Analyzing Risk & Benefits of Resiliency Projects

Embarcadero-Potrero 230 KV Transmission Project

Dick Patterson
Senior Manager, Economic and Project Analysis
PG&E

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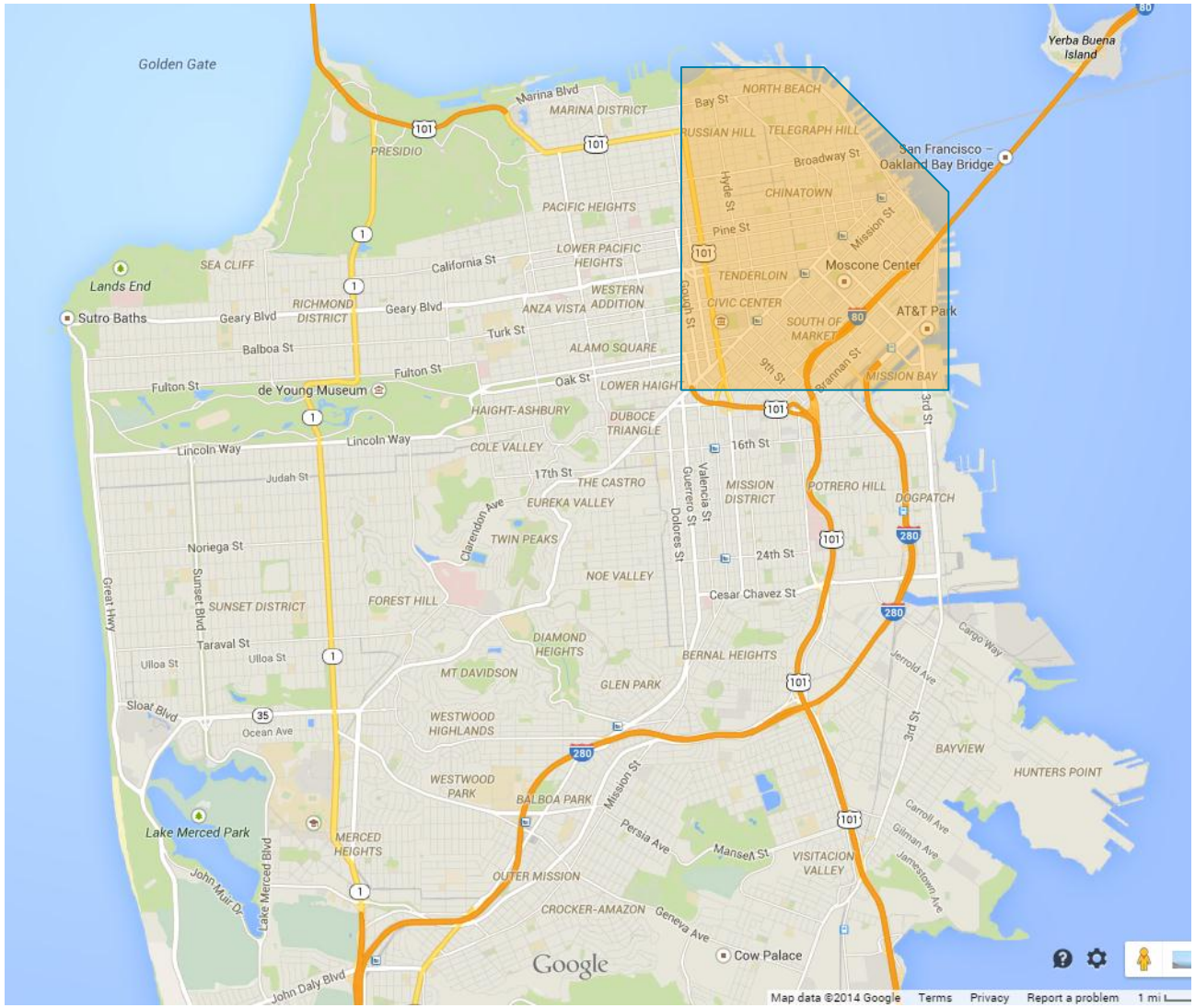
PG&E Company Overview

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

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

- 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

Dick Patterson
RAP5@pge.com