The Advanced Energy Centre’s Mission is to

**Foster** the adoption of innovative energy technologies in Ontario and Canada

**Leverage** those successes and experiences into international energy markets
Help utilities understand the pace of change in the energy sector, and inform intentional decisions to capture value and opportunities in a changing energy landscape.
Help utilities understand the pace of change in the energy sector, and **inform intentional decisions** to capture value and opportunities in a changing energy landscape.
THE FUTURE OF MICROGRIDS IN ONTARIO
Customer Profile

- 18,000 kWh, large residential home (equivalent to a 90-95th percentile customer)

Microgrid Use Case

- Solar used to offset electricity consumption, and for net metering
- Battery used for TOU arbitrage
  - Battery capacity bid into DR auctions and OR market
- Battery, controller, and switchgear provide run-through resiliency
RESIDENTIAL – COST-BENEFIT RESULTS

Based on a desired payback of 8 years, residential microgrids are not expected to be economic in the near term, but will become economic in the long term.

- Residential microgrids may be cost effective if other non-economic factors are taken into account - the value gap to make microgrids economic today is $1,900 per year.

The value gap may be filled by other economic and non-economic benefits:
- Reliability (willingness to pay)
- Utility or grid services
- Virtual Power Plants (VPP)
- EV integration
- Technology attractiveness

$ per year – Costs and Benefits

Value gap $1,900 per year

Value gap $300 per year

Net Benefit $400 per year

Today

2025

2035

1,460 1,810 2,130

320 370 430

Energy Ancillary Arbitrage

1,000 1,500 2,000 2,500 3,000 3,500 4,000 4,500

Today 2025 2035
COMMUNITY - PROFILE AND USE CASE

Customer Profile
• 12 MW distribution feeder load serving a mix of residential apartments and office space

Microgrid Use Case
• Solar used for off-setting electricity consumption, peak reduction, and battery charging
• Battery used primarily to reduce local distribution peak
  - Used to bid into OR market and DR auction, and
  - Battery, controller, and switchgear provide run-through resiliency (key emergency and disaster resiliency)
• Demand Response (DR) loads are also used to reduce the local distribution peak
COMMUNITY – COST-BENEFIT RESULTS

Based on a desired payback of 10 years, the economics of community microgrids may not be positive today but are strong in the near and long term:

- The value gap needed to make community microgrids economic today is **$0.2 million per year** – high value T&D upgrade deferrals and reliability benefits can close the value gap.

### T&D Marginal Costs

High value T&D deferrals may be sufficient to justify microgrid deployment today (higher than $600/kW).

### $M per year – Costs and Benefits

- **Today**:
  - Value gap = $0.2M per year
  - Net Benefit = $1.2M per year

- **2025**:
  - Net Benefit = $1.9M per year

- **2035**:
  - Net Benefit = $1.9M per year

Source: PG&E/EPRI
EDA’s LDC of the Future Survey

• The overwhelming majority of LDC execs say that their LDC is ‘extremely well prepared to meet the challenges and opportunities of the future.’

• Most LDCs agree that innovation is their driving principle and that the ‘LDCs of the future’ will need to be high-tech and innovative.

• LDCs view several emerging technologies as being potentially transformational for the electricity distribution industry.

• With off-grid energy generation already in the crosshairs, LDCs also had strong opinions about different revenue models to turn to if customers choose to go off-grid.
LDCs are ready to embrace micro grids

Unprompted, half of LDCs cited energy storage systems/batteries as a new and emerging technology that would be transformative for distributors. Nearly as many mention micro grids and other off-grid energy generation. Electric vehicles and the infrastructure for them round out the top three.

Source: EDA’s LDC of the Future Survey, 2016
LDCs would prefer to keep micro grid initiatives within the utility

<table>
<thead>
<tr>
<th>Initiative</th>
<th>Percentage of LDCs</th>
<th>Percentage of Other Utilities</th>
<th>Percentage of Don't Know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ownership of Transformer Stations</td>
<td>92%</td>
<td>5%</td>
<td>3%</td>
</tr>
<tr>
<td>Smart Grid initiatives</td>
<td>87%</td>
<td>13%</td>
<td>2%</td>
</tr>
<tr>
<td>Load Management (Demand Management)</td>
<td>80%</td>
<td>18%</td>
<td>2%</td>
</tr>
<tr>
<td><strong>Micro Grid initiatives</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transmission ownership of greater than 50 kilovolts</td>
<td>77%</td>
<td>21%</td>
<td>4%</td>
</tr>
<tr>
<td>GIS (Geographical Information System) Services</td>
<td>75%</td>
<td>21%</td>
<td>4%</td>
</tr>
<tr>
<td>Financing (On Bill Financing)</td>
<td>71%</td>
<td>29%</td>
<td>3%</td>
</tr>
<tr>
<td>Electric vehicle charging infrastructure</td>
<td>61%</td>
<td>36%</td>
<td>2%</td>
</tr>
<tr>
<td>Energy storage</td>
<td>61%</td>
<td>37%</td>
<td>2%</td>
</tr>
<tr>
<td>Energy audits</td>
<td>56%</td>
<td>42%</td>
<td>3%</td>
</tr>
<tr>
<td>Streetlighting services</td>
<td>45%</td>
<td>52%</td>
<td>2%</td>
</tr>
<tr>
<td>Cloud computing</td>
<td>38%</td>
<td>63%</td>
<td>2%</td>
</tr>
<tr>
<td>Other behind the meter services</td>
<td>36%</td>
<td>57%</td>
<td>7%</td>
</tr>
<tr>
<td>Owning renewable generation</td>
<td>31%</td>
<td>65%</td>
<td>4%</td>
</tr>
<tr>
<td>Water system management or ownership</td>
<td>24%</td>
<td>73%</td>
<td>3%</td>
</tr>
<tr>
<td>Owning non-renewable generation</td>
<td>23%</td>
<td>71%</td>
<td>6%</td>
</tr>
<tr>
<td>District heating</td>
<td>22%</td>
<td>75%</td>
<td>3%</td>
</tr>
<tr>
<td>Waste water system management or ownership</td>
<td>19%</td>
<td>78%</td>
<td>4%</td>
</tr>
<tr>
<td>Water heater rentals</td>
<td>18%</td>
<td>82%</td>
<td>4%</td>
</tr>
<tr>
<td>Geothermal solutions</td>
<td>18%</td>
<td>79%</td>
<td>3%</td>
</tr>
<tr>
<td>Telecommunications</td>
<td>17%</td>
<td>83%</td>
<td>3%</td>
</tr>
<tr>
<td>Fibre optics</td>
<td>12%</td>
<td>89%</td>
<td>3%</td>
</tr>
</tbody>
</table>

Source: EDA’s LDC of the Future Survey, 2016