Analyzing Risk & Benefits of Resiliency Projects

Embarcadero-Potrero 230 KV Transmission Project

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PG&E Company Overview

Company Facts

• Over 21,000 employees
• 70,000 square-mile service territory
• $15.6 billion in revenues
• Peak electricity demand: ~20,000 MW
• Over 15 million people served
  – 5.2 million electric customers
  – 4.4 million gas customers
• Over 50% of PG&E’s electric supply comes from non-greenhouse gas emitting facilities
Area at Risk: Downtown San Francisco

SF Downtown
• Financial District
• Union Square
• The Embarcadero
• North Beach
• Chinatown
• Nob Hill
• Telegraph Hill
• South of Market

Customers
• 5K commercial
• 25K residential
Risk of Outage

- Existing lines located within 10 miles of 2 major faults
- San Francisco 1906 earthquake magnitude 7.8
- 90% - Probability of both cables failing in magnitude 7.8 quake
- 40% - Probability of both cables failing from earthquake within 50 years
Value of Service Methodology

Methodology:
1. Estimate outage costs (direct + indirect)
2. Estimate probability of outage
3. Expected project benefits = Outage probability x Outage cost
4. Estimate project cost
5. Net benefit of project = project benefits – project cost
Customer Outage Costs

• Two types of outage costs:
  – **Direct**: Costs incurred by customers
  – **Indirect**: Costs incurred by government agencies and ripple effects

• **Direct outage costs** determined via a **survey of businesses** served by Embarcadero substation

• **Indirect outage costs** = 0.5 to 2 times direct outage costs
Outage Cost Estimation

• Direct Outage Costs (survey)
  • Total outage costs = net revenue lost + out of pocket costs
  • Surveyed 220 Customers
    • 150 of 2,200 small and medium sized customers
    • 20 of 45 large customers
    • 55 of 2,400 master metered tenants

• Indirect Outage Costs (literature search)
  • Reviewed hazard loss literature
  • Every event different
  • Very difficult to estimate
  • Conclusion: Use range of 0.5 to 2 times direct costs
### Estimated Outage Costs

<table>
<thead>
<tr>
<th>Outage Duration</th>
<th>Direct ($M)</th>
<th>Indirect ($M)</th>
<th>Total Outage Cost ($M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 Hours</td>
<td>126</td>
<td>63 – 251</td>
<td>187 – 377</td>
</tr>
<tr>
<td>4 Days</td>
<td>407</td>
<td>204 – 815</td>
<td>611 – 1,222</td>
</tr>
<tr>
<td>3 Weeks</td>
<td>1,417</td>
<td>709 – 2,834</td>
<td>2,126 – 4,251</td>
</tr>
<tr>
<td>7 Weeks</td>
<td>2,923</td>
<td>1,461 – 5,845</td>
<td>4,384 – 8,768</td>
</tr>
</tbody>
</table>

- Outage costs not linear over time
- Costs are in today’s dollars
- Outage costs would be avoided if new transmission line built (probability of all 3 lines failing concurrently is near 0)
Net Project Benefits

- Project Benefit = $4.5 to $8.8 billion
- *Expected* Project Benefit = $370 million to $740 million
- Project Cost = $170 million
- Net Project Benefit = Expected Benefit – Project Cost
- Net Project Benefit = $200 million to $540 million
Thank You

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