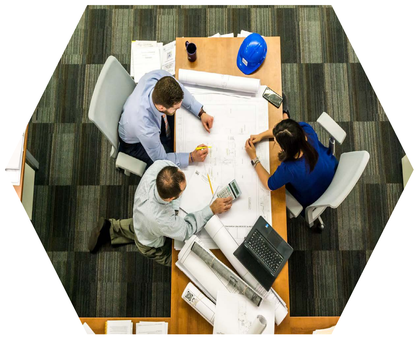
# Decision Support Systems for Improved Construction and Maintenance of Non-Electrical Infrastructure for Energy

A. Robinson Fayek[1], S. AbouRizk[2], W. Pedrycz[3], M. Zuo[4]

## BACKGROUND

The construction, operation, and maintenance of non-electrical infrastructure for energy requires decision makers to take into consideration unique project characteristics, new types of risks, and data limitations. The proposed research will investigate the development of dynamic decision-support systems and modeling techniques to account for these characteristics.



## SHORT-TERM OBJECTIVES

- Develop a comprehensive definition of infrastructure for energy.
- Identify & quantify the most significant issues impacting the construction, operation, & maintenance of energy infrastructure in terms of cost, schedule, quality, efficiency, & safety.
- Identify risks involved in constructing, operating, & maintaining energy infrastructure.
- Identify methods for measuring the impacts of significant factors & risks.
- Develop & deliver a Future Energy Systems course in the non-electrical infrastructure theme.
- Foster interdisciplinary collaborations, both internally & externally to the university.

## PROJECT OVERVIEW

In order to effectively harness energy sources, we must design and construct facilities to extract, process, and deliver energy to end users. The construction, operation, and maintenance of such facilities requires proper planning and execution in order to reduce risks and uncertainty, and to allow for efficiency, cost-effectiveness, and safety during each of these stages.

Since future energy systems involve new technologies and have far-reaching social, economic, and political impacts, the development, operation, and upkeep of the associated infrastructure poses unique challenges for practitioners. The processes of constructing, operating, and maintaining long-life energy infrastructure assets, in comparison with other aspects of development such as design, pose many complex risks, including weather-related challenges, unproven technology, and unknown stakeholder interactions and interests. Therefore, risks that are not common to the construction and maintenance of other types of infrastructure may arise, and decision making has to be made in an environment of considerable uncertainty.

Data on such future energy infrastructure projects may be limited, of low quality, or non-existent, and in such contexts, expert knowledge will be required in addition to project data for effective modeling and decision making. To address these issues, innovative modeling and decision-making approaches will be developed to address the unique characteristics of such projects, deal with new types of risks, and address data limitations in developing and validating models and decision-support tools.

## THEME OVERVIEW

Non-Electric Infrastructure

Whether for hydrocarbons or new fuels derived from renewable resources, effective methods for storing, handling and transport are essential to the harnessing of energy sources. Infrastructure for movement and storage of these resources must be developed with an understanding of its social, economic, and environmental impacts — including potential unintended consequences, such as the creation of locked-in emissions, or the stranding of assets. A base of knowledge related to these questions must be developed, and distributed to planners, users, and decision-makers whose choices can shape our energy future for generations to come.

## EXPECTED OUTCOMES

- Innovative processes & tools for better management of energy infrastructure projects.
- Reduction in cost, duration, & risk in project execution.
- Greater efficiency, predictability, & profitability in executing energy infrastructure projects.
- Increased competitiveness in energy infrastructure construction & maintenance.
- Greater investment in energy infrastructure in Canada.
- Increased global competitive standing of the Canadian energy sector.
- Software licensing and commercialization opportunities of the developed decision support systems.

## EXTERNAL PARTNERS

Our external partners will be defined as the project progresses and may include the following:

- Colleagues at NAIT
- Colleagues at other Canadian universities
- International colleagues
- Industry partners currently collaborating with us on applied research
- New industry partners

[1]University of Alberta, 7-287 Donadeo Innovation Centre for Engineering, 9211-116th Street NW, Edmonton, AB T6G 1H9, *aminah.robinson@ualberta.ca*
[2]University of Alberta, 7-232 Donadeo Innovation Centre for Engineering, 9211-116th Street NW, Edmonton, AB TG6 1H9 *abourizk@ualberta.ca*
[3]University of Alberta, 11-293 Donadeo Innovation Centre for Engineering, 9211-116th Street NW, Edmonton, AB T6G 1H9 *wpedrycz@ualberta.ca*
[4]University of Alberta, 10-203 Donadeo Innovation Centre for Engineering, 2911-116th Street NW, Edmonton, AB T6G 1H9 *ming.zuo@ualberta.ca*

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FUTURE ENERGY SYSTEMS

CANADA FIRST RESEARCH EXCELLENCE FUND

This research has been undertaken thanks in part to funding from the Canada First Research Excellence Fund.