Applying a Sustainability Metric To Today's Standard Economic Analyses

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Outline

1. Background
2. Metrics
3. Carbon Footprint Method
4. Case Study
5. Future Work
6. Conclusion
7. Questions

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Background

Background

- Changing Conditions in the United States
  - Economy
  - Political Climate
  - Resource Use Efficiencies
  - Population Trends
- Challenges for Industries
  - Improving Operations
  - Cost Reduction
  - Regulatory Compliance
- Emerging Trends: Sustainability
  - New Value for Customers, Shareholders, and Other Stakeholders
  - New Opportunity for Value Creation
- Industries Adapting to Trends and Building Competitive Edge

"76% of executives say engaging in sustainability contributes positively to shareholder value in the long term." – McKinsey & Company

Background

- Water Treatment Companies are Responding to Sustainability Challenges
- Internal Improvements
  - Day-to-Day Business Practices
  - Benefits: Energy Use, etc.
- External Improvements
  - Sustainability to Drive Innovation
  - Improving Technology and Service Offerings
- Result: Water Treatment Industry and Clients Achieve Sustainability Goals

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Metrics

- *“With a sustainability vision in place…executive team[s] must marshal specialized capabilities for weighing options and quantifying benefits and risks”* (Lubin 2010.)

Metrics – Standard Analyses

- Metrics: Tools to Guide the Decision-Making Process for Endeavors Affecting Sustainability and Other Goals
- Benefit: Break Down Options into a Common Denominator: Economics
- Standard Metrics: Lifecycle Cost Analysis (LCA)
  - Capital Costs (e.g. Equipment Costs)
  - Installation Costs (e.g. Packing Density for Membrane Equipment)
  - Consumables (e.g. Media Replacement Costs)
  - Operational Costs (e.g. Chemical Consumption, Energy Costs)
  - Maintenance Costs (e.g. Waste Disposal, Repair Costs)
  - Typically Normalized on Yearly Basis
- Easy to Use
- Widely Accepted Across Industries
- Shortcoming: Do Not Directly Account for Environmental Impacts

Metrics – Non-Standard Analyses

- Created to Address Shortcomings of Conventional Analyses
- Not Intended to Replace Standard Methods
- Benefit: Provides a Way for Industries to Directly Evaluate Environmental Impact
- Non-Standard Metric: Carbon Footprint Analysis
  - Rooted in Current Environmental Debates
  - Quantify Carbon Dioxide Emissions Caused Directly or Indirectly by an Individual, Organization, Event or Product
  - Measured in Tons of Carbon Dioxide Equivalent
  - Indicate Entity's Contribution to Environmental Impact Over Time
- Used to Aid Businesses in Making Environmentally-Conscious Business Decisions
- Methods Developed by U.S. EPA and Other Entities

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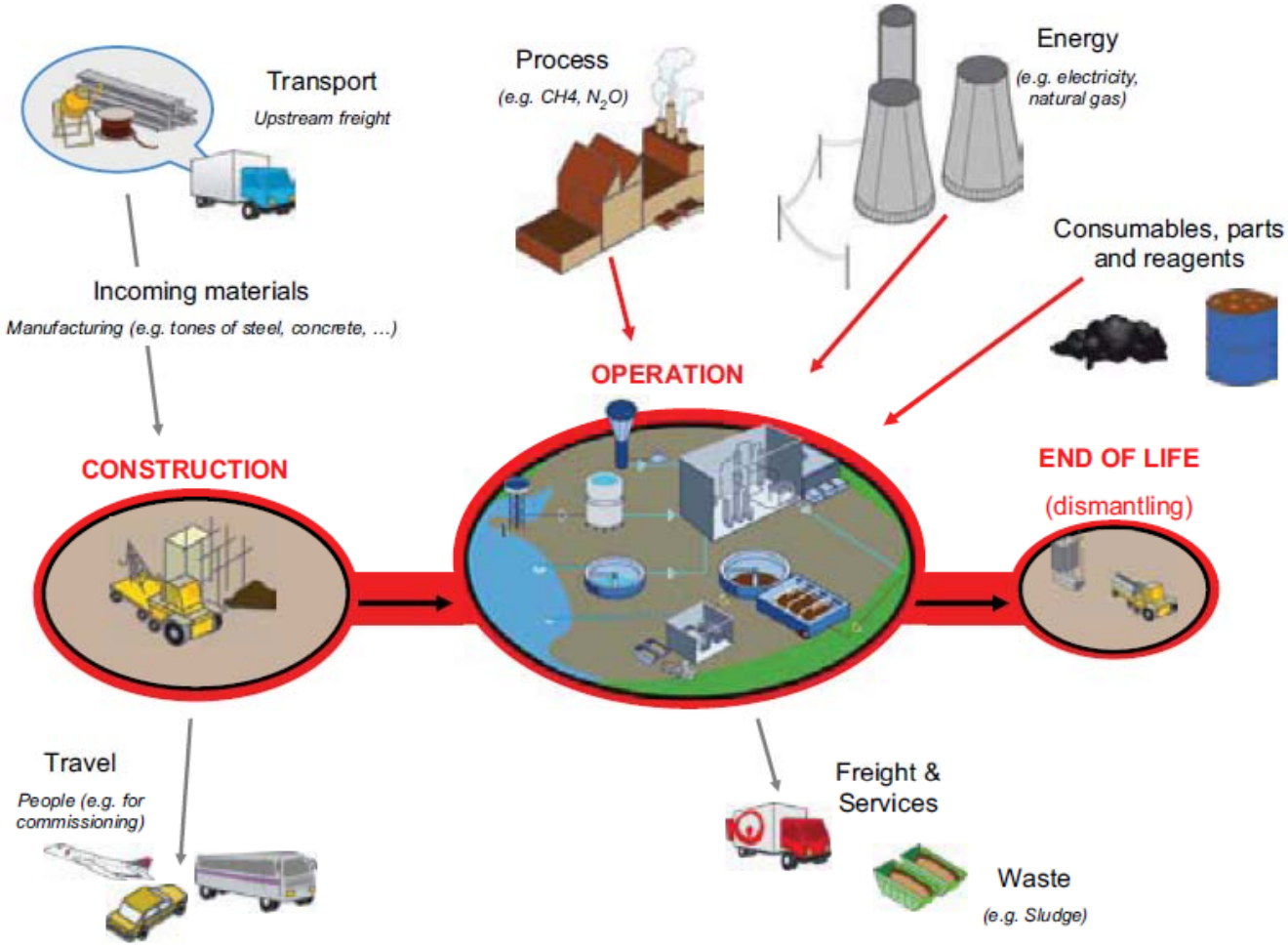
Carbon Footprint Method

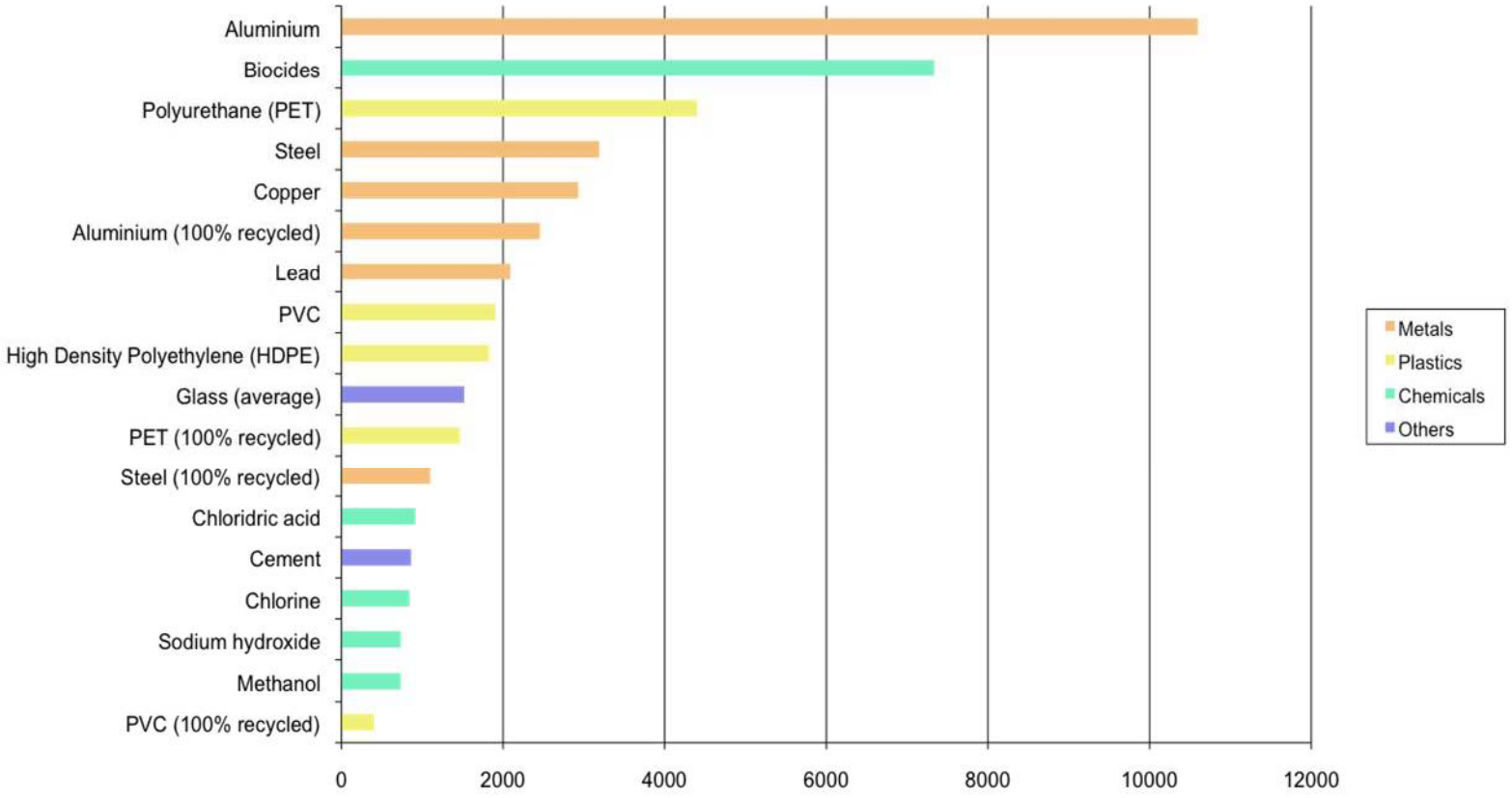
Carbon Footprint Method

- Step 1: Set Boundaries
- Step 2: Define Activity Data



Carbon Footprint Method

- Step 3: Choose Emission Factors
  - *Emission Factor: representative value that attempts to relate the quantity of a pollutant released to the atmosphere with an activity associated with the release of that pollutant.* (EPA 2010.)



Carbon Footprint Method

- Step 4: Calculate Carbon Footprint

$$C = \sum_{i=1}^{n} (A_i)(EF_i)$$

- Where:
  - C = Carbon Footprint [kg CO_2 eq/year]
  - A_i = Activity Data (e.g. amount of natural gas consumption to power a facility; expressed in kW/year or other relevant units)
  - EF_i = Emission Factor [kg CO_2 eq/kW] (or other relevant unit)

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Case Study

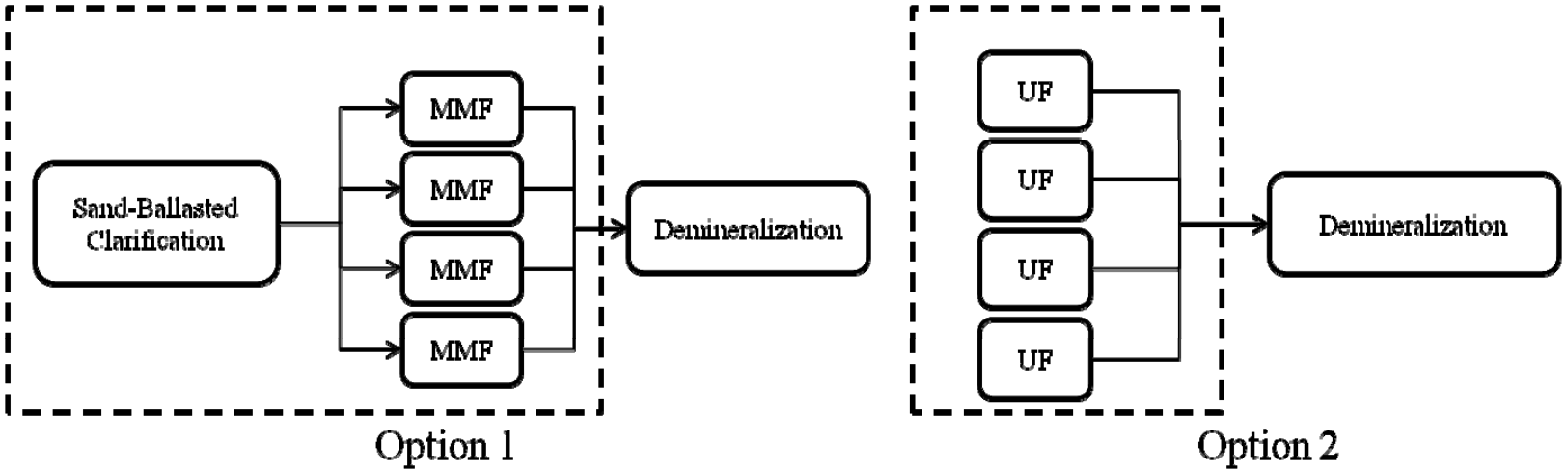
Case Study - Background

- 2010: N.A. Water Systems Performs Carbon Footprint Analysis for Client in Midwest of United States
- Application
  - Boiler Feed Make-Up System
  - Two Alternative Solutions for Demineralization Pre-Treatment Step
    - → ACTIFLO® Turbo High-Rate Clarification, Sand-Ballasted Settling and Multimedia Filtration
    - → Membrane Ultrafiltration
- Technical Design

Parameter	Treatment Goal
Flow Rate	600 gpm
Total Suspended Solids (TSS)	< 2 mg/L
Total Organic Carbon (TOC)	< 2 mg/L
Other	Account for Algal Blooms

Case Study - Analysis

- Step 1: Set Evaluation Boundaries
  - Set Around Competing Technologies Within Overall Treatment Process
  - 20 – Year Analysis

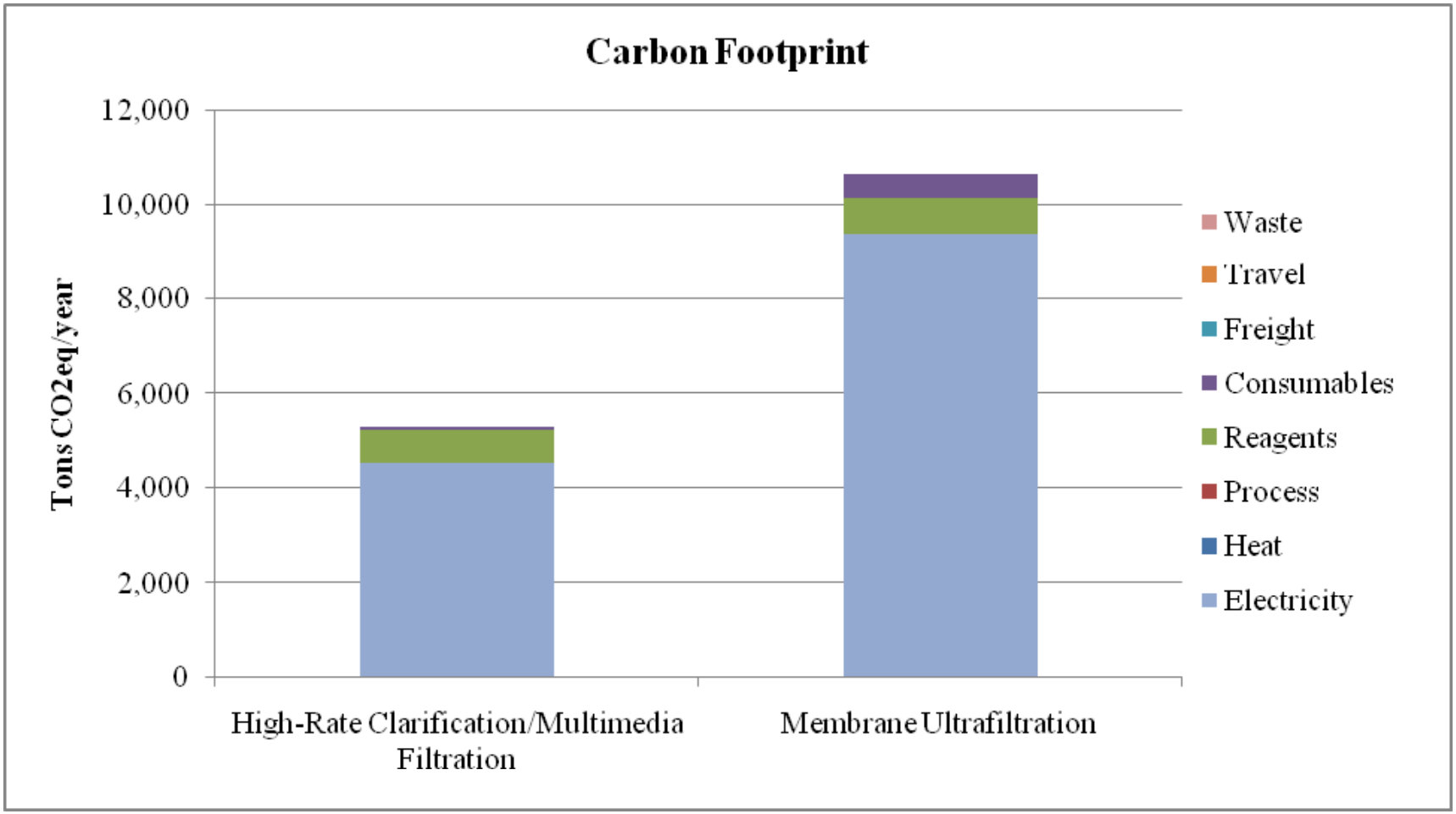


- Step 2: Define Activity Data
  - Energy Consumption
  - Process Factors (e.g. CH_4, N_2O Emissions, etc.)
  - Chemical Usage
  - Consumables
  - Travel, Freight Excluded Due to Preliminary Stage of Project Development

Case Study - Analysis

- Step 3: Choose Emission Factors
  - Sources:
    - U.S. EPA Database
    - Intergovernmental Panel on Climate Change (IPCC) Database
    - Others With Relevance to Parameters Considered in Analysis
- Step 4: Calculate Carbon Footprint
  - Apply Carbon Footprint Equation

Case Study - Results



Discussion

- Two Parties Affected Over Two Timeframes

	Industry Client	Water Treatment Supplier
Short Term	• Utilize Carbon Footprint Analysis As-Is to Influent Purchasing Decision	• Review Technical Design to Find Opportunities for Improvement that Will Decrease Carbon Footprint
Long Term	• Use Environmentally-Influenced Decision as a Benchmark for Achieving Sustainability Benefits	• Use Analysis to Drive Innovation

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Future Work

Future Work

- Continue Research to Support Inputs to Carbon Footprint Models
  - Activities
  - Emission Factors
- Water Treatment Companies to Expand Methodology
  - Materials of Construction, Other Factors Affecting Carbon Footprint Model
  - Common Approach Between Companies
- Build Experience Utilizing Carbon Footprint Analyses
- Apply Carbon Footprint Analyses to Standard LCA Models

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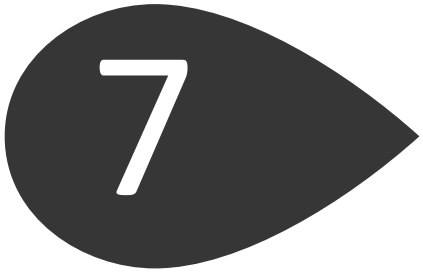
Conclusion

Conclusion

- Challenges for Industries
- Adaptation to Sustainability
  - Industries
  - Water Treatment Companies
- Metrics: Tools to Aid Decision-Making
  - Standard Metrics (e.g. LCA)
  - Carbon Footprint
- Streamlining Carbon Footprint and Combining it With LCA Analyses Will Help Aid Industries in Achieving Sustainability and Other Goals



Questions?