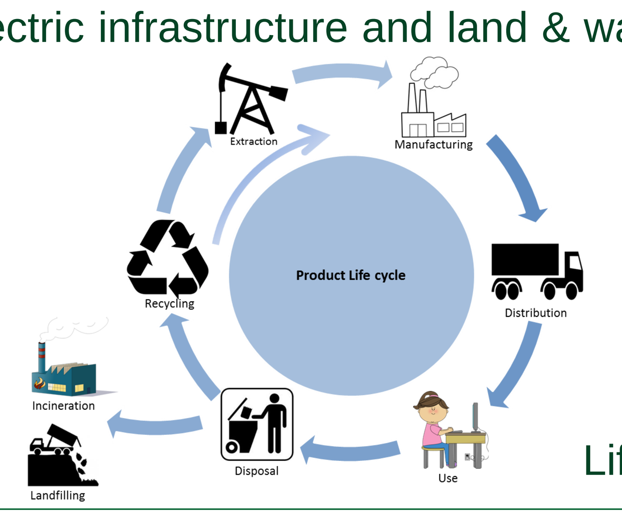


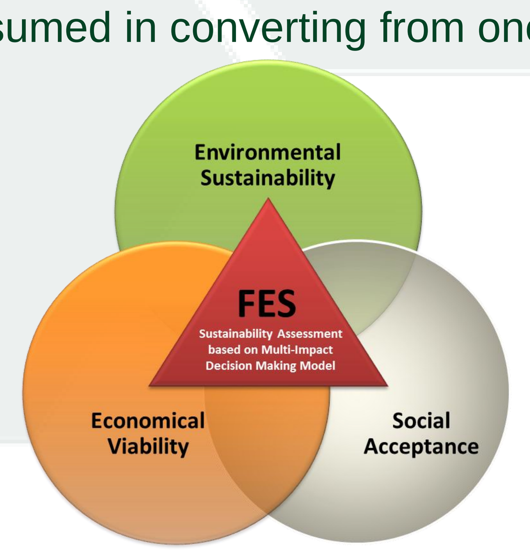

Life cycle thinking

## AIMS AND OBJECTIVES

The research aims to answer the following questions related to system characterization:

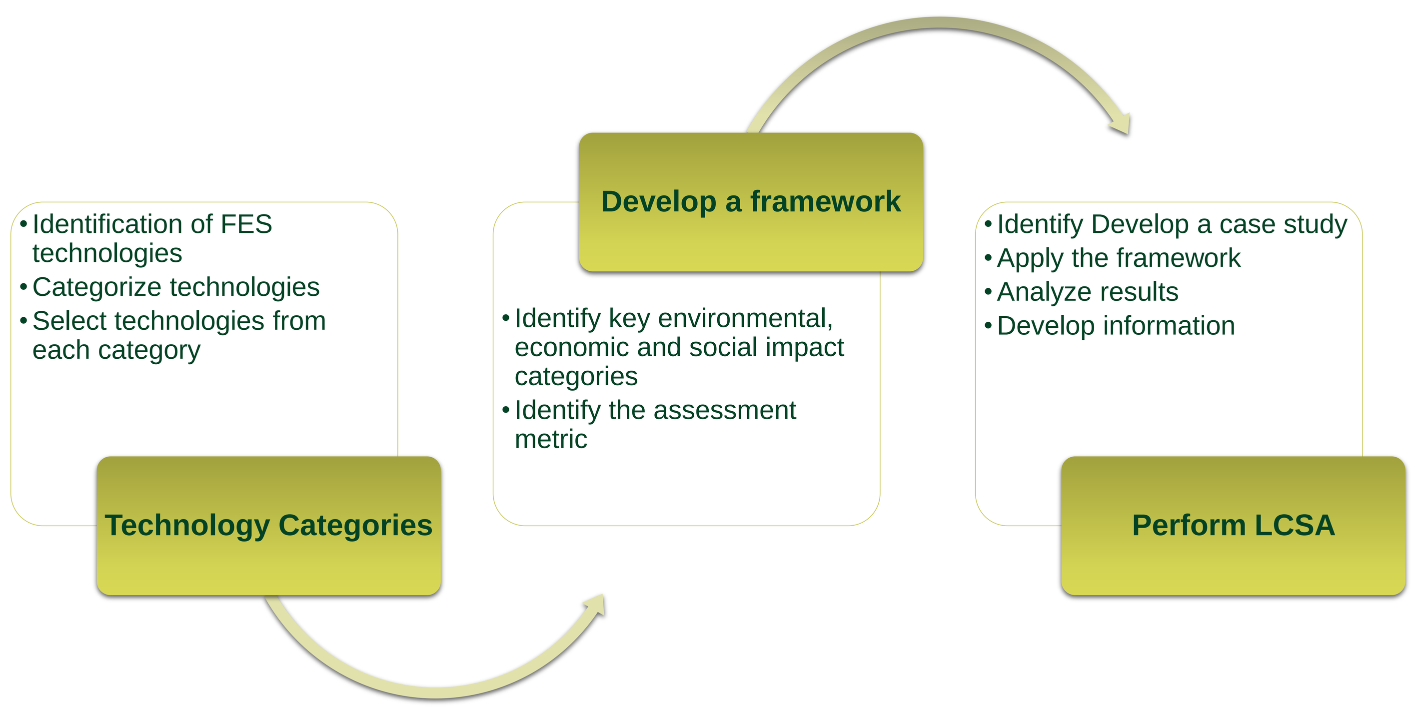
- Which primary energy sources do we have in a particular jurisdiction?
- How much primary and secondary energy do we use, and where?
- What are the pathways to convert each primary energy to secondary energy?
- What are the costs of producing each form of energy?
- How much energy and other resources are consumed in converting from one to another form of energy?

The ultimate objective of the project is to identify the technologies, which have the potential of being economically viable, environmentally sustainable and socially acceptable.

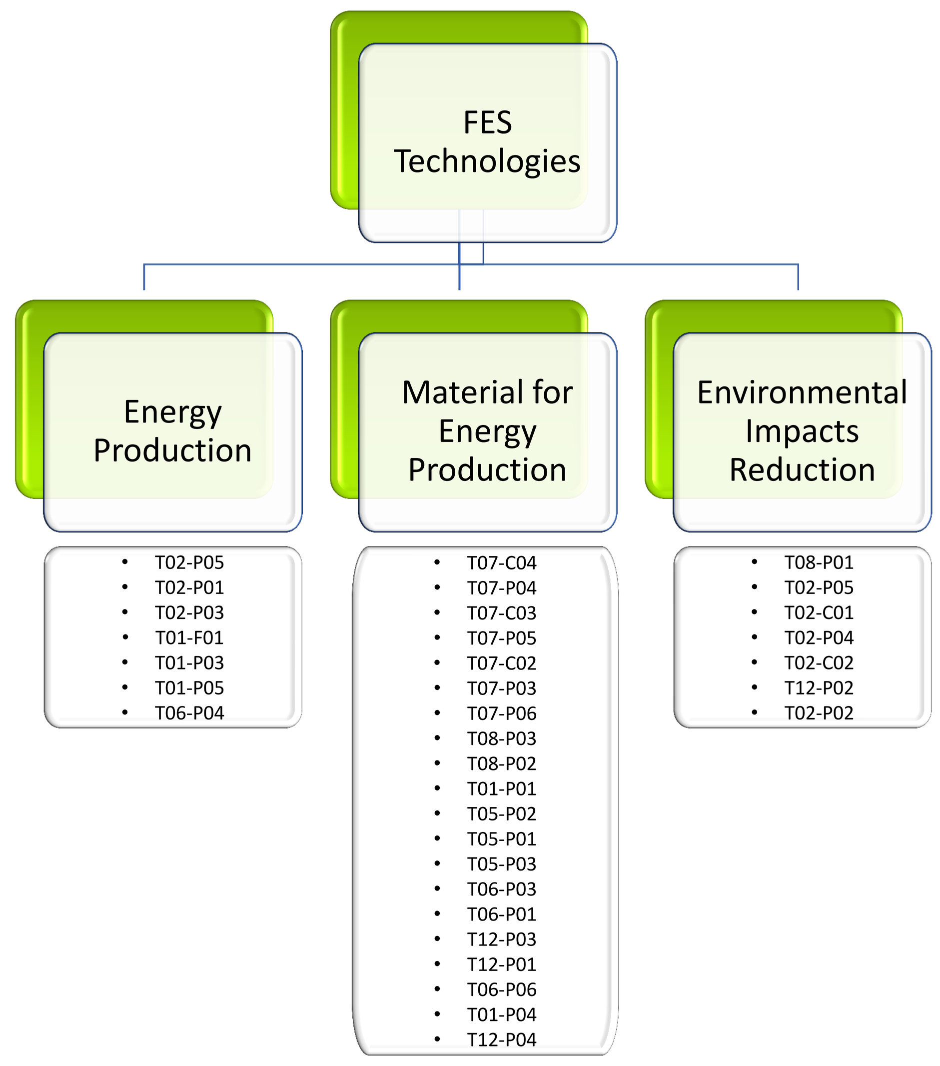



## RESULTS

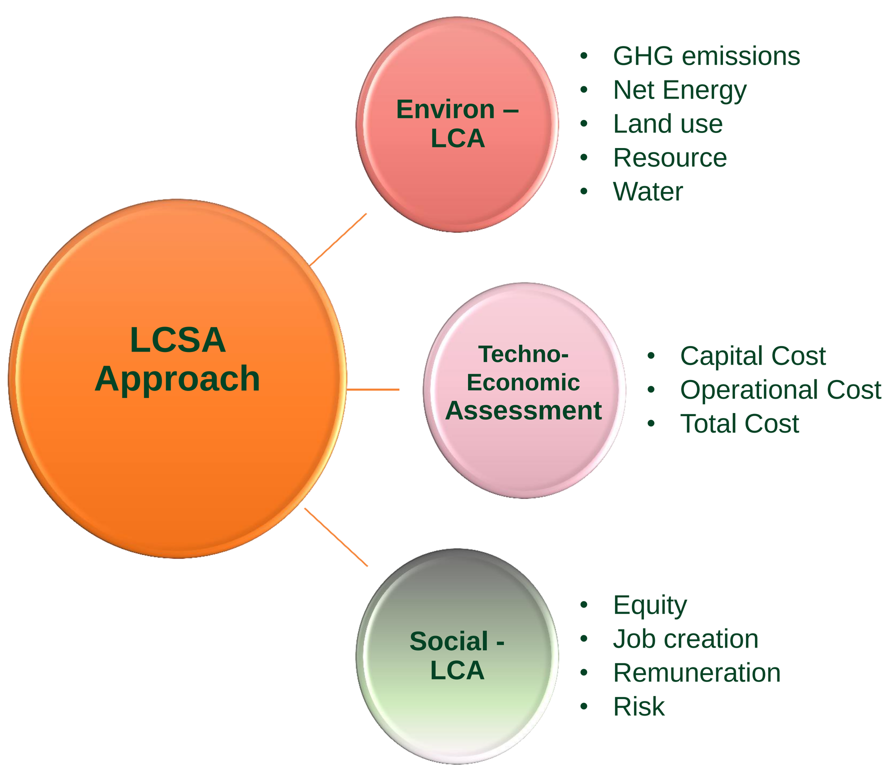
- An LCSA framework has been developed.
- Technologies under FES have been reviewed and categorized:
- Key environmental, economic and social impact categories have been identified.
- The assessment metrics for each impact category have been determined




FES technology assessment pathway




Technology Categories




Key Sustainability Metrics

## FUTURE DIRECTIONS

- Perform LCSA for selected technologies from each category
- Evaluate their environmental, economic and social performance
- Develop GHG emissions abatement cost for each category
- Develop information for decision makers in industry and government in making investment decisions and policy formulation
- Helps decision making based on the economically and environmentally sustainable technologies

## PARTNERS

This project will be complementary to Future Energy System, University of Alberta and NSERC/Cenovus/Alberta Innovates Associate Industrial Research Chair Program in Energy and Environmental Systems Engineering (IRC) and Cenovus Energy Endowed Chair in Environmental Engineering (Endowed Chair). These programs have contributed significantly to the system level research on energy processes.

## FES PROJECT OVERVIEW

Understanding energy systems at a system-wide level means recognizing the countless ways that they integrate into our daily lives. From the instant when an energy source is first captured, to the moment you access it by flipping a light switch or starting your engine, it has traveled through a system to reach you. Systems modeling allows us to identify and quantify each step along the way, to simulate the impact of alternative systems, and to predict the potential consequences of change. System-wide analysis and modeling will never provide a guaranteed forecast of the future, but it can identify possible benefits and disadvantages to change, highlight areas requiring additional study, and help us to consider the viability of an entirely new energy future.

[1]Department of Mechanical Engineering, University of Alberta

[2]Department of Civil and Environmental Engineering, University of Alberta

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