Developing a Municipal Energy Efficiency Plan for the Town of Bethel:

A Cost-Benefit Analysis

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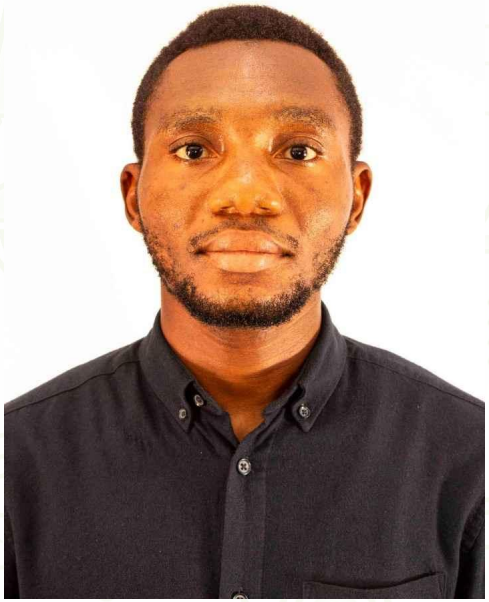

Ph.D. Student in Ecology & Environmental Sciences
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- National of **Ghana**
- Studied **M.Phil. Blue Economy and B.A. Economics and Geography**
- Previously interned with research firms, NGOs, and policy think tanks including **Africa Centre for Energy Policy (ACEP)**
- Interested in integrating local dimensions into energy policy; natural resource governance; and social dimensions of coastal and marine renewable energy

About Us>> Rafiul Ahmed

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- National of **Bangladesh**
- Studied **B.Sc. Economics & Statistics**
- Previously worked as a Senior Research Assistant with one of the leading think tanks of South Asia**, South Asian Network on Economic Modeling (SANEM), United Nations Development Programme (UNDP)**
- Interested in policy-driven transition from non-renewable to renewable energy, with a focus on sustainable development.

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Associate Professor
Class Instructor: ECO 505: Sustainable Energy Economics and Policy- Spring Semester
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03 Mr. John Snell

Certified Energy Auditor
Energy Auditor: Bethel Town Facilities
John Snell, LLC

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Bethel Energy Profile

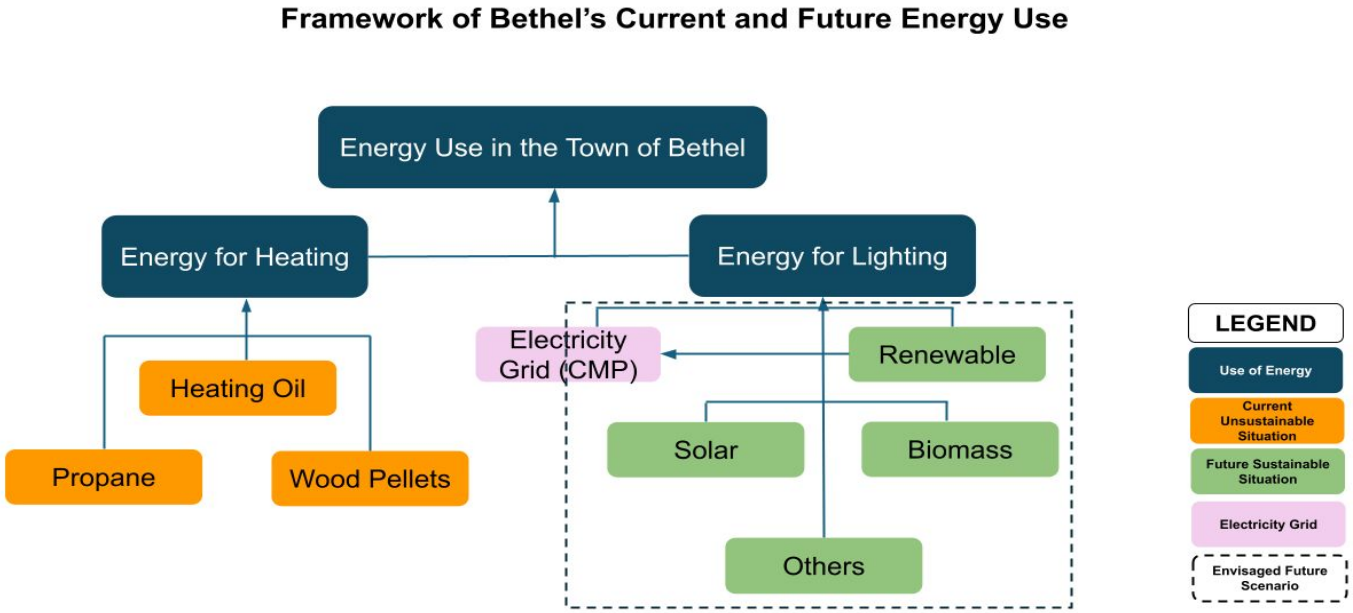


Fig. 1: Framework of Bethel's Energy Mix: Authors' Construct

- Bethel's participation in the CRP is a demonstrated effort to locally contribute to Maine's comprehensive clean energy goals:
  - 80% renewable electricity by 2030
  - 100% by 2050

Approach to the Study

- The study relied largely on data from the 2024 Energy Audit of the town's six major facilities, conducted by John Snell LLC as its baseline
- Sourced additional data from town-level, state-level and national energy agencies and macroeconomic indicators:
  - **Town of Bethel annual facilities budget and expenditure allocation**
  - Federal Reserve Bank (FRB)
  - U.S. Department of Energy (DOE)
  - U.S. Environmental Protection Agency (EPA)
  - U.S. National Institute of Standards and Technology (NIST)
  - Maine Governor's Energy Office (Maine-GEO)
  - Maine Governor's Office of Policy Innovation and the Future (Maine-GOPIF)
- Conducted cost-effectiveness analysis and cost-benefit analysis of Bethel's energy use

Municipal Energy Mix

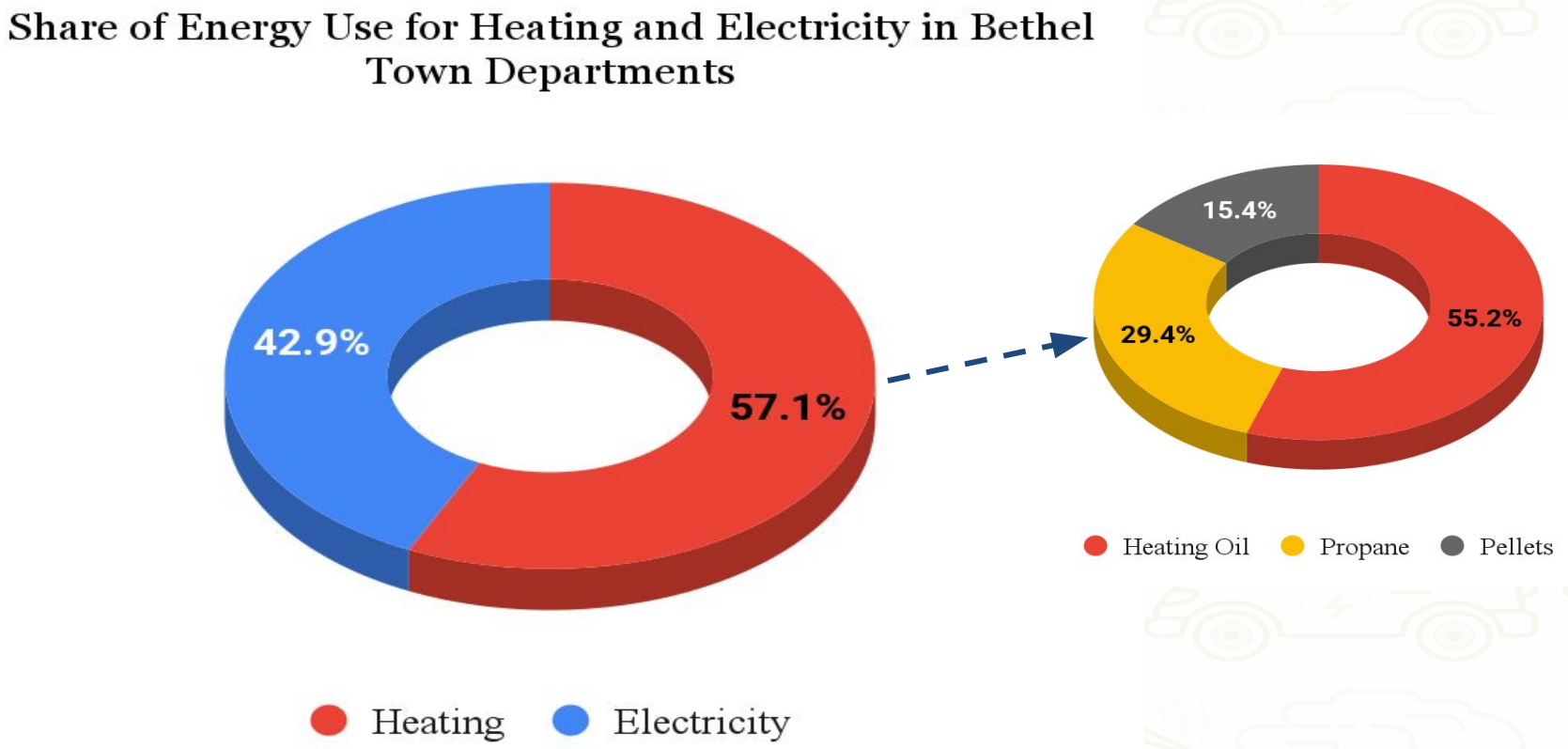


Fig. 2: Energy use for electricity and heating

Municipal Energy Mix (cont.)

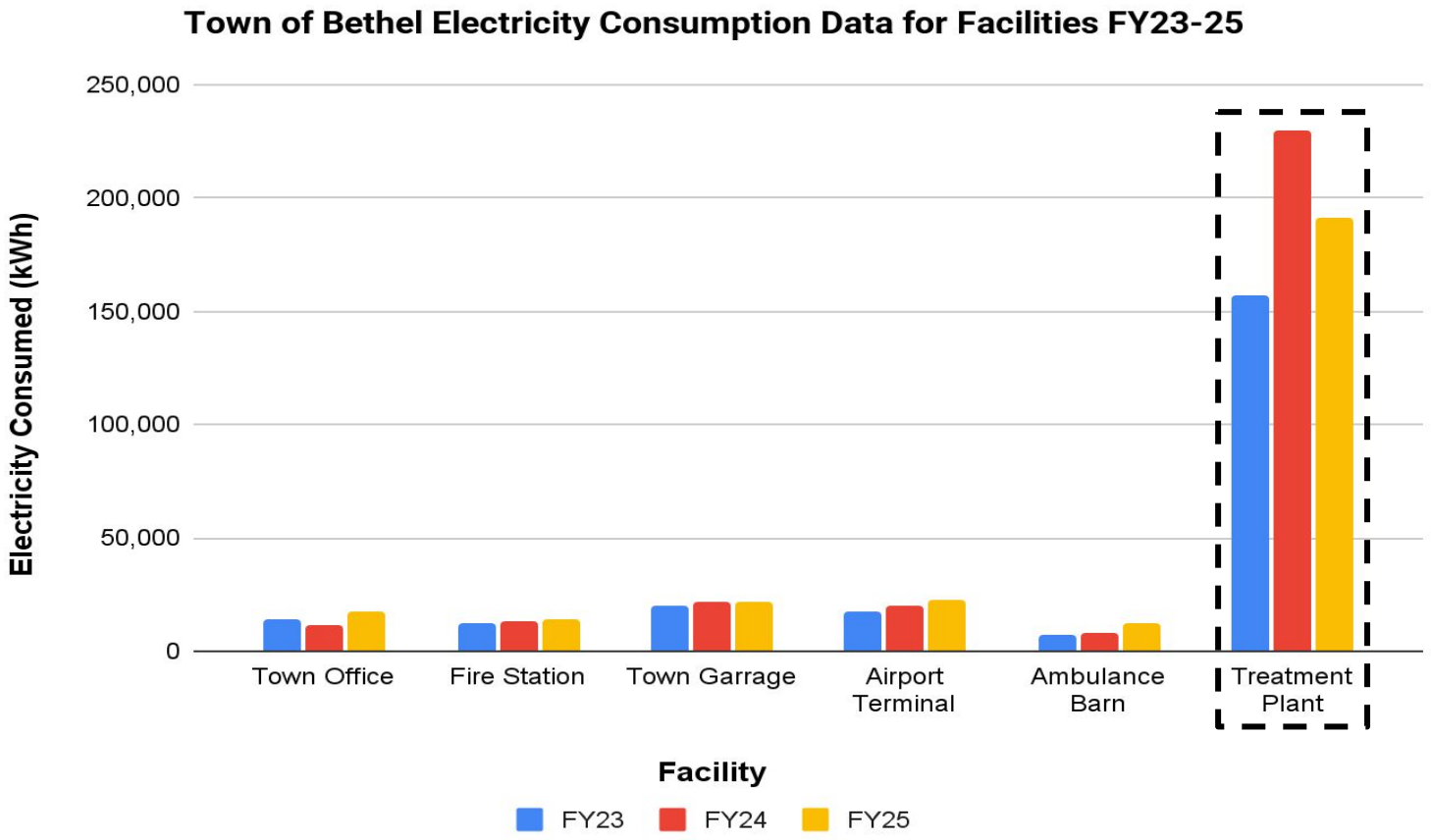


Fig. 3: Annual electricity use

Municipal Energy Mix (cont.)

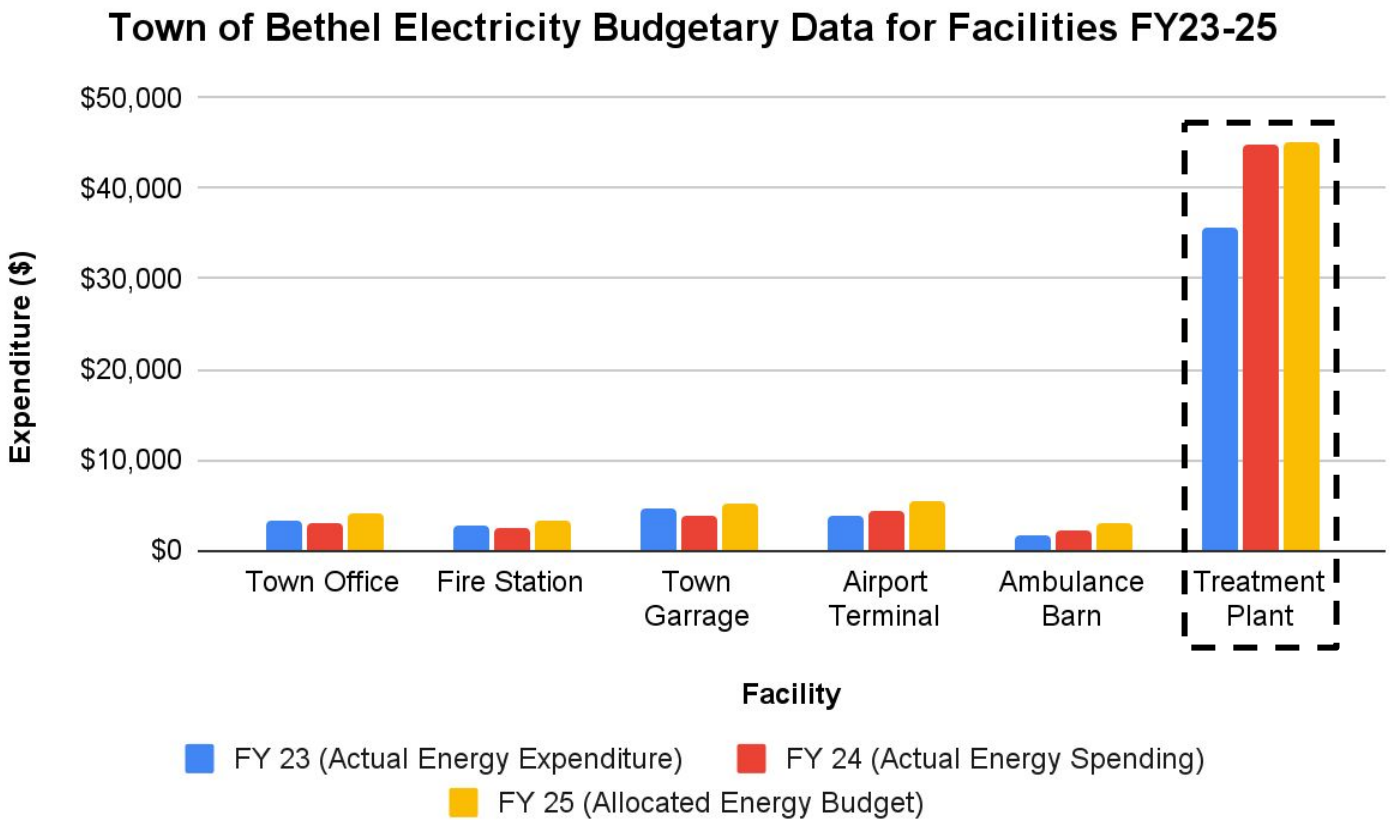


Fig. 4: Annual electricity expenditure

Municipal Energy Mix (cont.)

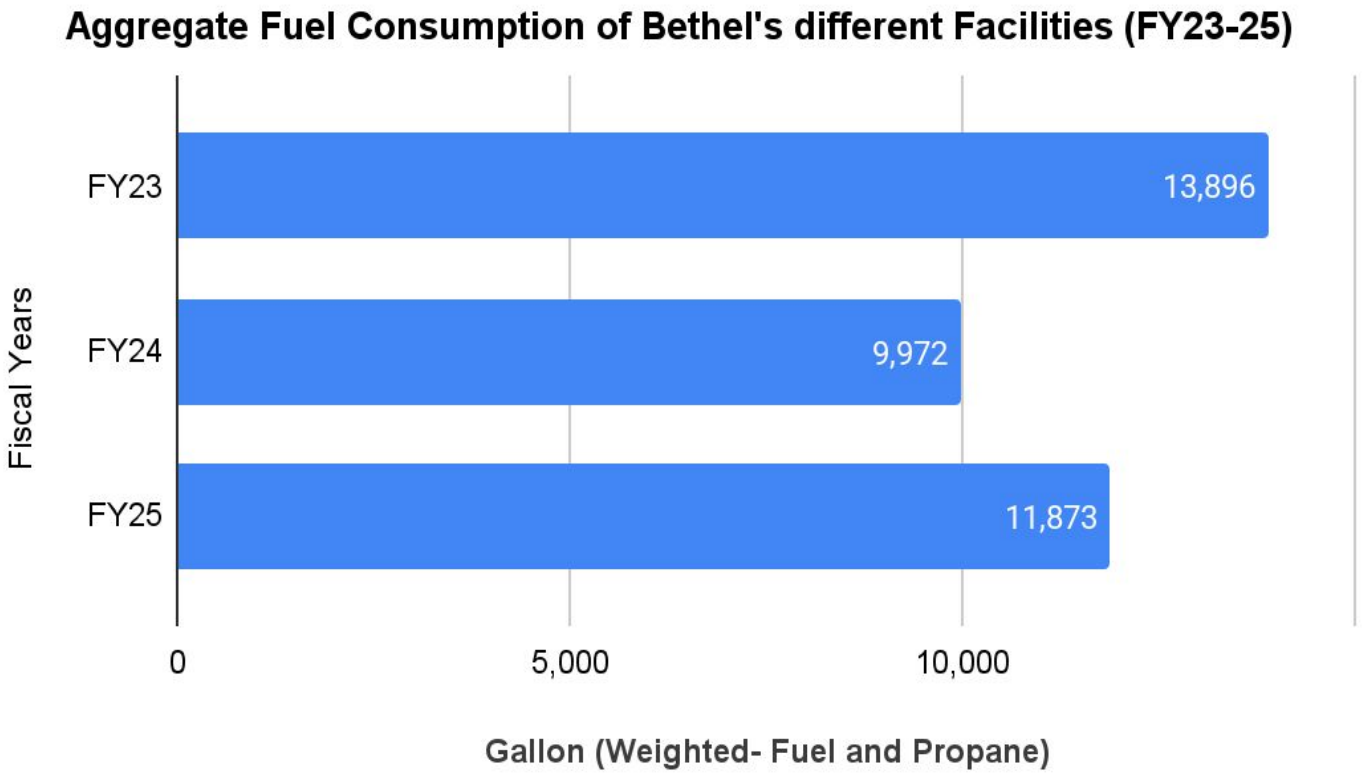


Fig. 5: Annual heating fuel use

Municipal Energy Mix (cont.)

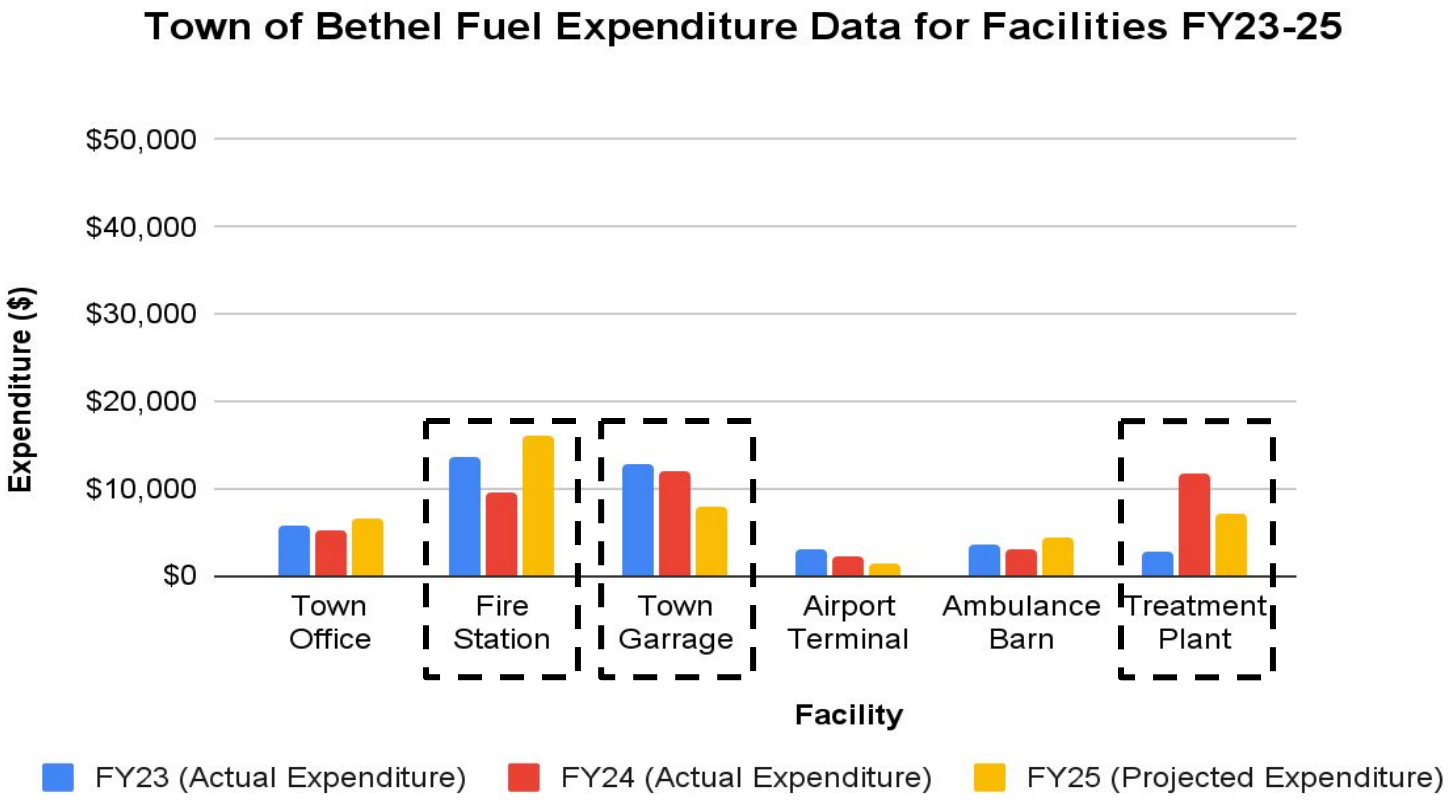


Fig. 6: Heating fuel expenditure

Municipal Energy Mix (cont.)

Electricity Price Trends

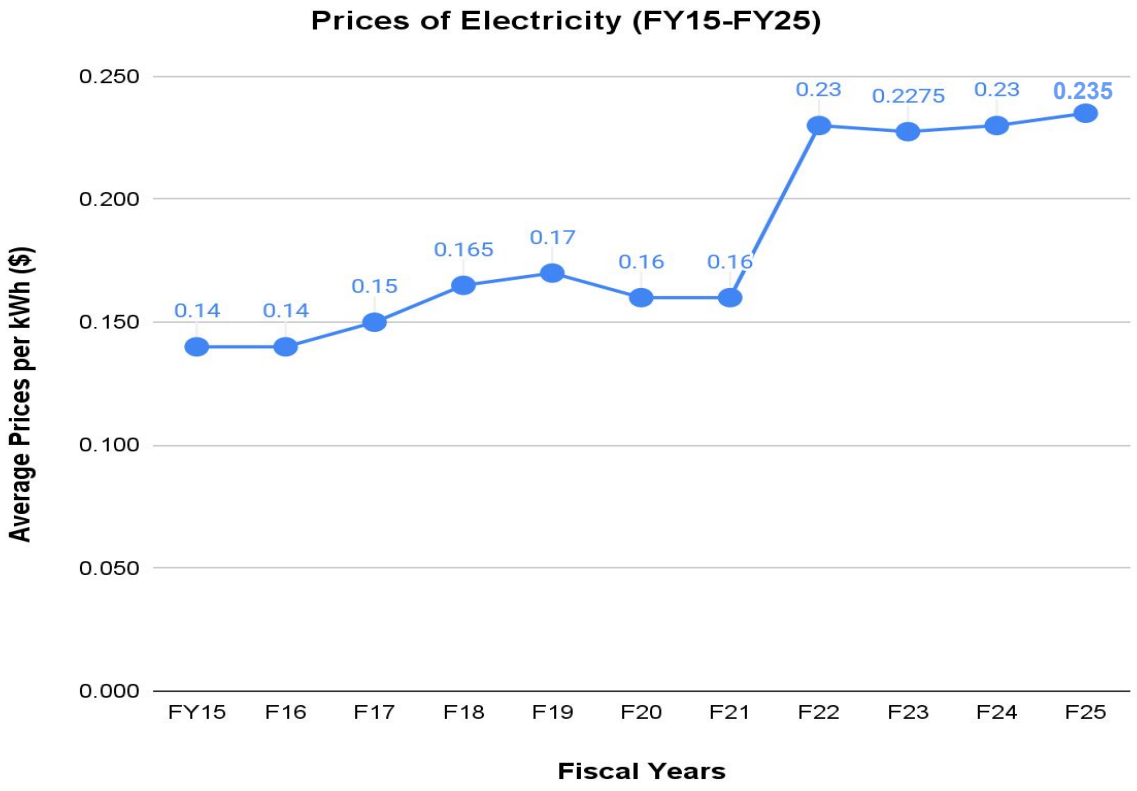


Fig. 7: Electricity prices across fiscal years

Municipal Energy Mix (cont.)

Fuel Price Trends

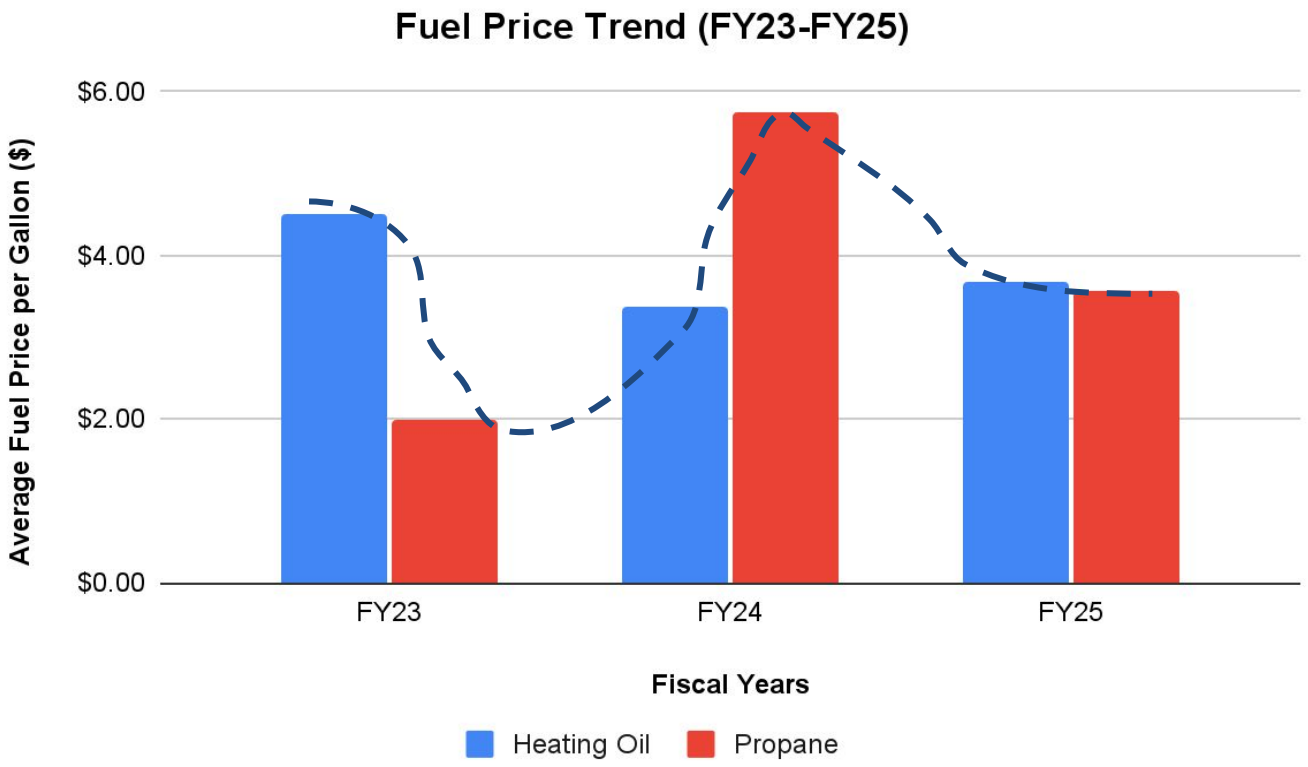


Fig. 8: Heating fuel prices across fiscal years

Shaping Bethel's Energy Future

Efficiency Analysis

Shaping Bethel's Energy Future (cont.)

Cost-Effectiveness of Current Energy Use

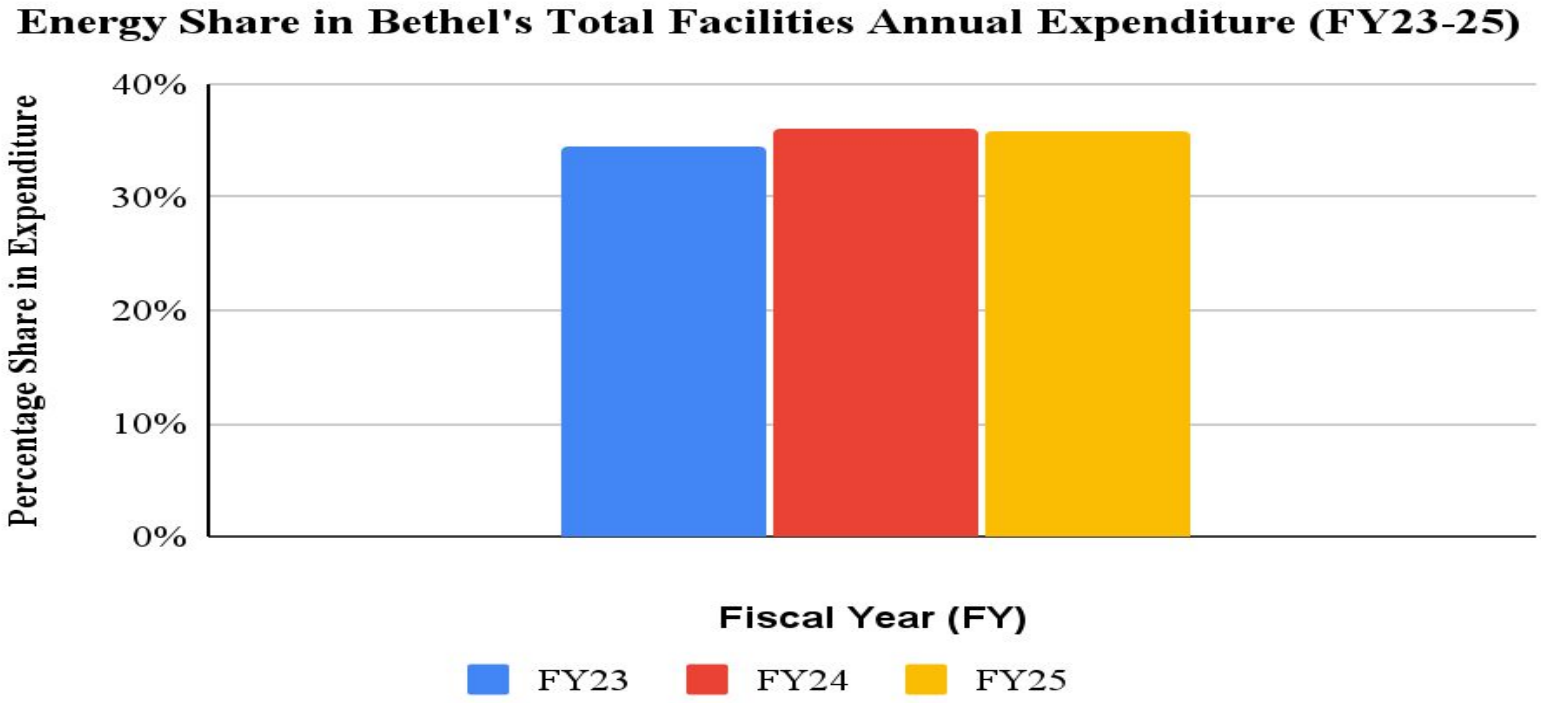


Fig. 9: Cost-effectiveness of energy expenditure in town facilities

Shaping Bethel's Energy Future (cont.)

Cost-Effectiveness of Current Energy Use (cont.)

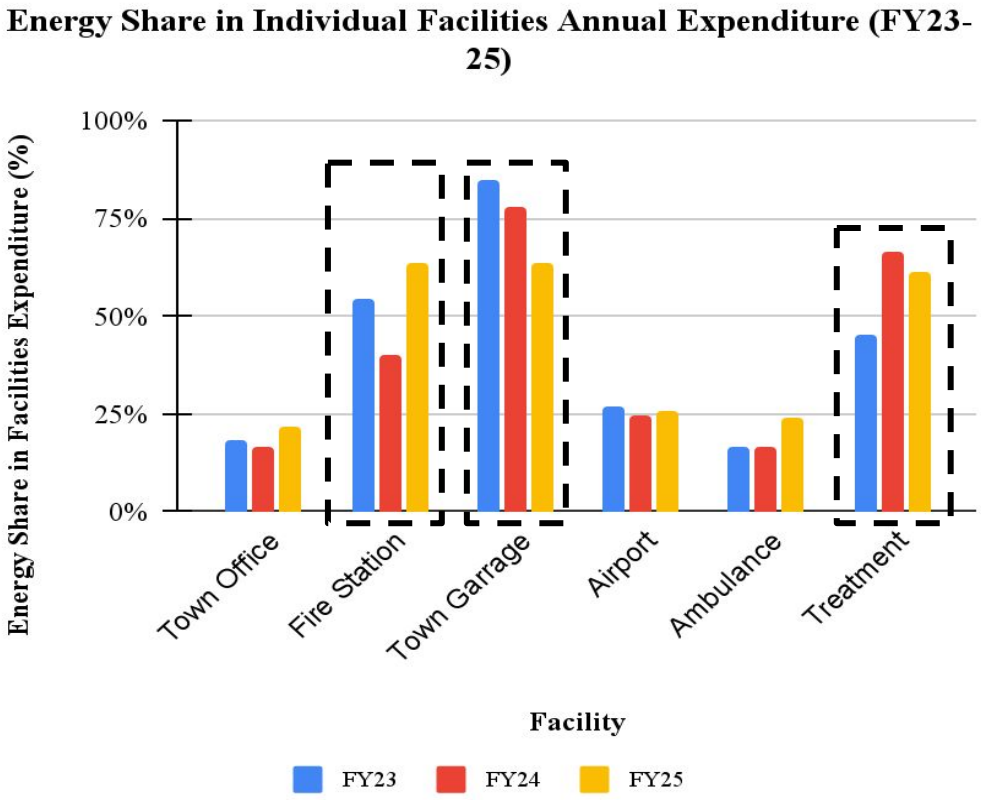
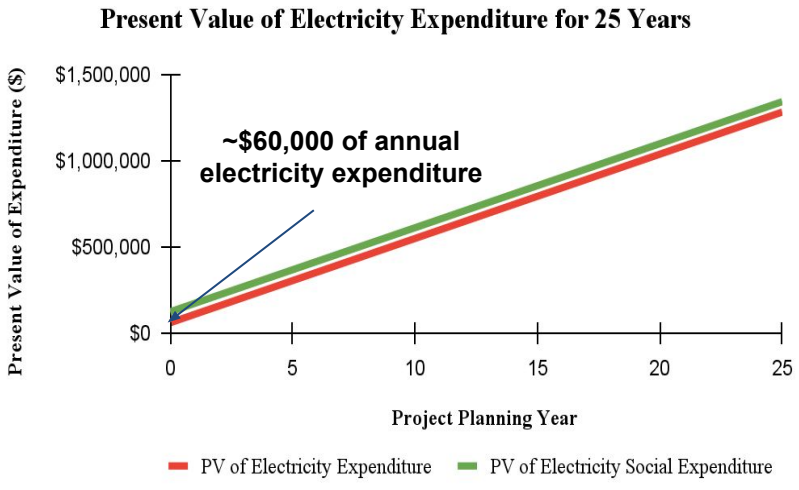


Fig. 10: Cost-effectiveness of energy expenditure in town facilities

Shaping Bethel's Energy Future (cont.)

Cost-Effectiveness of Current Energy Use (cont.)



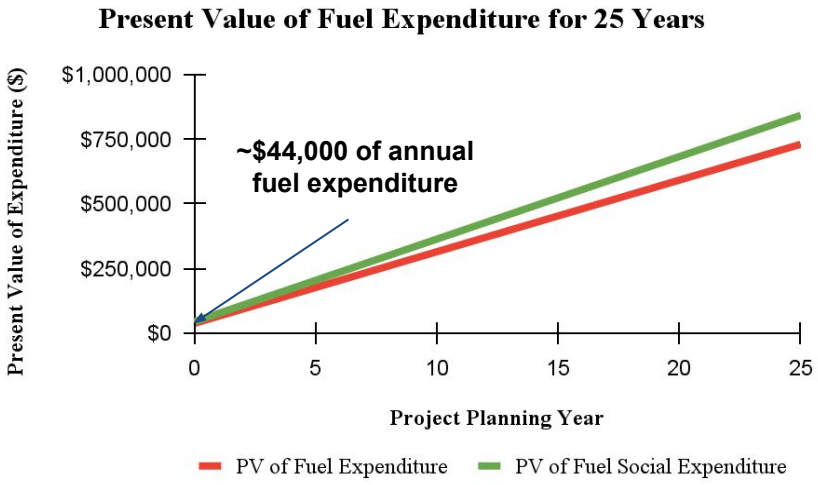


Fig. 11: Cost-effectiveness of energy use in town facilities

How much will this energy expenditure in the next 25 years be worth today?

Shaping Bethel's Energy Future (cont.)

Opportunities for Green and Sustainable Energy:

How feasible is solar PV installation in Bethel Town Facilities?

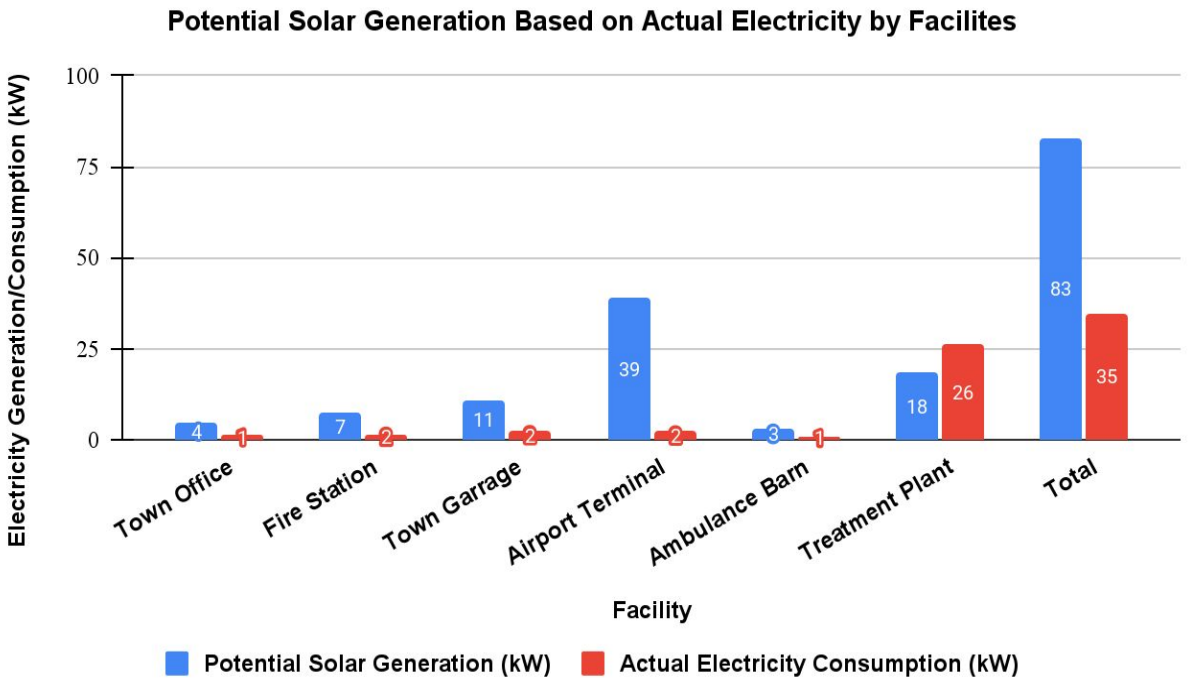
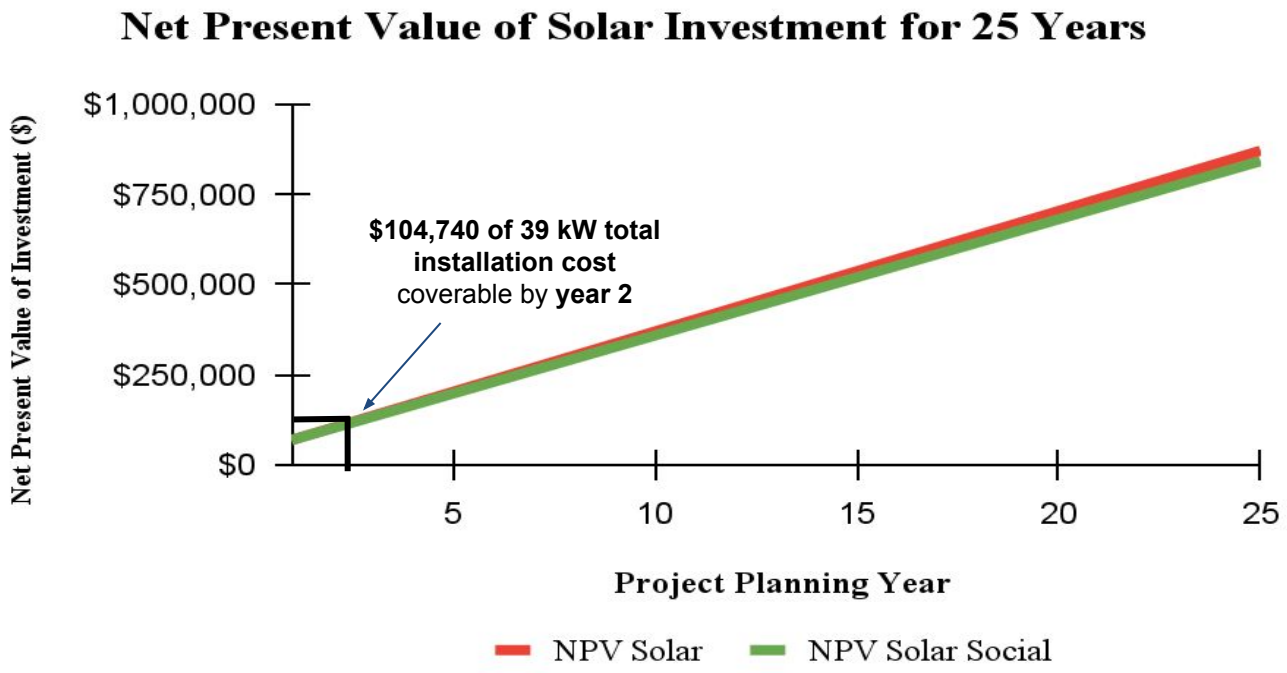


Fig. 12: Potential solar generation and actual electricity consumption capacity in town facilities

Shaping Bethel's Energy Future (cont.)

Opportunities for Green and Sustainable Energy:

How viable is solar as an alternative energy for Bethel Town Facilities?



How much will investment in solar energy for the next 25 years be worth today?

Fig. 13: Viability of potential solar use in town facilities

Shaping Bethel's Energy Future (cont.)

Opportunities for Transitioning to Green and Sustainable Energy:

How cost-effective is it to continue the status quo or switch to solar in a short-term (at least 5 years)?

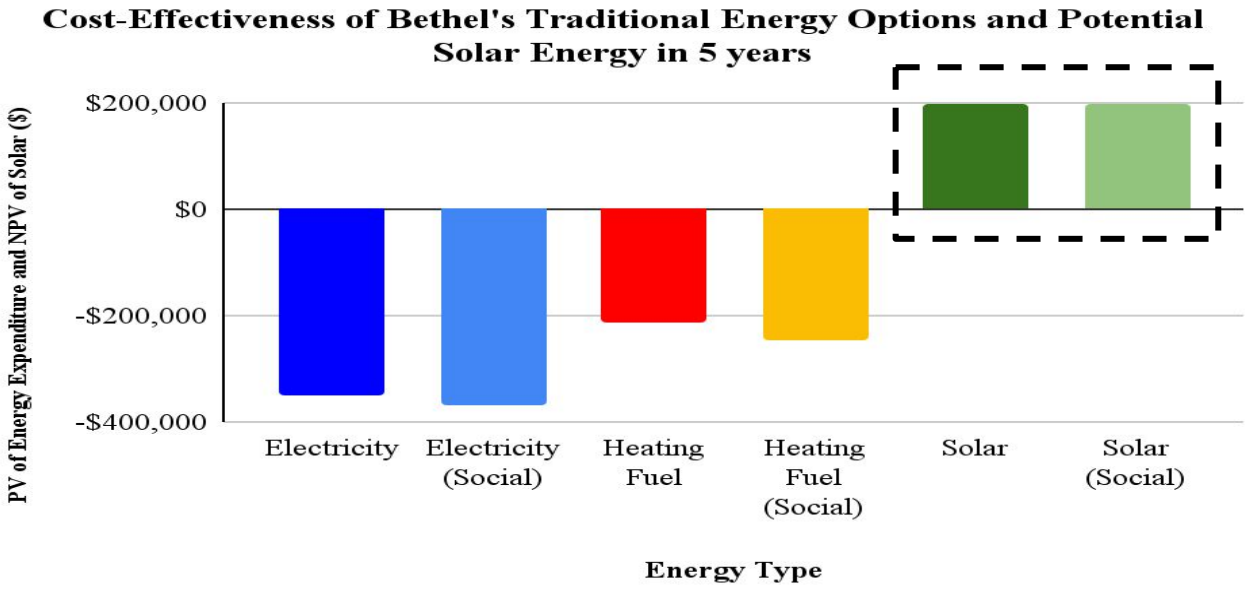
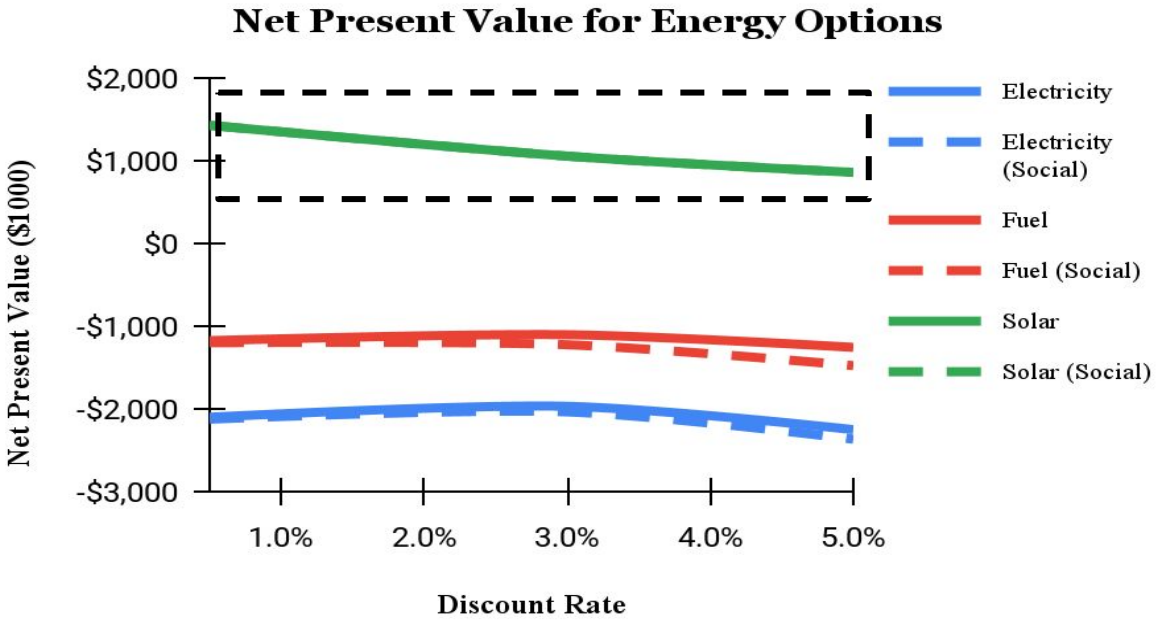


Fig. 14: Comparison between NPV of solar and present cost of traditional energy options

Shaping Bethel's Energy Future (cont.)

Opportunities for Transitioning to Green and Sustainable Energy:

Sensitivity Analysis of Potential Solar PV and Traditional Energy Options for the next 25 years



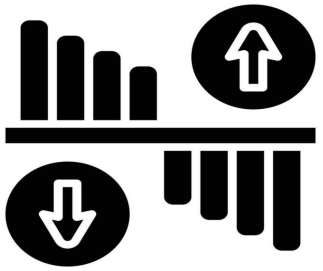


Fig. 15: Sensitivity of solar PV investment to energy market factors

Proposed Roadmap for Bethel's Energy Transition

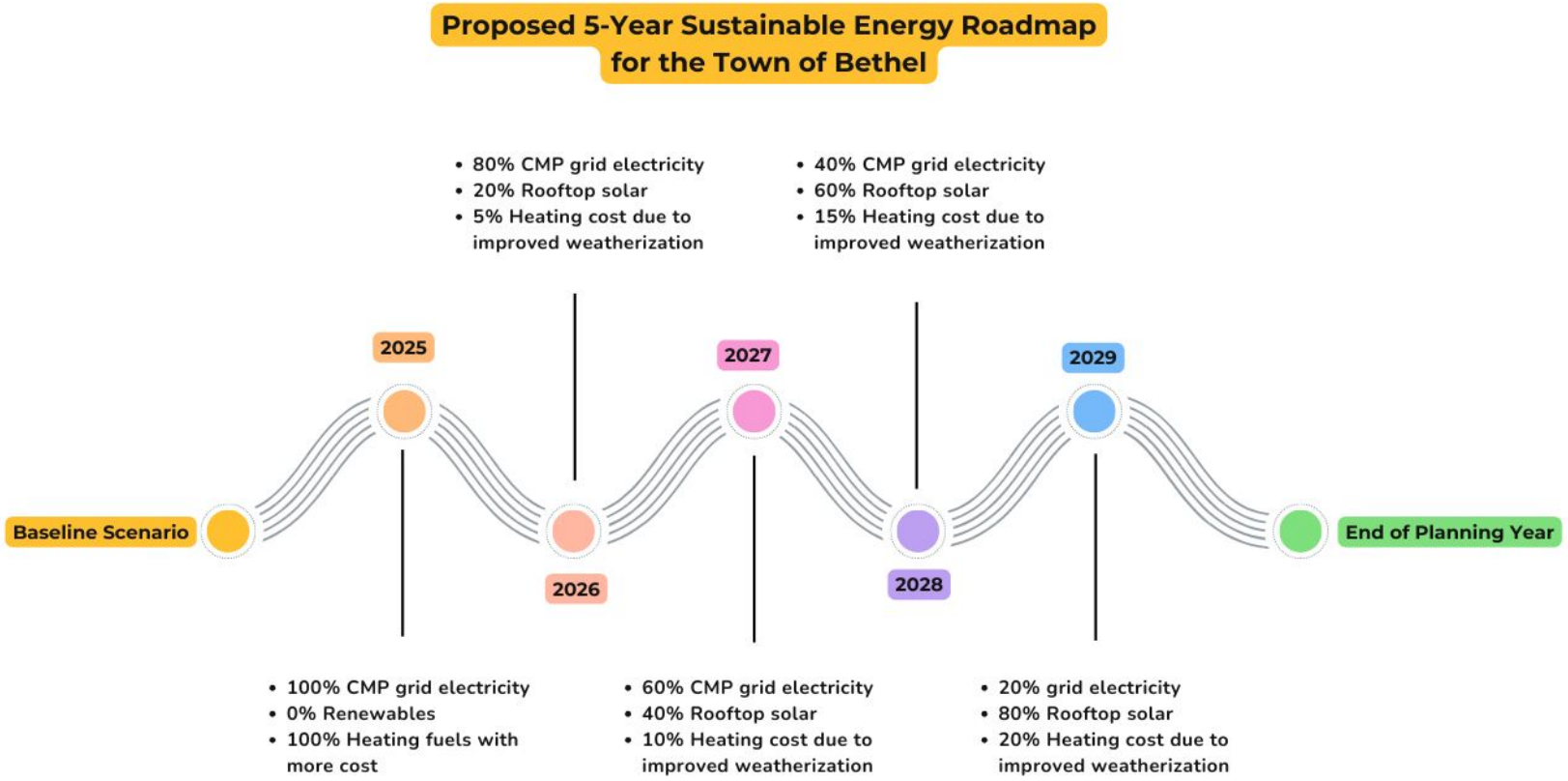
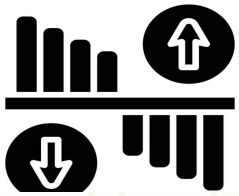


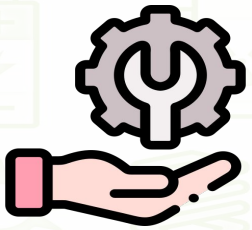
Fig. 16: Proposed energy transition roadmap for Bethel

Expected Challenges



Fuel market price volatility

Limited technical capacity



Uncertain future financing opportunities

Extreme winter weather conditions

Recommended Pathways to Sustainable Energy in Bethel

Pursue a gradual upgrade of facilities to solar

Leverage grants (e.g., CRP, DOE, GOPIF) and renewable tax credits to finance upgrade

Build internal capacity in renewable technologies and awareness on clean energy adoption

Enhance heating efficiency through weatherization and ensure use of efficient and energy-star appliances

Align town energy codes with state and federal energy policies and incentives

Your questions and feedback are warmly welcomed!

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