Sustainability in the supply chain of Enel Green Power North America

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Agenda

1. Project Overview
2. Methodology
3. Hotspot Analysis
   a. Wind
   b. Solar
   c. Electrical equipment
   d. Transportation
4. Final recommendations
5. Sources
Enel Green Power North America (EGPNA)

- **Owner and operator** of renewable energy plants in North America
- Present in **23 U.S. states** and **2 Canadian provinces**
- Headquartered in **Andover, MA**
- **450 employees**
- **Owned by Enel**, an Italian energy company and one of the world’s leading integrated electricity and gas operators
Problem Statement

EGPNA is installing sustainable energy solutions

Are EGPNA’s suppliers sustainable?

Which products have the greatest impact on the company’s supply chain from the sustainability perspective?
Business Case

**Goal State:** Understand which products/categories have the greatest impact on the company’s supply chain from the sustainability perspective, in order to initiate strategic collaborations with suppliers.

The successful development of this project will support two of EGPNA’s strategic goals

- **Embed Sustainability in EGPNA’s Procurement (and Supply Chain) processes (a 3 year vision).**
  - This project will kick-off the effort

- **Improve EGPNA’s Sustainability performance in front of investors and other stakeholders.**
  - This project will develop a repeatable framework that will enhance EGPNA’s reporting
Project Scope

► EGPNA seeks to improve the sustainability of its supply chain, but does not have an understanding of what components have the greatest impact.

► EGPNA has processes for managing sustainability in the construction, commissioning and operation of its facilities, but lacks a framework for its supply chain operations.

► This project aims at providing:
  o A framework for evaluating the sustainability of the components of EGPNA’s supply chain.
  o A pilot hotspot analysis, to identify where to start and what indicators to use.
  o Recommendations on how to develop a repeatable process that will enable EGPNA to embed sustainability into its supply chain.
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Methodology – Overview

Tool Development

Research and Implementation

Execution and reassessment

Identify primary consumption points

Wind Turbines
- Materials sourcing
- Lifecycle impacts
- Human rights
- Community relations
- Employee health, safety and wellbeing
- Biodiversity

Solar Panels
- Energy Management
- Waste and Waste Water
- Hazardous Materials
- Lifecycle impacts End of life
- Materials sourcing

Electrical equipment
- Human rights and manufacturing
- Material Sourcing
- Environmental Concerns

Define scorecard using benchmarks

E-S-G lenses

Environment

Society

Governance
Methodology - Primary consumption points

- Evaluate power plants bill of materials and purchasing schedules to determine essential components and manufacturers
- Look up components and manufacturers on SASB.org

https://www.sasb.org/sics/
Methodology - Material issues

- Use SASB Materiality Map to identify primary concerns for each industry
Methodology - Use benchmarks

- Find sustainability leaders
- Find relevant indicators
  - SASB
  - Company Reports
  - Industry-relevant literature
Methodology - Hotspot analysis

\[ \text{HOTSPOT} = \text{Value} \times \text{Impact} \]

Impact

Value

Analysis of suppliers

Analysis of components

Awareness  HOTSPOTS

Quick Hits
Methodology - Next steps

Once benchmark levels are set:

1. Collect and analyze EGPNA and its suppliers’ data to determine the baseline level
2. Compare the baseline level with the benchmark using the tool
3. Collaborate with suppliers to determine new goals

<table>
<thead>
<tr>
<th>Solar</th>
<th>Size of Plant in MW</th>
<th>4</th>
<th>4</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>KPI:</td>
<td></td>
<td>FSLR</td>
<td>TRINA</td>
<td>Supplier C</td>
</tr>
<tr>
<td>Energy (MWh/MW)</td>
<td>348</td>
<td>1</td>
<td>267.3</td>
<td>221</td>
</tr>
<tr>
<td>Metric tons CO2/MW</td>
<td>343</td>
<td>1</td>
<td>32</td>
<td>182</td>
</tr>
<tr>
<td>Water (Gals/MW)</td>
<td>1,634,908</td>
<td>1</td>
<td>361,001</td>
<td>497,960</td>
</tr>
<tr>
<td>Waste Water discharged (m^3/MW)</td>
<td>5613</td>
<td>1</td>
<td>713.5</td>
<td>973</td>
</tr>
<tr>
<td>Hazardous Waste recycled %</td>
<td>79%</td>
<td>1</td>
<td>70%</td>
<td>50%</td>
</tr>
<tr>
<td>Solid Waste Recycled %</td>
<td>88%</td>
<td>1</td>
<td>60%</td>
<td>40%</td>
</tr>
<tr>
<td>Society – Labor %</td>
<td>100%</td>
<td>1</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Governance</td>
<td>100%</td>
<td>1</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Cost ($/MW)</td>
<td>$1,000,000</td>
<td>$800,000</td>
<td>$1,100,000</td>
<td>$600,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Saved or Excess Waste</th>
<th>A</th>
<th>B</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy used (MWh)</td>
<td>323</td>
<td>508</td>
<td>248</td>
</tr>
<tr>
<td>Metric tons CO2</td>
<td>404</td>
<td>172</td>
<td>332</td>
</tr>
<tr>
<td>Water (Gals)</td>
<td>5,095,708</td>
<td>4,547,870</td>
<td>2,260,288</td>
</tr>
<tr>
<td>Waste Water discharged (m^3)</td>
<td>19,998</td>
<td>18,560</td>
<td>17,548</td>
</tr>
<tr>
<td>Hazardous Waste recycled %</td>
<td>-36%</td>
<td>-116%</td>
<td>-296%</td>
</tr>
<tr>
<td>Solid Waste Recycled %</td>
<td>-112%</td>
<td>-192%</td>
<td>-352%</td>
</tr>
<tr>
<td>Society – Labor %</td>
<td>0%</td>
<td>0%</td>
<td>-200%</td>
</tr>
<tr>
<td>Governance</td>
<td>0%</td>
<td>0%</td>
<td>-200%</td>
</tr>
<tr>
<td>Dollars</td>
<td>800,000</td>
<td>400,000</td>
<td>1,600,000</td>
</tr>
</tbody>
</table>

Data collected for benchmark (SUNPOWER), FSLR and TRINA referenced to S2, S3, S4 respectively.
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Wind - Overview

- **Largest category of Enel’s purchases**
  69%, or €938M of the last 12 months’ total purchases of €1.4b corresponded to wind plants, spare parts for wind turbine generators, and civil works equipment for wind power generation.

- **Main suppliers**
  Vestas American Wind (59%)
  General Electric (13%)
  Nordex USA (8%)
  Michels Power (6%)

- **SASB**
  Materials sourcing
  Lifecycle impacts of products and services
  Human rights and community relations
  Employee health, safety and wellbeing
  Biodiversity impacts

*Source and benchmark: Vestas LCA*
## Wind - Environmental Scorecard

<table>
<thead>
<tr>
<th>Category</th>
<th>Indicator</th>
<th>Benchmark</th>
<th>Hotspots</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environment – Climate Change</td>
<td>• Return on energy</td>
<td>25 to 40</td>
<td>Plant siting and design&lt;br&gt;Plant lifetime</td>
</tr>
<tr>
<td></td>
<td>• Grams CO2 per kWh</td>
<td>6.9</td>
<td>Manufacturing of tower (29%), nacelle (17%), and foundations (15%)&lt;br&gt;Transportation from supplier</td>
</tr>
<tr>
<td></td>
<td>• % of production in the U.S.</td>
<td>80%</td>
<td>Tower manufacturing and nacelle assembly</td>
</tr>
<tr>
<td></td>
<td>• 100% WindMade accreditation</td>
<td>Y</td>
<td>Use of renewable energy for operations</td>
</tr>
<tr>
<td>Environment – Waste</td>
<td>• % recyclability of the wind turbines</td>
<td>84.5</td>
<td>Non-metal components&lt;br&gt;Use recycled metals or push its end-of-life recycling</td>
</tr>
<tr>
<td>Environment – Toxicity</td>
<td>• Terrestrial ecotoxicity potential (mg DCB-e / kWh)</td>
<td>41</td>
<td>Release of heavy metals (chromium, mercury and arsenic) to air (79%) and soil (21%) in manufacturing, mainly of the nacelle (31%) and tower (15%)</td>
</tr>
<tr>
<td></td>
<td>• Freshwater ecotoxicity potential (mg DCB-e / kWh)</td>
<td>62</td>
<td>Manufacturing of cables (40%), due to polymer materials (PVC and PET)&lt;br&gt;Distance to the grid (baseline 20km)&lt;br&gt;Release of heavy metals such as nickel, vanadium and barium</td>
</tr>
</tbody>
</table>

- **30x** Return on energy
- **6.9** gCO2 / kWh
- **84.5%** Recyclability
## Wind - Social Scorecard

<table>
<thead>
<tr>
<th>Category</th>
<th>Indicator</th>
<th>Benchmark</th>
<th>Hotspots</th>
</tr>
</thead>
</table>
| Society – Toxicity| • Human ecotoxicity potential                    | 1427      | Manufacturing of cables (50%) and tower (21%)  
Distance to the grid (baseline 20km)  
Recycling - If materials are not effectively recycled, the impact actually increases by a factor of 4.5x |
|                   | (mg DCB-e / kWh)                                |           |                                                                                                              |
| Society – Safety  | • Injuries in supply chain (per million working hours) | 7         | Construction and maintenance work  
Blade failure  
Safety distance from human activity  
Extend analysis to whole supply chain |
|                   |                                                |           |                                                                                                              |
| Society – Labor   | • Human Rights Policy                           | Y         | Emerging markets                                                                                             |
|                   | • International Labour Organization             | Y         |                                                                                                              |
|                   | • Social Due Diligence                          | Y         |                                                                                                              |

- Injuries / M working h = 7
- Ecotoxicity potential (mg DCB-e / kWh) = 1427
- ✓ Human Rights Policy
- ✓ Social Due Diligence
Wind - Governance Scorecard

Supply Chain
- UN Global Compact
- Employee Code of Conduct
- Business Partner Code of Conduct

Ethics
- World Economic Forum’s Partnering Against Corruption Initiative
- Bribery Risk Assessment

Reporting
- Carbon Disclosure Project
- Life Cycle Assessment of complete wind power plants
Wind - Hotspot Analysis

**Impact**

- Supplier map based on estimated past supplies
- Based on comparison of CSR criteria
- Compared scorecards of different companies
- Higher impact means worse sustainability performance for the company, comparatively

**Value**

<table>
<thead>
<tr>
<th>Suppliers</th>
<th>Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nordex USA</td>
<td>Cables</td>
</tr>
<tr>
<td>Michels</td>
<td>Injuries Human Rights</td>
</tr>
<tr>
<td>Power</td>
<td>Nacelle</td>
</tr>
<tr>
<td>Electric</td>
<td>Tower</td>
</tr>
<tr>
<td>Vestas</td>
<td></td>
</tr>
</tbody>
</table>

19
Wind - Conclusions

- **Supply chain** improvement is very material because manufacturing and end-of-life phases dominate the environmental impacts.

- **Manufacturing** stage dominates all potential environmental impacts. Consequently, a long life of operation significantly reduces overall impacts. Environmental impacts decrease by around 17% for an increased lifetime of 4 years (20% of the baseline 20 years).

- **Recycling**, represents the second most important phase because of its avoided potential impacts at end-of-life if conducted effectively.
  - The turbine is constructed of around 87% metal (primarily iron and steel, and to a lesser extent aluminium and copper).
  - It is very important to recycle turbines’ materials to be able to account for the end-of-cycle credits of avoided impact.
  - Even better, the preferred way is to build the turbines with recycled metals altogether.

- **Transportation** from production locations to the wind plant has a high variability, as its share ranges between 1% and 40% depending on the category and location, justifying a more refined, case-by-case analysis.
Wind - Recommendations

- Request information on the location where the materials come from, as transportation can be as high as 40% of the impact, or as low as 1%.

- Adopt Vestas’s benchmark as a starting reference, and update once a year if a better benchmark or goal is found.

- Collaborate with Vestas and other suppliers in measuring and improving human rights and safety in the extended supply chain.

- Collaborate in advancing the state of the art of blade recycling and recyclability since their composite material recovery is not yet established.

- Collaborate in advancing the use of water footprint. Vestas current LCA analysis takes into account freshwater used, but not the type of water, or the water scarcity of the region.

- Include in the analysis, in sensitive communities, the potential impacts of land use, deforestation, noise and local impacts on flora and fauna, generally included in Environmental Impact Assessments (EIA).
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In the coming years, most of EGPNA's new installed plants will be solar.

**SASB and SunPower CSR report**

- **Energy Management**
- **Waste and Waste Water Management**
- **Hazardous Materials Management**
- **Lifecycle impacts of products and services**
  - Products that are able to be recycled
  - End of life material recovered
- **Materials sourcing**
  - Tungsten, Tin, Tantalum, and Gold sourcing
  - Conflict materials
Define Benchmarks

- Based off of multiple CSR’s,
- SUNPOWER’s solar panels are only Cradle to Cradle certified DC panels in the industry

SUNPOWER is one of the leaders in sustainability for solar

SUNPOWER has the only Cradle to Cradle certified DC panels in the industry
## Solar - Environmental Scorecard

<table>
<thead>
<tr>
<th>Category</th>
<th>Indicator</th>
<th>Benchmark</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environment – Climate Change</td>
<td>Energy use (MWh per MW produced)</td>
<td>348</td>
<td>Manufacturing process</td>
</tr>
<tr>
<td></td>
<td>Metric tons of CO2 per MW produced</td>
<td>225</td>
<td>Includes Scope 1, 2, and 3 GHG emissions</td>
</tr>
<tr>
<td></td>
<td>Water (gallons) use per MW produced</td>
<td>1,634,928</td>
<td>Manufacturing process</td>
</tr>
<tr>
<td>Environment – Waste</td>
<td>Waste Water Discharged per MW (m³/MW)</td>
<td>5,613</td>
<td>Manufacturing process</td>
</tr>
<tr>
<td></td>
<td>Solid Waste recycled</td>
<td>88%</td>
<td>Manufacturing process</td>
</tr>
<tr>
<td>Environment – Toxicity</td>
<td>Hazardous waste recycled</td>
<td>79%</td>
<td>Manufacturing process</td>
</tr>
</tbody>
</table>

Data collected for benchmark (SUNPOWER) referenced in S2
Solar - Social Scorecard

Safety
- Injuries in supply chain <1.2 per million working hours
- Extend to the entire chain

Labor
- Human Rights Policy
- International Bill of Human Rights
- International Labour Organization
- Conflict Minerals Policy
Solar - Governance Scorecard

Supply Chain
- UN Global Compact
- Employee Code of Conduct
- Business Partner Code of Conduct

Ethics
- World Economic Forum’s Partnering Against Corruption Initiative
- Supplier Certification and auditing

Reporting
- Carbon Disclosure Project
- Corporate Sustainability Report
Solar - Hotspot Analysis

- Based on comparison of CSR criteria
- Compared scorecards of different companies
- Higher impact means worse sustainability performance for the company, comparatively

Supplier map based on potential future supplies

Impact

Value

Suppliers

Solar World
First Solar
Trina Solar
Sun Power

Components

Impact

Value

Hazardous waste
Water Usage
Energy Usage
Solar - Recommendations

- Look for suppliers that have comprehensive Governance and Social policies similar to SunPower.

- Adopt SunPower’s benchmark as a starting reference, and update once a year if a better benchmark or goal is found.

- Collaborate with suppliers to develop standard KPIs to measure then come up with plans of attack to improve

- Scope 1 and 2 Emissions are 90% of the emissions, focus on the energy reduction at the manufacturing plants

- Form relationships with suppliers that either champion sustainability initiatives or want to become more sustainable
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Electrical Equipment - Overview

Main Suppliers
- Siemens
- ABB
- GE

Material Issues
- Energy Management
- Waste and Hazardous Materials Management
- Lifecycle impacts of products and services
- Product Safety
- Business Ethics and Competition
- Materials sourcing
## Electrical Equipment - Environmental Scorecard

<table>
<thead>
<tr>
<th>Category</th>
<th>Indicator</th>
<th>Benchmark</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environment – Energy Management</td>
<td>Company - Percentage of renewable energy from total energy consumed [%]</td>
<td>5%</td>
<td>Green power is only purchased in Europe or US</td>
</tr>
<tr>
<td></td>
<td>Company Energy intensity [MWh per Million USD of sales]</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>Environment – Climate Change</td>
<td>GIS unit - SF6 Losses during Manufacturing [% w/w]</td>
<td>0.50</td>
<td>At end-of-life the switchgears are collected and the sulphur hexafluoride gas is reclaimed for reuse in new equipment.</td>
</tr>
<tr>
<td></td>
<td>GIS unit - SF6 Losses during Use Phase [% w/w per year]</td>
<td>0.10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GIS unit - SF6 Losses at End of Life Phase [% w/w]</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Environment – Waste</td>
<td>Power Transformer Unit - Energy Losses during Use Phase [kWh/ MVA]</td>
<td>413,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Company - Percentage waste recycled [%]</td>
<td>90%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Power Transformer Unit - Recycle Waste at End of Life Phase [kg/MVA]</td>
<td>548</td>
<td></td>
</tr>
</tbody>
</table>

- **<400** Trafo Energy Losses MWh/ MVA
- **<0.1%** GIS SF6 Losses/ year
- **90%** Recyclability
## Electrical Equipment - Social Scorecard

<table>
<thead>
<tr>
<th>Category</th>
<th>Indicator</th>
<th>Benchmark</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Society – Employee H&amp;S</td>
<td>Employee total recordable incident rate [incidents per 1,000 employees]</td>
<td>10</td>
<td>ILO rate</td>
</tr>
<tr>
<td></td>
<td>Employee Fatality Rate [fatalities per 1,000 employees]</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Society – Product Safety</td>
<td>Percentage of units recalled</td>
<td>0%</td>
<td></td>
</tr>
</tbody>
</table>

- **Incidents Rate** / 1,000 employees: 10
- **Fatality Rate** / 1,000 employees: 0
- **Percentage Units Recalled**: 0%
Electrical Equipment - Governance Scorecard

Supply Chain
- UN Global Compact
- Employee Code of Conduct
- Business Partner Code of Conduct

Ethics
- World Economic Forum’s Partnering Against Corruption Initiative
- Bribery Risk Assessment

Reporting
- Carbon Disclosure Project
- Life Cycle Assessment
Electrical Equipment - Hotspot Analysis

- Based on comparison of CSR criteria
- Compared scorecards of different companies
- Higher impact means worse sustainability performance for the company, comparatively

Supplier map based on estimated past supplies.
Electrical Equipment - Recommendations

- Target suppliers with increased % of renewable energy in electricity use, or planning to do so. Purchase of renewable energy is currently done mainly in Europe and the US.

- Favor suppliers that have transformers with technologies for load loss reductions.

- Target suppliers with comprehensive recycling policies.

- Target suppliers that have programs in place for reclamation of GIS switchgears at end of life phase.

- Explore switchgear suppliers that develop switchgears with insulation fluids other than SF6. Sulphur hexafluoride (SF6) is a very potent greenhouse gas, which is used in switchgears for medium- and high-voltage applications.

- No critical or conflict minerals are used in transformers or switchgears.
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CO2 From Transportation of Bulky Items

- Blades and Towers
- Trackers
- Copper

Other metal equipment
Transportation - CO2 emissions framework

Emission Factor (Kg CO₂ / ton-km) * Weight (ton) * Distance (km)
Transportation - CO2 emissions top suppliers analysis

Prioritize by weight and distance

Tier 1 Tier 2 Manufacturer Plant site

(T1)
Transportation - CO2 emissions top suppliers analysis

IAW with GHG Protocol Scope 3 Calculation Guidance (T1)

1. Have manufacturer determine the top 5 components by weight
2. Determine the distance and mode of transportation between each supplier
3. Have Tier 1 suppliers determine the top 5 components that are sourced by weight
4. Determine the distance and mode of transportation between each supplier
5. Fill in the table with weight of components per unit and enter the number of units, and the distances for each mode of transportation
## CO2 from transportation – Tool

<table>
<thead>
<tr>
<th>Metric tons CO2 per MWh of Solar</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>1080.142</td>
<td></td>
</tr>
</tbody>
</table>

### Total CO2 produced from transportation (metric tons)

<table>
<thead>
<tr>
<th>CO2 (metric tons)</th>
<th>Truck</th>
<th>Rail</th>
<th>Ocean (Short)</th>
<th>Air (Longhaul)</th>
<th>Total CO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>4330.587</td>
<td>8.046</td>
<td>8.032</td>
<td>8.016</td>
<td>2.526</td>
<td>8.052</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CO2 Per ton mile</th>
<th>Truck</th>
<th>Rail</th>
<th>Ocean (Short)</th>
<th>Air (Longhaul)</th>
<th>Total CO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.086</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.032</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.016</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.528</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.912</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Transportation method

- **Truck**: Rail, Ocean (Short), Air (Longhaul)

### CO2 Per ton mile

- **Truck**: Rail, Ocean (Short), Air (Longhaul)

### Unit Weight (tons)

#### Top 5 suppliers to Supplier A in miles

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Miles</th>
<th>Unit Weight (tons)</th>
<th>Percentage of unit weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supplier A</td>
<td>100</td>
<td>0.3</td>
<td>20%</td>
</tr>
<tr>
<td>Supplier B</td>
<td>8000</td>
<td>1.72</td>
<td>20%</td>
</tr>
<tr>
<td>Supplier C</td>
<td>300</td>
<td>113.76</td>
<td>20%</td>
</tr>
<tr>
<td>Supplier D</td>
<td>2000</td>
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### Total of Top 5 Tier 1 suppliers

| Supplier A | 100   | 0.3                | 20%                       |
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### Metric tons CO2 per MWh of Solar

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<tr>
<th>Metric tons CO2 per MWh of Solar</th>
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### Total CO2 produced from transportation (metric tons)

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<tr>
<th>CO2 (metric tons)</th>
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### CO2 Per ton mile

- **Truck**: Rail, Ocean (Short), Air (Longhaul)

### Unit Weight (tons)

#### Top 5 suppliers to Supplier B in miles

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### CO2 Per ton mile

- **Truck**: Rail, Ocean (Short), Air (Longhaul)

### Unit Weight (tons)

#### Top 5 suppliers to Supplier C in miles

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### CO2 Per ton mile

- **Truck**: Rail, Ocean (Short), Air (Longhaul)

### Unit Weight (tons)

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2. Methodology
3. Hotspot Analysis
   a. Wind
   b. Solar
   c. Electrical equipment
   d. Transportation
4. Final recommendations
5. Sources
Final recommendations

1. Define **criteria to select suppliers**, weighting in the different prioritized impacts.
   - Use the scorecards of this project as checklists.
   - Update the benchmarks once a year.
   - Select suppliers that report on material issues according to SASB’s Materiality Map.
2. Request an LCA or at least a detailed **impact analysis** to suppliers following Vestas and Sunpower’s examples.
3. Request an analysis of the **local social impact** of these suppliers on their communities as well.
4. Collaborate with Vestas, Sunpower, ABB and other suppliers in measuring and improving human rights and safety in the extended supply chain.
5. Assess the specific impact of **transportation**, by asking about the origin of components to suppliers.
6. Consider using a **price for carbon** to inform internal purchasing decisions.
7. Collaborate in advancing the use of **water footprint**, taking into account types of water and local water scarcity.
8. Lead **stakeholder dialogue** and local community development.
Next steps

1. Implement the scorecards
   a. **Break down into components** each of the categories analyzed (Wind, Solar, Electrical Equipment).
   b. For each component, **create benchmark scorecards**, derived from the scorecards provided in this project, and add further component-specific sustainability requirements.
   c. Include the criteria as part of the **tenders**
   d. **Assess suppliers** in regard to the key indicators and hotspots identified, using the scorecards.

2. Use the assessment for purchasing decisions, and **collaborate with suppliers** to improve the metrics.
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Sources - Wind

Vestas, Life Cycle Assessment of Electricity Production from an onshore V110-2.0 MW Wind Plant, 2015

Wind manufacturing and supply chain, U.S. Department of Energy

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Sources - Solar


Sources - Electrical Equipment


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• E4 – Vestas, 2015. LCA of Electricity Production from an Onshore V110-2.0 MW Wind Plant.
Sources - Transportation

Project Team

Joe Lucido

John Sterman
Project Mentor

Lorena Pelegrín

Xavier Roca