Using Monetized Risk and Triple Bottom Line Life-cycle Costs to Make Capital Improvement Decisions

NW Distribution System Transmission Improvements Case Study

One Water Conference - August 27, 2014
Making Capital Improvement Decisions
Columbus DPU Profile

- Serve 1.1 million customers
  - Water
  - Wastewater (Sanitary and Storm)
- Top Issues
  - Aging infrastructure
  - Changing regulations
- CIB is $250M/yr
- Overall budget is $550M/yr
What Drives our Decisions?

1) Reliability/safety of service

- Redundancy
- Reliable assets
- Reliable processes
Drivers

2) Cost

- Efficient delivery of services
- Economic utilization of resources
Drivers

3) Environmental stewardship
What Else Drives our Decisions?

4) Emotion – Altruism, Fear, Worry
   - Public welfare
   - Bad press
   - Blame
Business Drivers Often at Odds
Choosing to Spend Customers' Money

Never black or white
### Evaluation Methods

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Status Quo</th>
<th>Alt. 1 Griggs</th>
<th>Alt. 2 Bethel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak Demand</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Fire Fighting</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
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<tr>
<td>River Crossing Redundancy</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Fisher Booster Station Redundancy</td>
<td>N</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Financial Cost</td>
<td>$2 M</td>
<td>$26 M</td>
<td>$18 M</td>
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</tbody>
</table>

Qualitative assessment by experienced staff:
- Easiest
- Most Subjective
Evaluation Methods

<table>
<thead>
<tr>
<th>Criteria</th>
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<th>Alt. 1</th>
<th>Alt. 2</th>
<th>Weight</th>
<th>Score</th>
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<td>SQ</td>
<td>Alt 1</td>
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<td>4</td>
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<td>15%</td>
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<td>Cost</td>
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<td>2</td>
<td>3</td>
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<td>Total Score</td>
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</table>

Score: 4.05

Multi-criteria analysis:
- More effort
- Less Subjective
### Evaluation Methods

#### Monetized Triple Bottom Line and Risk
- Most effort
- Least Subjective

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<tbody>
<tr>
<td>Peak Demand</td>
<td>$2.44</td>
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<td>$1.67</td>
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<td>Other</td>
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<td>NPV Cost</td>
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<td>$20.9</td>
<td>$16.1</td>
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Cost in Millions
Monetized TBL

- Financial costs to DPU
- Social costs
  - Loss of water service
  - Taste/Odor
  - Water in Basement (WIB)
  - Traffic disruption
- Environmental costs
  - SSO volume
  - Air pollution
  - Loss of biodiversity

Monetizing provides common language
- Everyone understands the value of a dollar
- Make a reasonable estimate of "value"
Monetized Risk

Risk = Likelihood x Consequence

- Types of Risk:
  - Loss of water service
  - WIB
  - Electrocution

Risk can’t be eliminated, just managed
Managing Risk

- We can always do more to reduce risk
  - But should we?
  - At what cost?

By monetizing we can directly answer the question... Does risk reduction provide value for customers’ money?
Business Case Evaluation (BCE) Case Study:

Northwest Water Distribution System
Problem – NW System Shortage

Blazer Tank: Daily Minimum Water Levels, June-August, 2005-2010

Used emergency storage for non-emergency use 83% of time

Emergency Storage Limit
## Pre-BCE: Non-monetary Evaluation

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<td>Water Quality</td>
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<tr>
<td>Adequate Pressure</td>
<td>N</td>
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<td>Henderson Transmission Redundancy</td>
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BCE: Monetized Social Risk

- Henderson or Bethel B.S. redundancy
- Peak demand
- Fisher B.S. redundancy
- Adequate pressure
- River crossing redundancy
- Henderson transmission redundancy
- Water quality
- Fire fighting
Risk Example 1: Peak Demand > Capacity

10% annual likelihood of peak demand > capacity during normal operations

Estimated Consequence of a 8 hour disruption
- 6000 customers lose water service
  $100/day residential, $2000/day non-residential
  $20/customer/hr average
- 6000 customers with low pressure
  $3/customer/hr average
Peak Demand > Capacity
Risk Cost

Outage: 10%/yr x 8 hr x 6000 customers x $20/customer/hr

+ Low pressure: 10%/yr x 8 hr x 6000 customers x $3/customer/hr

= $110,000/yr

30-yr present value of risk exposure = $2.44 million
Risk Example 2: Fire Demand > Capacity

Inability to fight fires - likelihood
- Assume 1 large fire per year on average
- 2% probability of inadequate Blazer Tank emergency storage
- 99% of the time, water can be diverted from other areas (choose fire fighting over customer outages)
- 1 fire/yr x 2% inadequate storage x 1% unable to divert flow = 0.02% chance of being unable to fight the fire
Fire Demand > Capacity
Risk Exposure

Inability to fight fires – consequence
- Possible loss of life or property destruction
- Assume $20 million consequence

Inability to fight fires – risk exposure
- Risk cost of fire = 0.02% x $20 M = $4,000/yr
- Risk exposure from outages while fighting fire = $8,910/yr
- Total risk exposure = $4000/yr + $8,910/yr; 30yr PV = $302k
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Millions

Status Quo, Griggs, Bethel - Full
Social Risk Reduction v. Cost

Benefits (Risk Reduction) < Costs for both alternatives
2nd Alternative
Bethel - Full Transmission Main

5 miles of new transmission main

Modify booster station

Abandon booster station
Final Alternative Operational Changes

- Isolation Valves (if needed)
- New Jockey Pump
- Modify Booster Station
- Refurbish Booster Station
Risk Reduction Matrix

- Henderson or Bethel B.S. redundancy
- Peak demand
- Fisher B.S. redundancy
- Adequate pressure
- River crossing redundancy
- Henderson transmission redundancy
- Water quality
- Fire fighting

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<thead>
<tr>
<th>Millions</th>
<th>Status Quo</th>
<th>Griggs</th>
<th>Bethel - Full</th>
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<th>Operational Changes</th>
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30-yr TBL Matrix

- Pro-rated Capital Costs
- Henderson or Bethel B.S. redundancy
- Peak demand
- Fisher B.S. redundancy
- Adequate pressure
- River crossing redundancy
- Henderson transmission redundancy
- Water quality
- Fire fighting
- O&M Costs

Millions

$18
$15
$12
$9
$6
$3
$0
($3)

Status Quo
Griggs
Bethel - Full
Bethel - Partial
Operational Changes
Social Risk Reduction vs. Cost

- Status Quo
- Griggs
- Bethel - Full
- Bethel - Partial
- Operational Changes

Net costs
Benefits

Millions
$0
$5
$10
$15
$20
$25
Triple Bottom Line NPV

- Status Quo
- Griggs
- Bethel - Full
- Bethel - Partial
- Operational Changes

Financial Factors
Remaining Risk

Millions
$0
$5
$10
$15
$20
$25
George F. Meyers, P.E.

City of Columbus
Department of Public Utilities
Asset Management Office
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