# Development of a Framework to Formulate Energy Infrastructure Siting Alternatives

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# Energy Infrastructure Siting

- Demand for new energy infrastructure is growing
  - rising energy demand, **ageing infrastructure** and environmental concerns
- Siting energy infrastructure is a complex process
- Involves multiple stakeholders and long planning horizons
- Stakeholders often have multiple and conflicting objectives

# Infrastructure Siting Difficulties

- In recent years, siting energy infrastructure has become increasingly difficult
- Proposals to site new energy production and transmission systems routinely reach impasses at the stakeholder deliberation stage
- A main factor that leads to siting difficulties is the process used to formulate alternative siting options

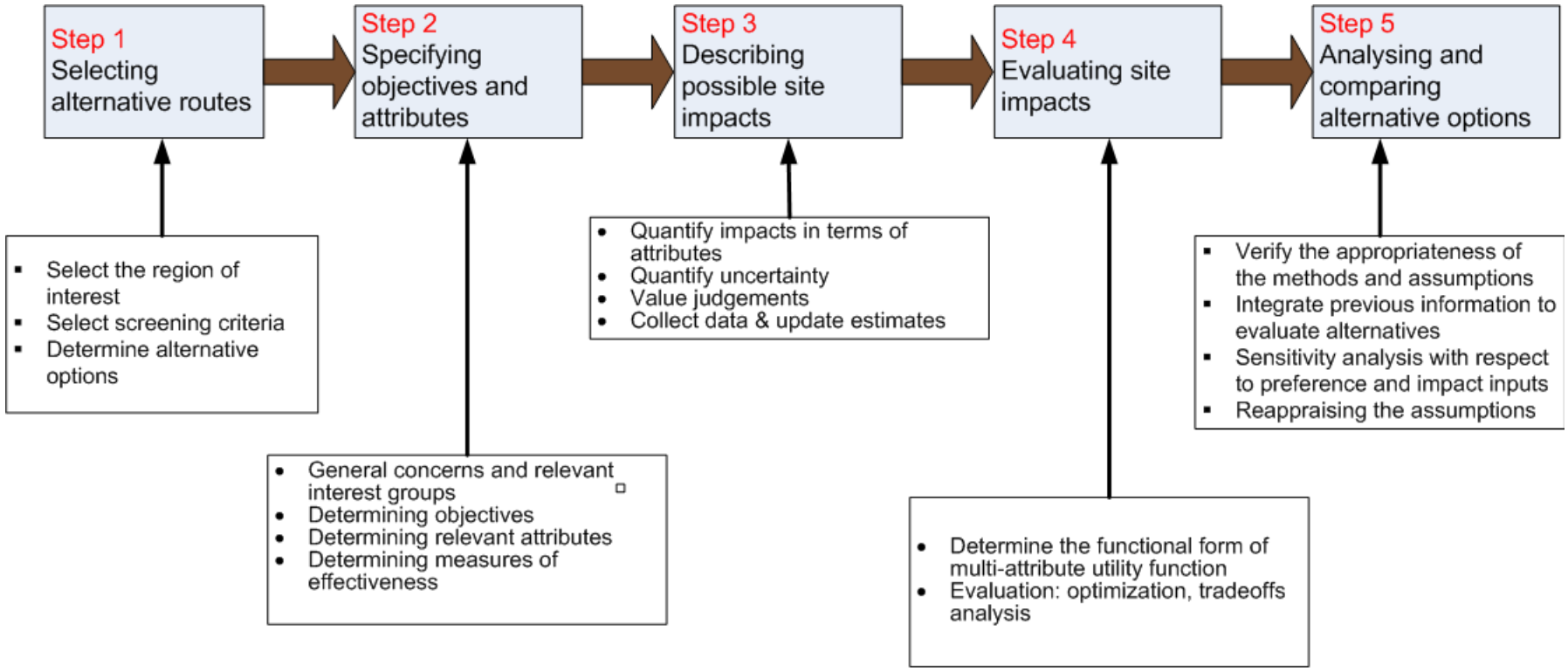
# Infrastructure Siting Difficulties

- Siting decisions: set of alternatives that provide different means to the end objective
- Alternatives: by proponent of energy project
- Must account for multiple stakeholder objectives
- Screening and evaluation procedures:
  - **objectives set by single or small group of stakeholders**
  - **biased**
  - **internally inconsistent attribute evaluations**
  - **implicit assumptions attribute weights assigned by stakeholders**

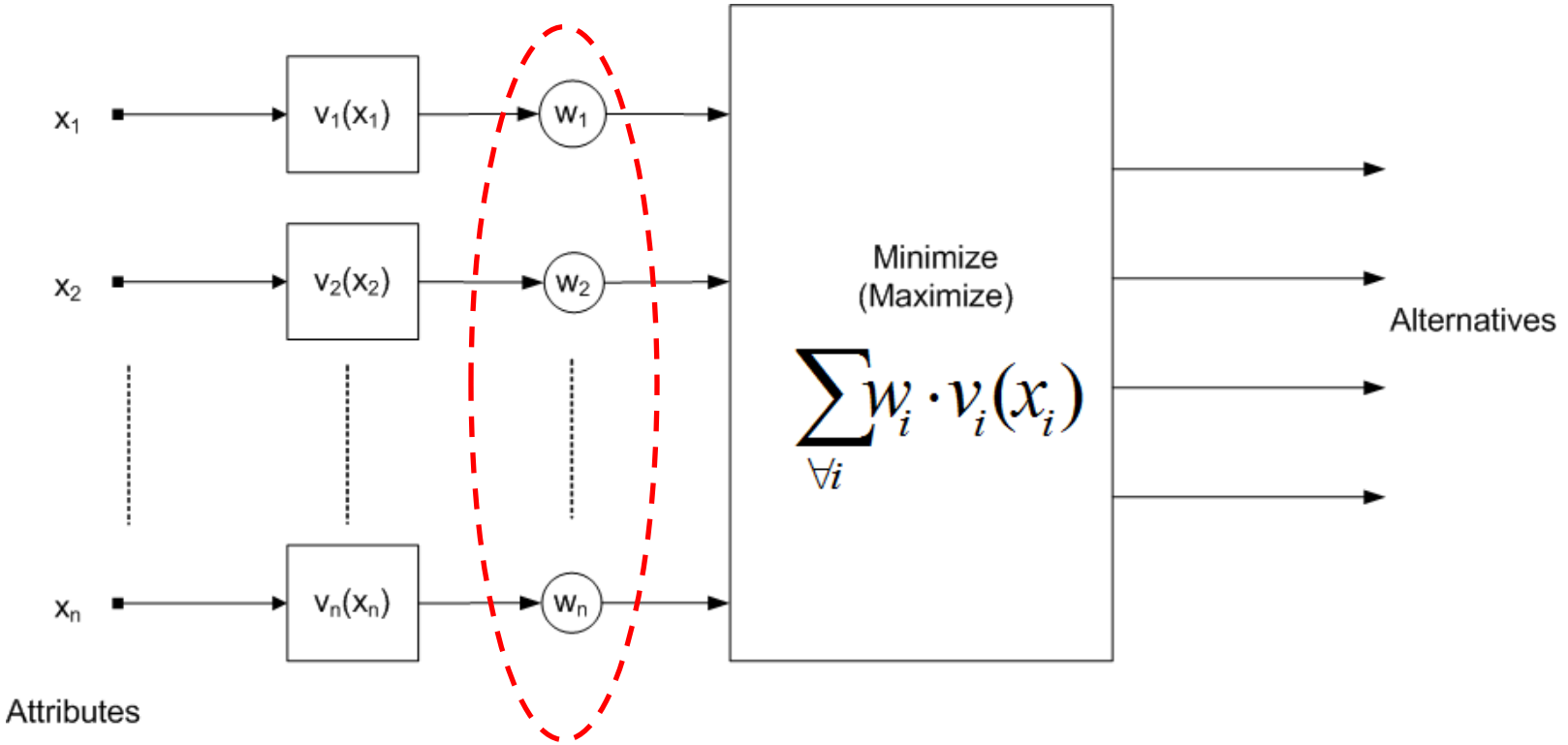
# Framework to Formulate Siting Alternatives

- **Good decisions:** address concerns of multiple stakeholders
- **Siting decisions:** alternatives supported by sound analyses
- **Alternatives:** formulated using a transparent process and all tradeoffs must be done explicitly
- Develop a framework to formulate alternative siting options
- Tightly couple the technical constraints with the objectives of multiple stakeholders

# Proposed Framework



# Proposed Framework

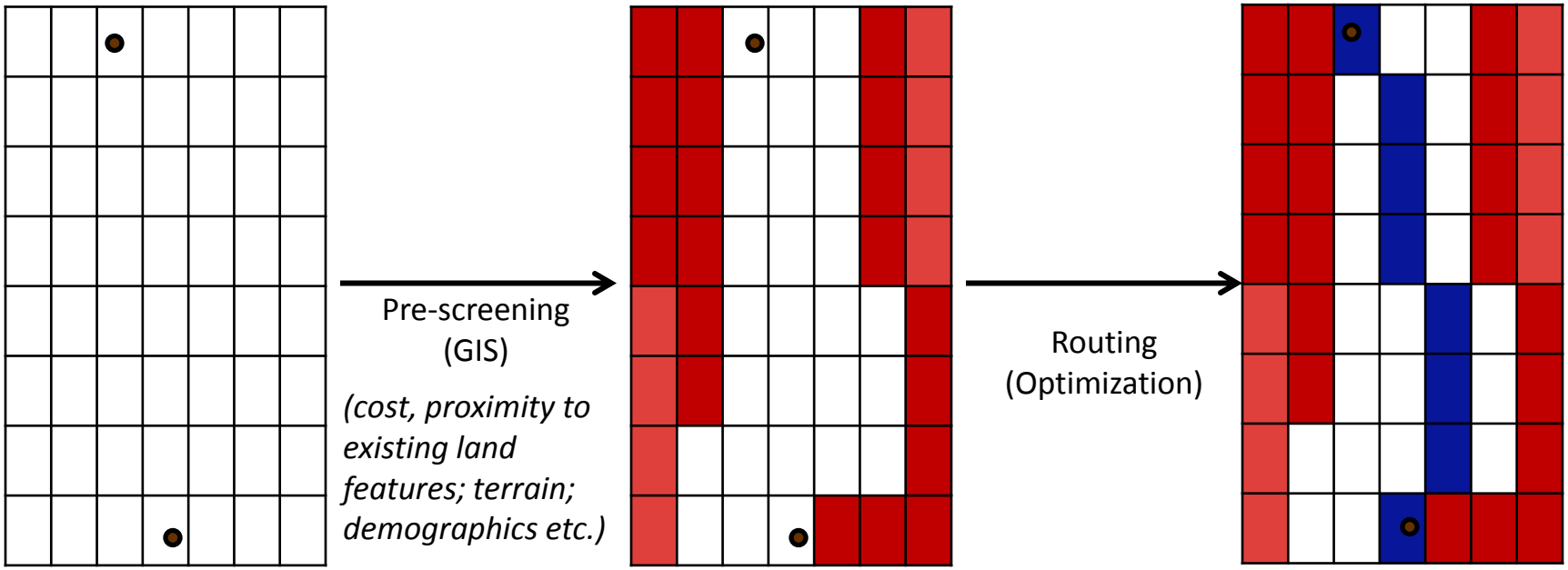



Reflect stakeholder preferences

# Transmission Line Siting Case Study

- Selection of a electricity transmission line corridor in Alberta
- Edmonton to Calgary - 500kV/2000MW HVDC
- Attributes considered:
  1) Economic cost
  2) Environmental impacts
  3) Residential impacts
  4) Agricultural impacts
  5) Visual impacts
  6) Public health and safety

# Route Selection

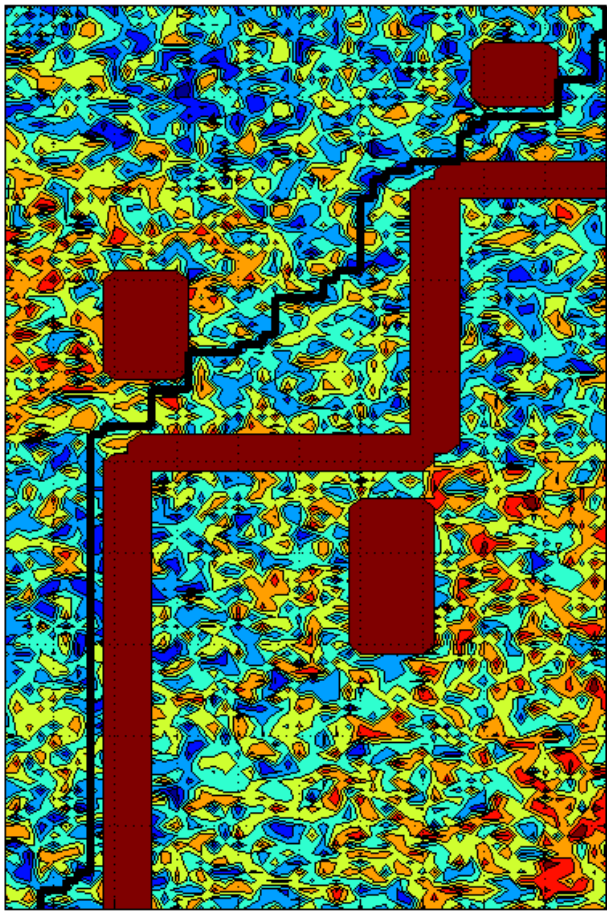


# Preliminary Results

- Route evaluation algorithm: minimum *cost* path selection (Dijkstra's algorithm)
- Can be implemented in popular GIS software platforms
- Data is obtained using publicly available sources
- The weights assigned by different stakeholders are inferred using regulatory hearing proceedings

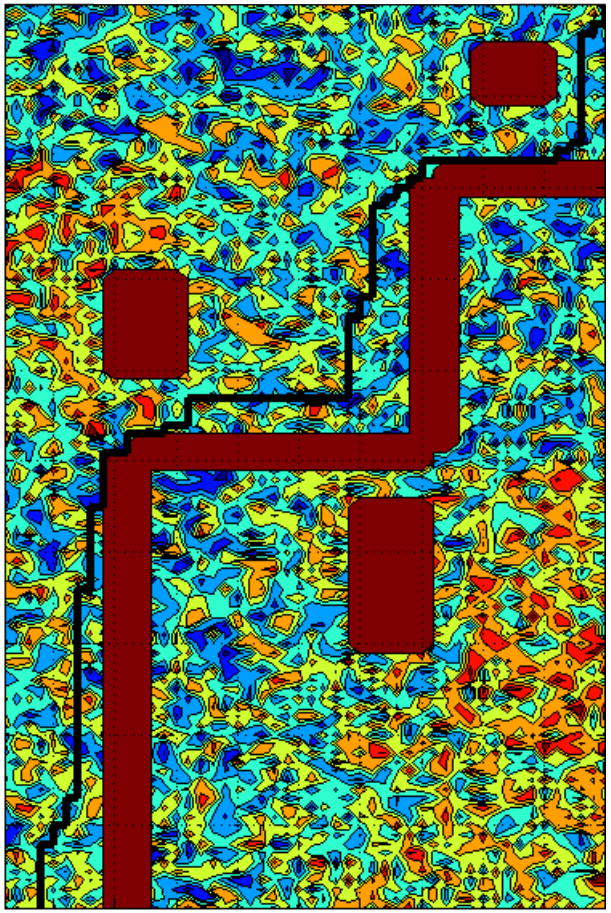
# Results

Route score = 74



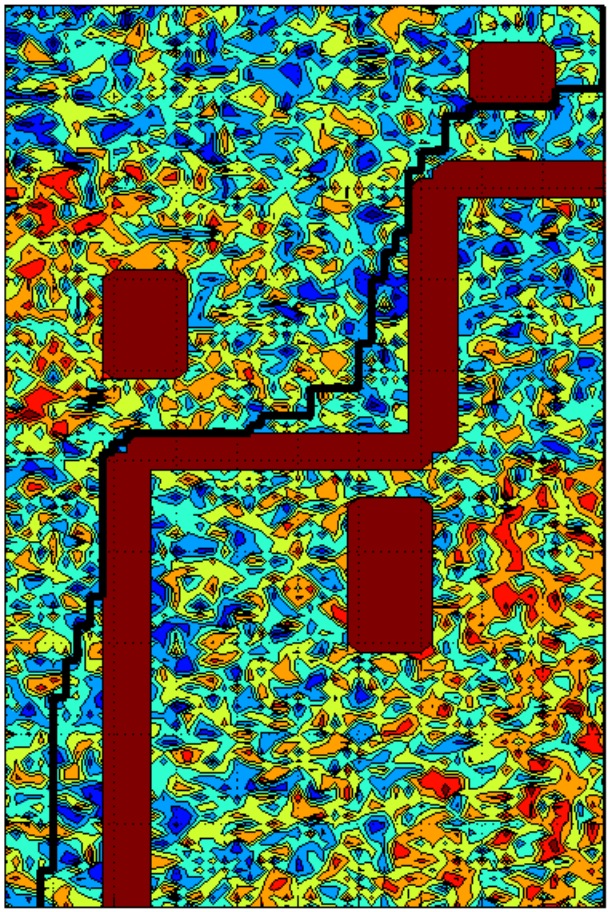
(1)

Route score = 79



(2)

Route score = 81



(3)

# Conclusions

- Infrastructure siting decisions are complicated by multiple and often conflicting objectives of the stakeholders
- The proposed framework inherently takes the multiple stakeholder objectives into account
- Alternatives formulated by this framework are more likely to address different stakeholder concerns.
- Therefore, the proposed framework can help the decision maker to make a responsible decision