Turning geothermal energy development into a scalable and repeatable manufacturing operation by eliminating the need for an aquifer

Robert Winsloe

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Eavor-Loop™: Scalable, Green & Baseload (TRL 7)

- Closed-Loop - Aquifer not required
- Thermosiphon (no parasitic pump load)
- No GHG / CO2 Release
- No water production
- Creates a heat exchanger with up to 100 km of wellbore
- Exploiting horizontal drilling revolution in North America
- Drilled with standard equipment
- Multilateral sections are completed without casing
Eavor-Lite™ Reference Site & Facility (→ TRL 7)

Started drilling on 2nd August – completed on 12th September (41 days)

Technical Objectives:
Primary
✓ Drilling and connection of an Eavor-Loop™
✓ Multilaterals & Junctions fully sealed during drilling
✓ No Casing in completion of laterals
• Demonstrate thermosiphon and heat transfer

Secondary
• Power production w/ addition of line heater & power unit
• Direct heat use w/addition of commercial greenhouse

Location:
• Near Rocky Mountain House / Eckville, AB.

Eavor-Lite (Cost Break-out)

<table>
<thead>
<tr>
<th>Item / Expense</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set-up</td>
<td>$225,000</td>
</tr>
<tr>
<td>Drilling - PD</td>
<td>$2,475,000</td>
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<tr>
<td>Drilling - Non PD</td>
<td>$3,500,000</td>
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<tr>
<td>Facility</td>
<td>$800,000</td>
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<tr>
<td>Pipeline</td>
<td>$600,000</td>
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<tr>
<td>Operations</td>
<td>$400,000</td>
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<tr>
<td>Contingency</td>
<td>$2,000,000</td>
</tr>
<tr>
<td><strong>Total Eavor-Lite CAPEX</strong></td>
<td><strong>$10,000,000</strong></td>
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Phase 1 – Project objectives (near city in Germany) → TRL 8

• Small Scale CHP:
  • 1 MWe installed power
  • 14 MWth
• Fully integrated with existing heat and electrical distribution infrastructure
• Scope would include utilization of existing well pad to drill two new vertical wells
• Target either sandstone or dolomite zone

We are seeking financial support for Phase 1 only
Phase 2 → TRL9

• Scale Up: Phased approach to add 3 more Eavor-Loops for electrical output of 5 MWe
  • Utilize common surface location to minimize surface infrastructure requirements
• Target either sandstone or dolomite zone
Phase 3

- Rapid Expansion: Scaled approach to add 14 more Eavor-Loops for electrical output of 50 MWe
  - 12 x 5 km lateral loops each
- Daisy chain design possible, not limited to proposed surface location
- Stacked design to exploit dolomite and granite basement zones of interest
Project Overview (TRL 7 → TRL 8 → TRL 9)

Key challenges
• We require financial support for Phase 1
• Reducing the cost of the drilling operation
• Improving the regulatory approval process

Sources:
Lazard LCOE report - version 11, Nov 2017
Canadian energy operators, corporate presentations
Potential impact in Germany (multiplied across the EU)

- Potential direct employment
- GHG reductions
- # Drilling Rigs Operating Simultaneously
- Generating capacity (MWth)
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10 million in 10

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Energy for Eavor™