WRRFs and Their External Impacts: The Social Cost and What Can Be done

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Outline

• Context
• Industry Description
• Define Social Cost
• Social Cost in Electricity
• Electricity and Social costs in WRRFs
• What is being done
• How to use the Social Cost in Communities
• Questions and Discussion
Context

• “A text without a context is a pretext for trouble” – Unknown

• Municipal Treatment
• Water Resource Recovery Facility
• Asset Management
Industry Description
Water Professionals

- What does it mean to be a Water Professional?
- What would our world be like if our profession did not exist?

Dirty water kills more people than all forms of violence, including war. - U.N. Secretary-General Ban Ki-Moon 2010
Social Cost

Social Cost = Private Cost + External Cost

Social cost is the total cost to society. It includes both private costs plus any external costs.

A private cost is the cost paid for a good or service.

An external cost occurs when producing or consuming a good or service imposes a cost upon a third party.

Example: Picnic in the Park

Source #1: www.economicshelp.org

Picture Source: Shutterstock – Public Domain
Context of Michigan’s Electricity Market

**Michigan’s Electric Power Generation²**

<table>
<thead>
<tr>
<th>Type of Power Generation</th>
<th>Monthly MWh</th>
<th>% of Energy Mix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Petroleum-Fired</td>
<td>14</td>
<td>0%</td>
</tr>
<tr>
<td>Natural Gas-Fired</td>
<td>3137</td>
<td>30%</td>
</tr>
<tr>
<td>Coal-Fired</td>
<td>4073</td>
<td>39%</td>
</tr>
<tr>
<td>Nuclear</td>
<td>2684</td>
<td>25%</td>
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<tr>
<td>Other Renewables</td>
<td>504</td>
<td>5%</td>
</tr>
<tr>
<td>Hydroelectric</td>
<td>115</td>
<td>1%</td>
</tr>
</tbody>
</table>

Monthly usage of 10,527 MWh = Yearly usage of 126,324,000 MWh

Source 2: Energy Information Administration, July 2016
Social Cost in Electricity in Michigan

- Particulate Pollution
- CO2 Pollution
- Neither are currently included in the private cost
Social Cost in Electricity in Michigan
Particulate Pollution

- **Michigan Study**
  - 2011 Study
  - 9 of the oldest power plants
  - 665 deaths Annually
  - $5.4 billion of Health-Related Damages in the US Annually

- **National Study**
  - $0.12 of health damages from the pollution produce by Coal per kWh.
  - $5.8 Billion worth of damages from Michigan’s Coal power plants.

Source #3: “Public Health Impacts of Old Coal-Fired Power Plant in Michigan” by Environmental and Health Engineering Inc. for Michigan Environmental Council 2011

Picture Source: Charlie Riedel, AP
Social Cost in Electricity in Michigan CO₂ Emissions

- CO₂ Emissions = 60,000,000 metric tons per year
- $39 per metric ton of CO₂
  - Social cost in this study is based on three large models: each model looked into the positive and negative considerations of sea level rise, agriculture, land loss, and space heating fluctuations
- $2.3 Billion of social cost

Source #5: Energy Information Administration, Data for 2014
Combined Social Cost of Carbon

- Particulate = $5.4 Billion
- CO₂ = $2.3 Billion
- $7.7 Billion per 126,324,000 MWh
- Estimate of $0.06 per kWh for the Social Cost
- The average private cost of electricity in Michigan is $0.10 per kWh
- What if your costs were 60% higher?

Sources: Calculated based on numbers from previous slides
Source 7: Energy Information Administration
Picture Source: Public Domain
Electricity Use in Michigan WRRFs

- MWEA Energy Survey
- Estimated Average Daily Flow from WRRFs = 1,386 Million Gallons.
- Estimated Energy use per year = 821,000 MWh/year.
- $49 million of Social Cost
- $35,000 per million gallons of average daily flow

Source #7: Michigan’s Wastewater Treatment Plants Energy Survey and Estimate of Energy Baseline by the MWEA, April 15, 2017
Source #7a: Calculated
Where Is the Local Social Cost?

- Health Care Costs
  - Pensions – City Budgets
- Weather Damages
  - 100 year storms

Picture Sources: Public Domain
What Is Being Done?

- Cogeneration
- Solar – Wind Generation
- Flare Maintenance
- Pump and Blower Efficiencies
- Landfill Diversion of Wastes
- VFD implementation

Picture Source: Keep Calm Posters
What Is Being Done?
Asset Management

What type of asset?

What is the optimal time of replacement?

Avoiding the Failure Zone will save Money.
How to Use Social Costs

- Sustainability Plan and Goals
  - Community Impact
- Include in Payback Calculations

<table>
<thead>
<tr>
<th></th>
<th>Without Social Cost</th>
<th>With Social Cost</th>
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</thead>
<tbody>
<tr>
<td>VFD Addition</td>
<td>50,000.00</td>
<td>50,000.00</td>
</tr>
<tr>
<td>Current Power Usage</td>
<td>250,000.00</td>
<td>250,000.00</td>
</tr>
<tr>
<td>Cost of Electricity</td>
<td>0.10</td>
<td>0.16</td>
</tr>
<tr>
<td>Cost of Electricity</td>
<td>25,000.00</td>
<td>40,000.00</td>
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<tr>
<td>Future Power Savings</td>
<td>0.25</td>
<td>0.25</td>
</tr>
<tr>
<td>Future Power Usage</td>
<td>187,500.00</td>
<td>187,500.00</td>
</tr>
<tr>
<td>Cost of Electricity</td>
<td>0.10</td>
<td>0.16</td>
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<tr>
<td>Cost of Electricity</td>
<td>18,750.00</td>
<td>30,000.00</td>
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<tr>
<td>Savings Per Year</td>
<td>6,250.00</td>
<td>10,000.00</td>
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<tr>
<td>Simple Payback</td>
<td>8.00</td>
<td>5.00</td>
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</tbody>
</table>
Things to Consider

- Selection of Treatment Technologies.
- Location of Infrastructure.
- Low Impact Development.
- Decentralized Treatment.
- Carbon Tax preparation.
- Community Education.

Picture Source: Public Domain
Bibliography

Source #1: www.economicshelp.org

Source #2: Energy Information Administration, July 2016

Source #3: “Public Health Impacts of Old Coal-Fired Power Plant in Michigan” by Environmental and Health Engineering Inc. for Michigan Environmental Council 2011


Source #5: Energy Information Administration, July 2016


Source #7: *Michigan’s Wastewater Treatment Plants Energy Survey and Estimate of Energy Baseline by the MWEA, April 15, 2017*
Questions and Discussion

How is your community taking into consideration Social Cost?

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