

Stakeholder Views

Government and Geothermal Association support will be the key to success



- Customer:
 - Subsidy keeps the customer financially whole through the system lifecycle
 - Eliminates carbon emissions while keeping energy costs affordable
- Builder / Developer:
 - More economical path to low / no carbon development
 - Presents opportunity to position their developments as the **green** alternative
- Geothermal and HVAC Contractors:
 - Faster market acceptance and adoption
 - Opportunity to expand business beyond what the Unregulated Model can provide (more geothermal installations for any given amount of GGRA funding)
 - Greater Ontario economic value compared to alternatives (more geothermal installations means more local content)

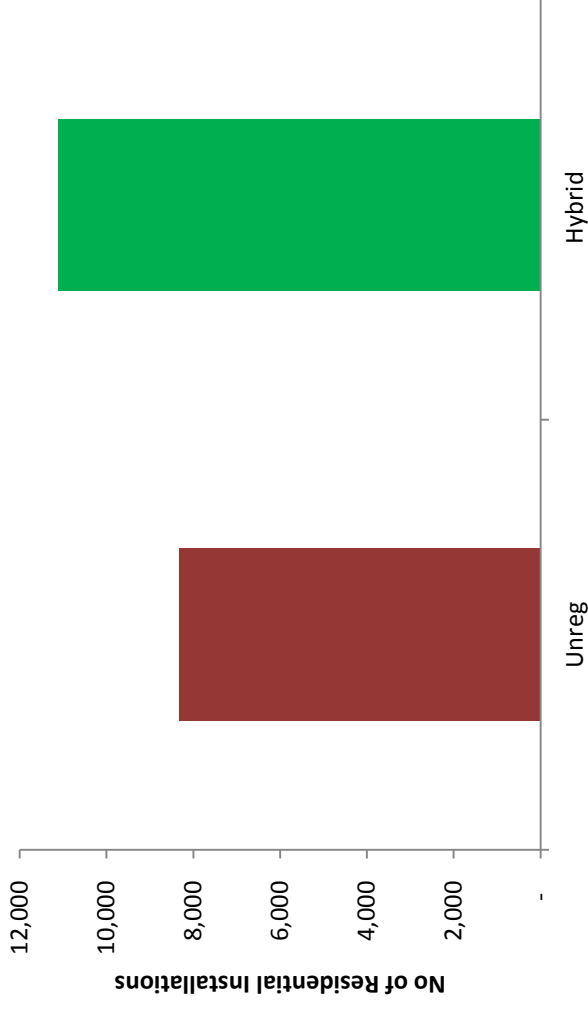
Government View

Significant multi-year GHG reductions through one time funding to new home owners



- Reduces incentive per customer
- Increases number of geothermal homes
- Built in electricity price hedge
- High GHG abatement at lower \$/Tonne
- Increased quality/standardization of a currently fragmented market
- Enbridge’s brand and credibility will significantly reduce risk to builders and customers
- Enbridge outsourcing model for installation and maintenance of geothermal systems enables competition in the market for these services

\$100 MM GIF Funding



Model Comparison & Factors for Success



| | Fully Unregulated Model | Hybrid Model | EGD Strengths | EGD Needs |
|--|-------------------------|---------------|---|---|
| Government subsidy to offset rate impact (\$/Customer) | 12,000 | 9,000 | Effective and efficient new construction delivery model | Government support to include geothermal activities in our OEB-regulated undertakings |
| Rented/Customer Owned Equipment (\$/Customer) | 9,000 | 4,500 | Patient low cost capital structure | Commitment that GGRA dollars will be made available for geothermal delivered through our proposed model |
| \$/Tonne of Carbon abated | 94 | 70 | Strong Brand and market reputation | Experience & partners in Geothermal industry (OGA support) |
| No of Customer with \$100 MM subsidy | 8,300 | 11,100 | Existing relationships with developers and builders | Support in convincing developers that Geothermal is an attractive option |

Next Steps



- Continue to define and develop partnership with Geothermal Industry
- Confirm assumptions and conduct market research
- Pilot project
- Seek Ministry Directive to Ontario Energy Board to allow us to include geothermal within regulated utility operations
 - Regulated cost base provides for oversight and regulated rates replace high upfront costs with regulated monthly payments over a long period of time
 - Leverages Enbridge's financial strength, customer base, marketing reach, supplier and industry relationships within a competitive procurement framework
 - Ability to offer lower and zero carbon solutions within regulation increases effectiveness of cap and trade funding and lowers carbon abatement costs



Appendix

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Analysis Summary

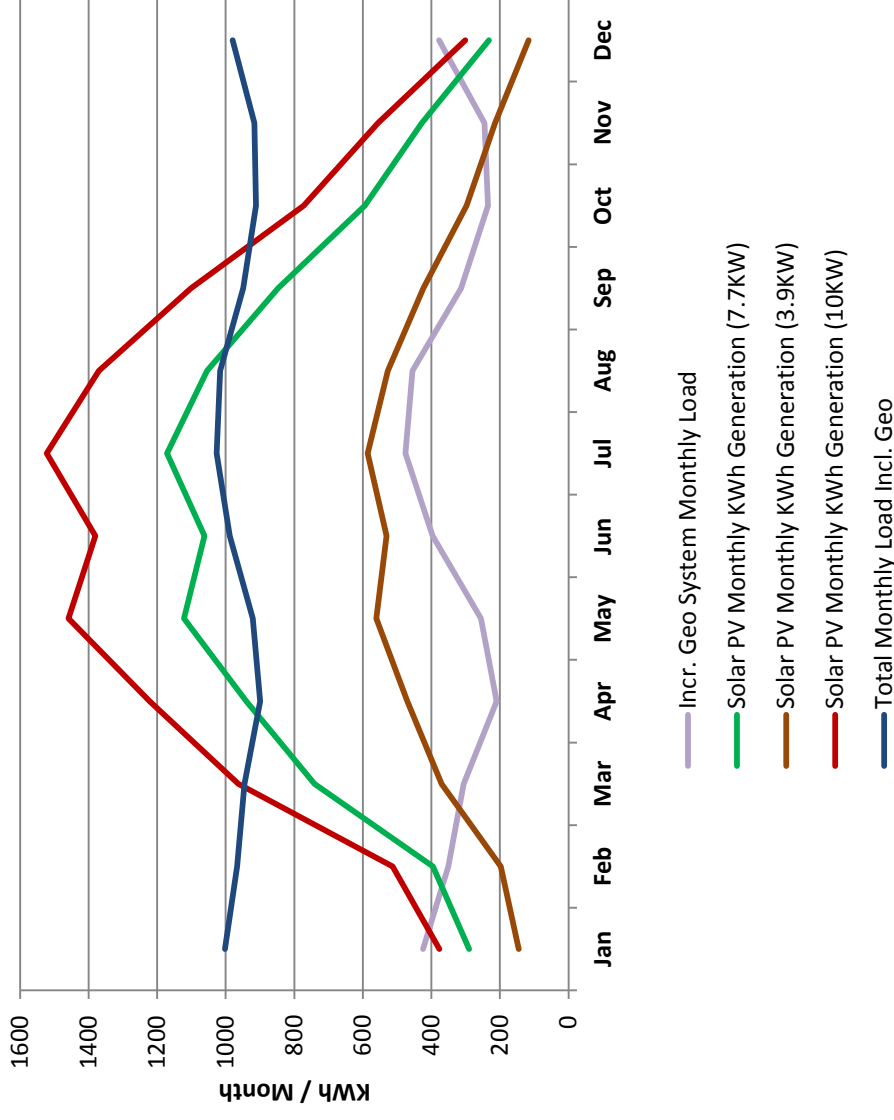


| | Unreg Model | Hybrid Model | NG Heating and AC |
|---|---------------|--------------|-------------------|
| Annual Heating/Cooling Cost | 4,089 | 3,748 | 2,698 |
| Capital Servicing | 3,089 | 2,748 | 1,641 |
| Electricity | 1,000 | 1,000 | 318 |
| Gas | - | - | 739 |
| Break even capital cost servicing with Gas | 1,698 | 1,698 | |
| CAPEX per customer (Year 1 - 20) | 21,000 | 21,000 | 11,750 |
| CAPEX per customer (Year 21 - 40) | 13,500 | 13,500 | 10,000 |
| Annual CO2 Emissions (Tonnes per year) | - | - | 3.21 |
| GGRA Funding per year | 1,391 | 1,050 | - |
| GGRA Capital Contribution | 12,000 | 9,000 | |
| \$/Tonne GHG (For 40 Years) | 94 | 70 | - |
| No of customers (\$100 MM GIF Funding) | 8,333 | 11,111 | - |
| Tonnes of CO2 abated per year | 26,727 | 35,636 | - |

Combination with Solar Offsetting incremental geo load



- Solar generation and geo system loads are not fully matched in winter
- Sizing Considerations
 - A solution is to oversize the solar system to meet peak
 - Or continue to use the grid as a battery
 - Three capacities considered: 3.9KW, 7.7 KW & 10KW
- 7.7kW solar system with battery:
 - Useful Life of System: 20 years
 - Cost: ~\$35,000
 - Annual Electricity Bill Savings: ~\$1,300
- Subsidy required for customer to break even in utility models:
 - Regulated = \$22,000-23,000
 - Unregulated = \$25,000-26,000
- This does not account for benefit of displaced electricity generation, transmission & distribution



Assumptions



| Inputs and calculations: | Unreg Model | Hybrid Model | Full Reg Model | NG Heating and AC | Notes |
|-----------------------------------|-------------|--------------|----------------|-------------------|--|
| Financial | | | | | |
| Regulated Equity Thickness | | 36% | 36% | 36% | |
| Unregulated Equity Thickness | 40% | 40% | 9.19% | 40% | |
| Regulated ROE | | 9.19% | 9.19% | 9.19% | |
| Unregulated ROE | 15.00% | 15.00% | 15.00% | 15.00% | |
| Capital Costs (\$) | | | | | |
| Loop | 7,500 | 7,500 | 7,500 | 7,500 | 3 Tonne vertical u-loop under each residence, average cost 2,500 per tonne |
| Heat Pump | 13,500 | 13,500 | 13,500 | 13,500 | Circulation pump \$1,000; 40 gallon tank \$1,500, Heat pump \$11,000 |
| Furnace | | | | 5,500 | Retail prices |
| Water Heater | | | | 1,500 | Retail prices |
| AC | | | | 3,000 | Retail prices |
| New service line | | | | 1,750 | New residential |
| Fuel Cost per unit (Cents) | | | | | |
| Cost of Natural gas per m3 | - | - | - | 43.34 | (includes 3.28 cents for Carbon Tax) |
| Cost of Electricity per KWH | 16.88 | 16.88 | 16.88 | 16.88 | 2017 forecast |
| Fuel Usage | | | | | |
| Natural Gas (m3) | - | - | - | 1,706 | New construction furnace and hot water based on new building code |
| Electricity (KWH) | 5,925 | 5,925 | 5,925 | 1,882 | From EGD Technical Group |
| Fuel Cost (\$) | 1,000 | 1,000 | 1,000 | 1,057 | |