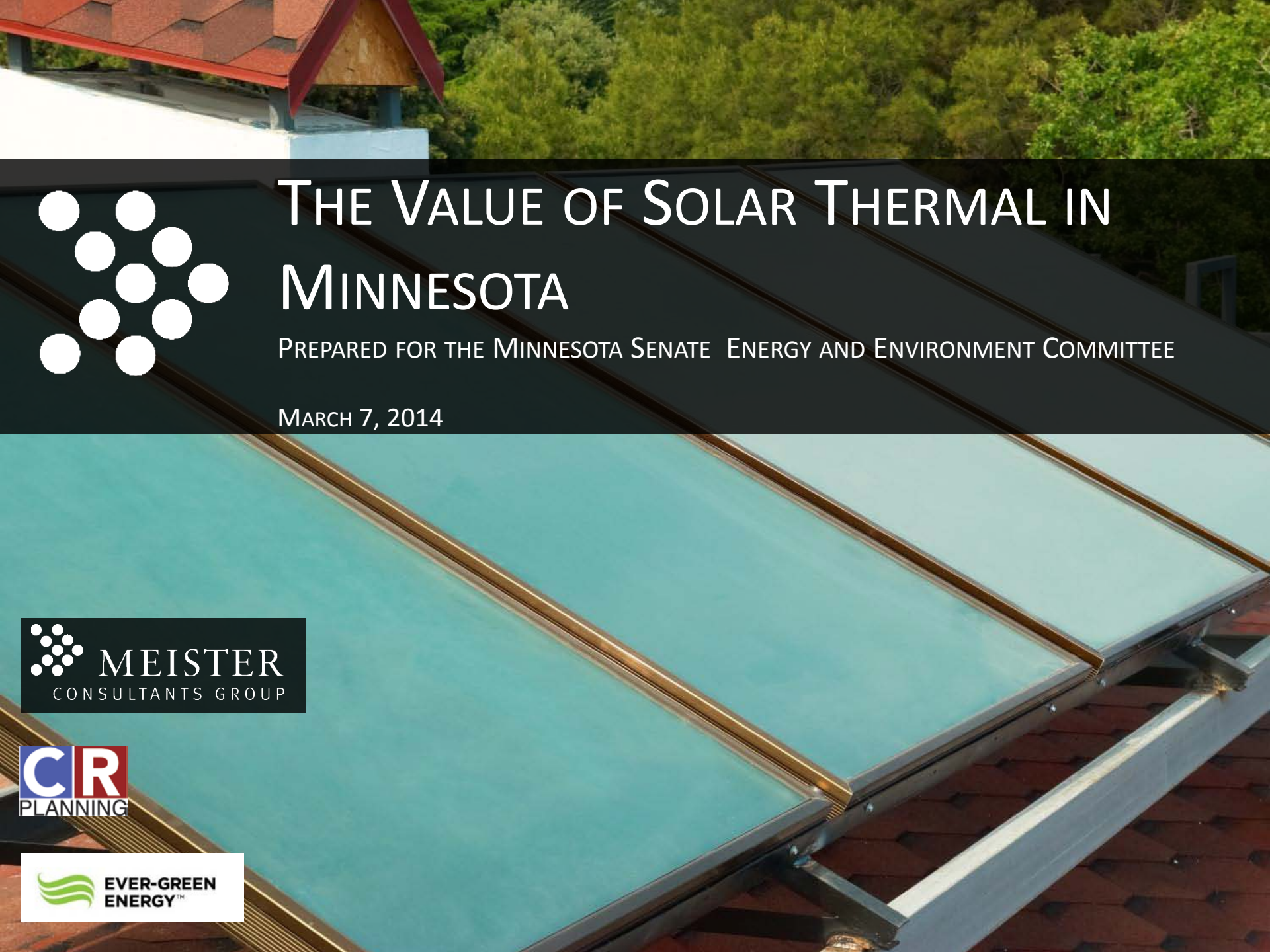


The Value of Solar Thermal in Minnesota

Prepared for the Minnesota Senate Energy and Environment Committee

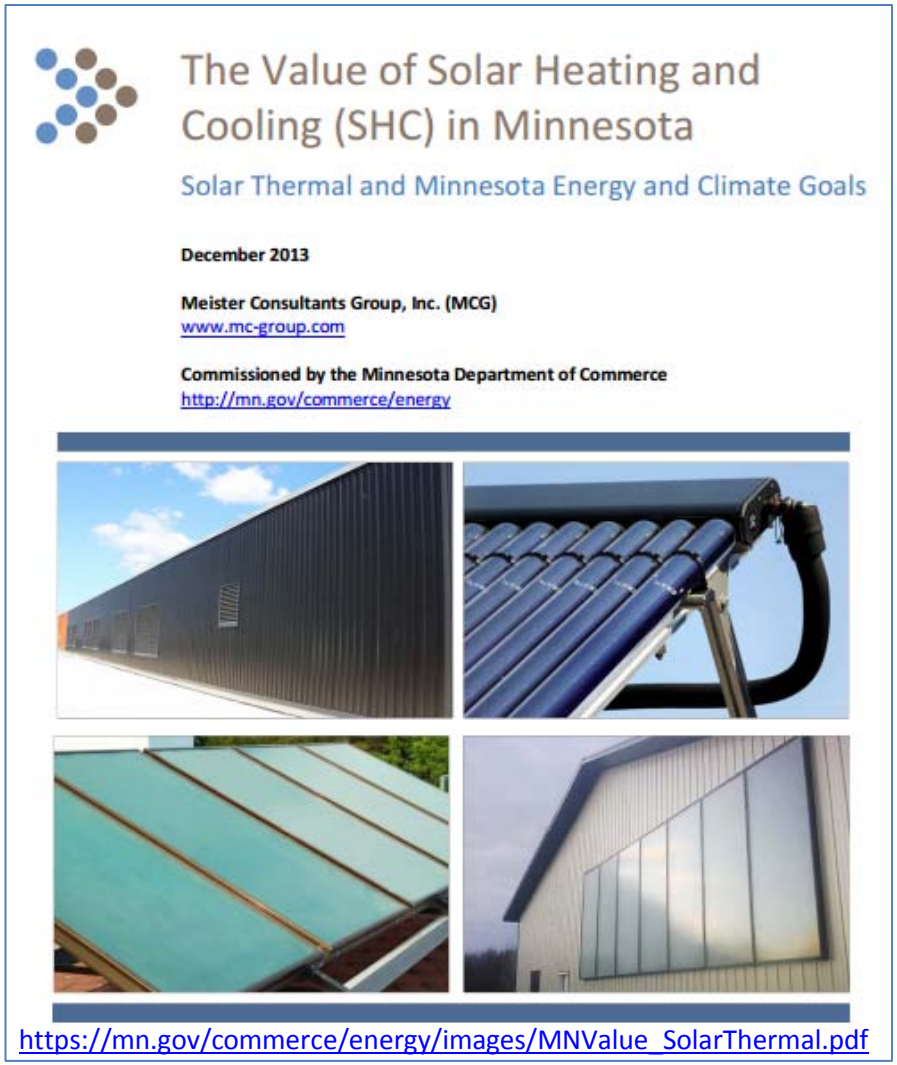
March 7, 2014

MEISTER CONSULTANTS GROUP

CR PLANNING

EVER-GREEN ENERGY™

The Value of Solar Heating and Cooling (SHC) in Minnesota

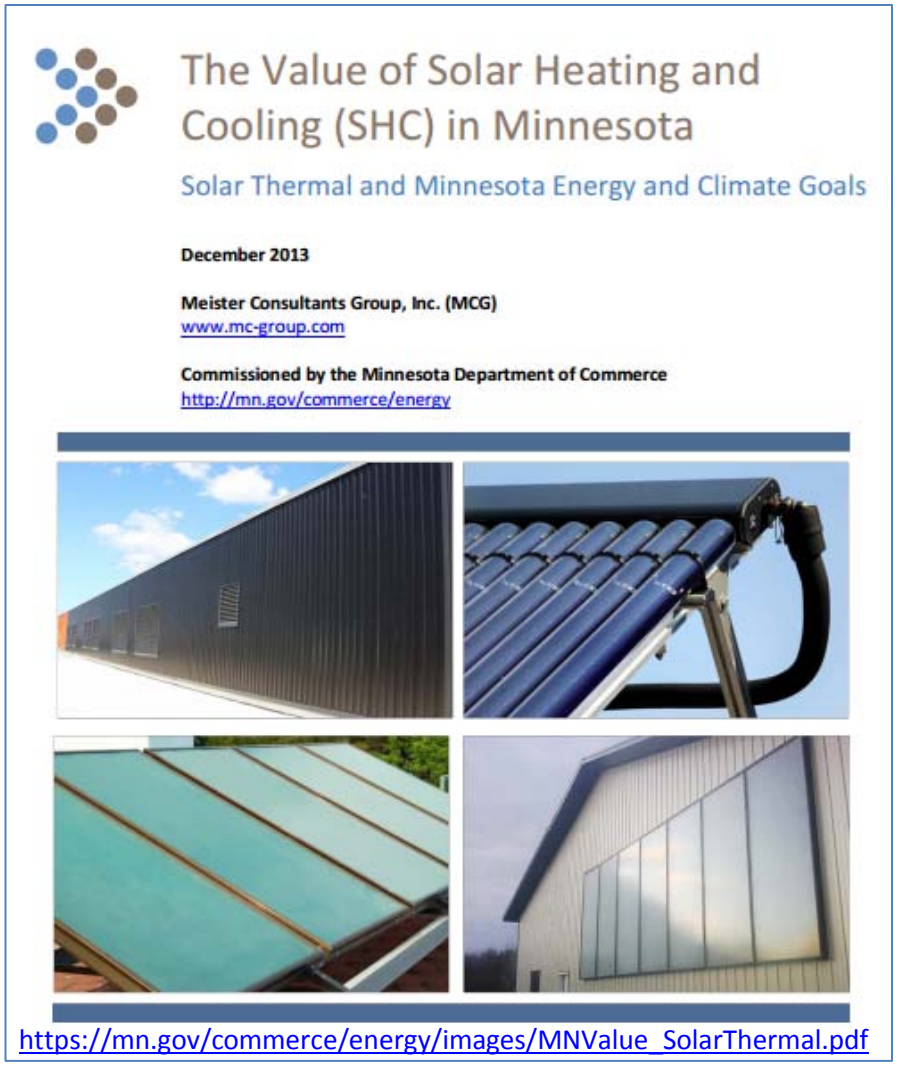


https://mn.gov/commerce/energy/images/MNValue_SolarThermal.pdf

Study Summary:

- Solar heating and cooling technologies
- Solar heating and cooling economics
- Market barriers
- Recommendations for market transformation

The Value of Solar Heating and Cooling (SHC) in Minnesota



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Solar heating and cooling is not solar electric!

- SHC technologies have distinct characteristics from PV technologies
- Integration with building systems is more complex
- SHC markets are still in their infancy – market transformation tools are significantly different than for solar PV

TECHNOLOGIES: SOLAR HOT WATER

Collectors capture heat from sun and transfer it to hot water storage tanks and building distribution system

Applications:

- Hot water and space heating
- Pool heating
- Process heating
- District energy

TECHNOLOGIES: SOLAR AIR HEAT

Provides heat by recirculating conditioned building air through solar collectors

Applications:

- Residential and commercial space heating

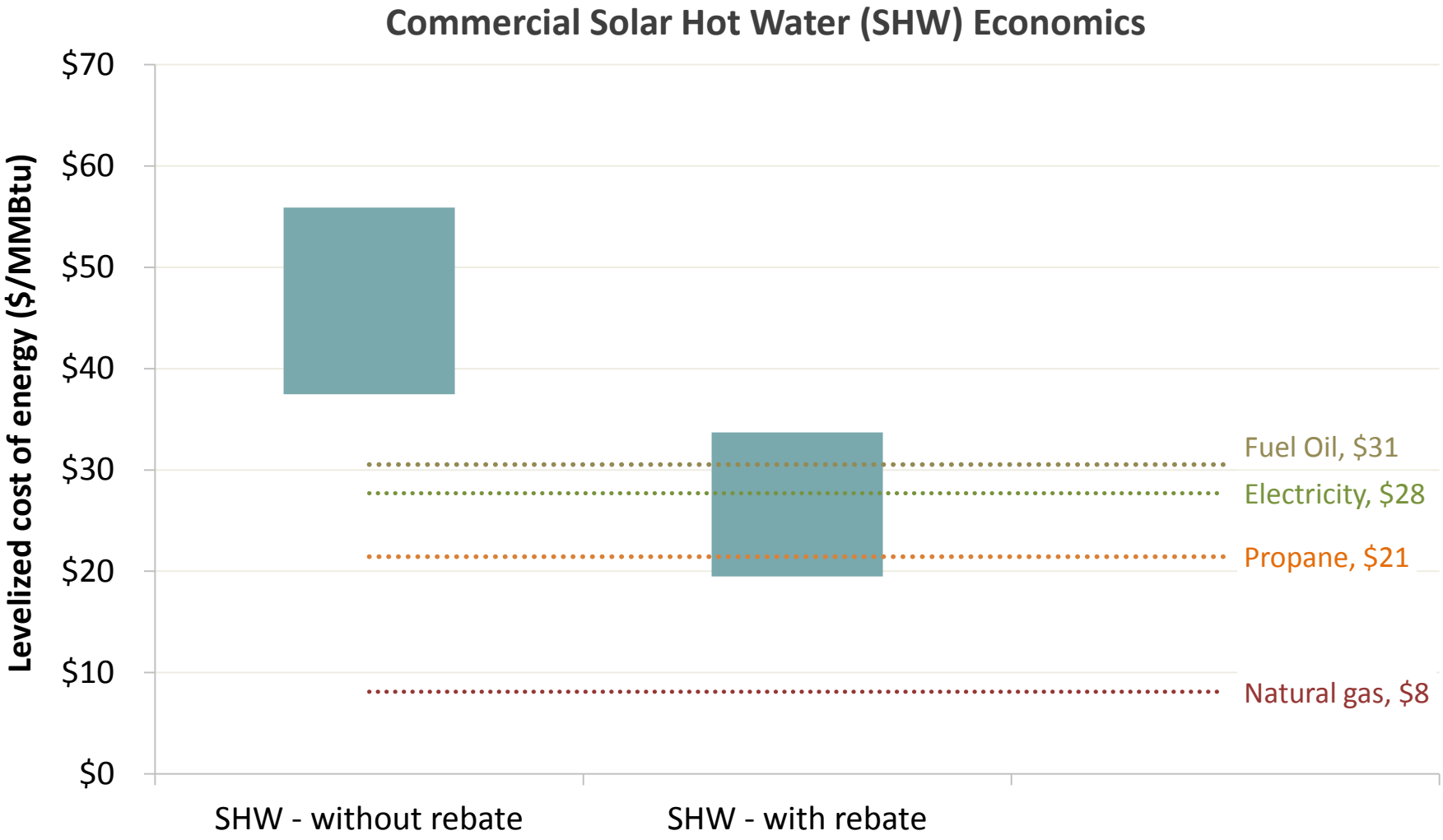
Technologies: Transpired Air Heating (Solar Walls)

Preheats incoming building air using solar radiation captured by solar walls (unglazed transpired collectors)

Applications:

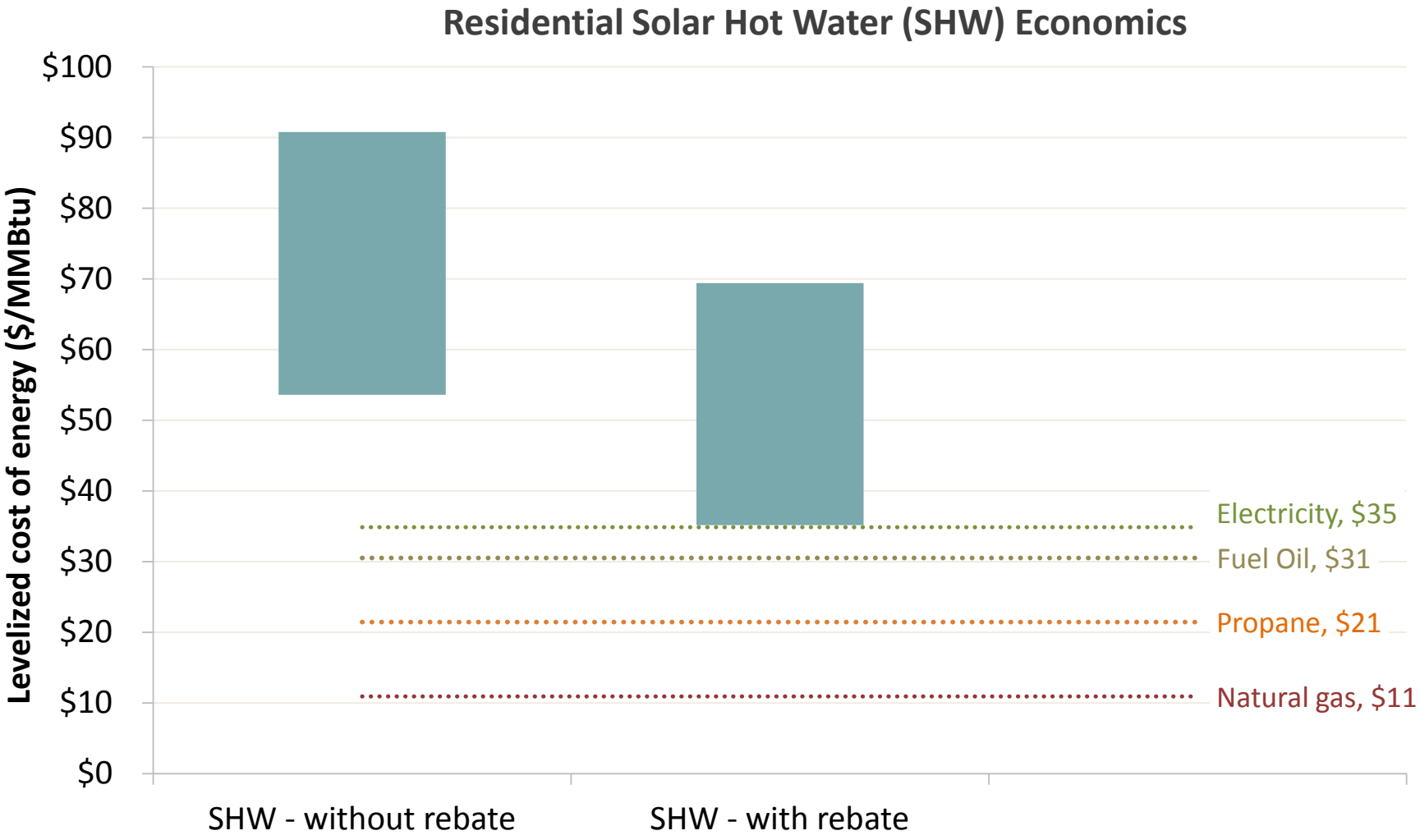
- Space heating / preheating for commercial and industrial buildings

LEVELIZED COST OF ENERGY: COMMERCIAL



Based on EIA, Minn. Dept. of Commerce, and industry data collected in 2013 or earlier

LEVELIZED COST OF ENERGY: RESIDENTIAL



Based on EIA, Minn. Dept. of Commerce, and industry data collected in 2013 or earlier

Near-Term Opportunities for SHC in Minnesota

Major near-term opportunities for SHC are in the following market sectors:

- **Commercial customers using expensive heating fuels**, such as electricity, propane, or fuel oil
- **Agricultural applications** where load characteristics coincide with solar resources and there is high dependence on propane
- **Low-income housing** where fossil fuel price volatility is problematic for owners and residents

SHC Market Barriers in Minnesota

Stakeholders identified a number of barriers that impact the Minnesota market:

- **High upfront costs and inadequate financing**
- **Poor market awareness of SHC benefits**
- **Certification standard costs**
- **Opaque permitting requirements**
- **Inadequate metering standards**
- **Workforce development challenges**

RECOMMENDATIONS FOR SHC IN MINNESOTA

Nine proposed recommendations:

1. **Create or expand incentives for high value SHC customer segments**
2. **Implement "Solar Ready" building requirements**
3. **Solar thermal requirements on new public buildings**
4. **New financing options to reduce upfront costs**
5. **Reduce SHC soft costs by**
   a) **Standardizing permitting processes**
   b) **Implementing a community aggregation purchase program**
6. **Create an online community-based outreach and information campaign**
7. **Create a SHC advisory group on certifications, standards, metering**
8. **Engage delivered fuel providers**
9. **Assess long-term potential in district and institutional heat/cool systems**

Get All the Details!

Webinar on the full report and findings:

- March 19, 1:00 PM
- Contact Stacy Miller to RSVP
- Details will also be on the CERTs website

Thank you! And now for our feature presentations . . .

Brian Ross
CR Planning, Inc.
bross@crplanning.com
612-588-4904