Green Flux

MSc Sustainable Finance | KEDGE Business School
Impact Investment Challenge 2022

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Problem

**3.5x GROWTH IN RENEWABLES**
needed globally in order to achieve the Paris Goals

**88 OUT OF 90 SCENARIOS**
provided by the IPCC assume some form of negative emissions as essential

**44,969 HECTARES**
of forest was burnt in Portugal in 2017

**Cut annual emissions by 10.5 MT/CO₂**
the Portuguese Government’s 2030 reduction target
Solution

BECCS Facility
- Located in area affected by wildfires in Portugal
- Bioenergy from biomass + CCS
- Nameplate capacity: 165MW
- Net carbon capture: 85,000 tpa of CO2

Bioenergy
- Bioenergy sold on Portuguese Electricity Market

Reforestation
- Biomass produced from willow trees
- 20,000 hectares of willow trees
- Carbon captured is sold as carbon offsets

Carbon neutral by 2050
- Support Portugal’s climate strategy to be carbon neutral by 2050
**Project Diagram**

- **Invesco**
- **BP**
- **TotalEnergies**
- **Schroders**
- **Banco Português de Fomento**

**Investors**

- Financial flow
- 30% of Capex

**Financier**

- Financial flow
- 70% of Capex

- Building contractor: **Mitsubishi Heavy Industries (MHI)**

**Project Developer**

- **Electricity utility company**
- 30% of CCCs

- **Portuguese Government**

- **Redes Energéticas Nacionais**

- **Green Flux**

- **Green Flux**

- **Electricity & GOs**

- **GOs**

- **Non-financial flow**

- **Revenue stream**

- **70% of CCCs**

- **BOT agreement**
Benefits for Stakeholders

Investors
- Attractive return on investment
- Green investment portfolio

Energy Companies
- Access to clean energy (GOs)
- Electricity revenue

Portuguese Government
- Paris Agreement Compliance
- Net zero by 2050

Mitsubishi Heavy Industries (MHI)
- Business opportunity
- Contribute to CC solution

Local Community
- Access to affordable, renewable energy

Project Developers
- Carbon offset revenue
<table>
<thead>
<tr>
<th><strong>Investment Card</strong></th>
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<tr>
<td><strong>Ticket Size</strong></td>
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<td><strong>Purpose</strong></td>
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<tr>
<td><strong>Funding Structure</strong></td>
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<td><strong>Target Investors</strong></td>
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<tr>
<td><strong>Sector</strong></td>
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<tr>
<td><strong>Project Cost</strong></td>
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<tr>
<td><strong>Investment IRR</strong></td>
</tr>
<tr>
<td><strong>Investment Tenor</strong></td>
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</table>
| **Management Fees** | 2% of committed investments  
                             20% of Exit Profits (Subject to KPIs) |
<table>
<thead>
<tr>
<th></th>
<th>BECCS</th>
<th>Green Flux</th>
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<tbody>
<tr>
<td><strong>Construction KW</strong></td>
<td>1,136 €</td>
<td>1,136 €</td>
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<tr>
<td><strong>Opex MWh</strong></td>
<td>109 €</td>
<td>55 €</td>
</tr>
<tr>
<td><strong>40y LCOE MWh</strong></td>
<td>92 €</td>
<td>50 €</td>
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<tr>
<td><strong>Transport Emissions</strong></td>
<td>No control over emissions from transportation</td>
<td>Minimize emissions from transportations</td>
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<tr>
<td><strong>Costs</strong></td>
<td>Prohibitively expensive</td>
<td>Cost benefit of integrated bio-fuel</td>
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<td></td>
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<td>BEP below current electricity price</td>
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**Project Feasibility**

**Steadily profitable after 3rd Year**

![Graph showing revenue and cashflow from assets over years 2023-2032.]

**Costs Breakdown**

- Net profit 18%
- Tax 5%
- Facility Operations 39%
- Carbon Storage & Transportation 16%
- Land 16%

**Feasibility**

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<tr>
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<th>Base Case</th>
<th>Scenario 1</th>
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<tr>
<td>Electricity Price</td>
<td>60 €</td>
<td>50 €</td>
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<tr>
<td>Project IRR</td>
<td>9.47%</td>
<td>5.09%</td>
</tr>
<tr>
<td>Investment IRR</td>
<td>18.84%</td>
<td>1.55%</td>
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</tbody>
</table>
**SDGs & KPIs / ToC**

**7 Affordable and Clean Energy**
- 1.15m MWh pa
- Renewable electrical supply

**13 Climate Action**
- -85,000 tpa CO₂ emissions in the atmosphere

**15 Life on Land**
- 30m Willow trees planted

**8 Decent Work and Economic Growth**
- ≈ 4,000 Direct, indirect jobs created/retained
Risk analysis

**Required Inputs**
- Many Partnerships
- Land: 20,000 h
- High Initial Capex; No Collateral for 3y

**Operational Risks**
- Biodiversity
- Safe Carbon Storage
- Forest Fires

**Exit Risks**
- Achievement of SDGs
- In case of non-achievement we commit to deduct our own profits by 10%

✓ Benefits for stakeholders
✓ Dependence on negative emission technologies for net zero
✓ Feasibility study & technological review
✓ High IRR

✓ Water infrastructure
✓ Technologies for CS are maturing
✓ Invest in Biodiversity areas
Our team

Carolin
Impact & Risk Manager

Lisa
COO

Sammy
CFO

Ayman
CEO

Saara
Legal Counsel

Contact us at info@greenflux.com
Appendices
Appendix 1
Location of the Project
Figure 1: Bioenergy and carbon capture and storage (BECCS) schematic
Appendix 3 - SDGs & KPIs

7 Affordable and Clean Energy
- Land Size: 20,000 h
- Wood/h: 13 tpa
- Wood: 260,000 tpa
- Energy Density: 4.5 MWh/t
- Wood Energy: 1.15 MWh pa

13 Climate Action
- Carbon Capture: 100,000 tpa
- CC Rate: 85%
- Net CC: 85,000 tpa

15 Life on Land
- Land Size: 20,000 h
- Trees Spacing: 2.5m
- Trees/h: 1,500
- Total # Trees: 30,000,000

8 Decent Work and Economic Growth
- Stockholm Exergi
  - Direct jobs: 11,500
  - Indirect jobs: 16,500
  - Total jobs: 28,000
  - Total jobs/8: 3,500

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Appendix 4 – Theory of Change

**Inputs**

**Team**
- Capital Requirements
  - Equity investors

**Partnerships**
- Government (land lease)
- Project Developers (loan management)
- Private equity investors
- Mitsubishi Heavy Industries
- Supplier for 30m willow trees
- 75 Farmers to plant & harvest trees
- Insurance companies

**Activities**

1. Lease land from government
2. Cooperate with government to finance impact measurement studies
3. Cooperate with MHI to build the facilities
4. Cooperate with a project developer to manage the loans
5. Cooperate with auditors to compile financial and non-financial reports
6. Run of the BECCS facilities
7. Planting & harvesting of trees

**Outputs**

1. Land lease agreement signed
2. Impact Measurement Reports
3. BECCS facility built
4. # Loans agreed
5. Shareholder agreements signed
6. Staff hired (farmers; facility workers)
7. Financial & Non-financial reports
8. Contracts signed
9. 30m trees planted

**Outcomes**

-85,000 tpa of CO₂ emissions in the atmosphere
1.15m MWh pa Renewable electrical supply
30m willow trees planted
≈ 4,000 direct, indirect jobs created/retained

**Impact**

- Stay at or below 1.5 degrees
- 7.2 increase share of renewable energy in the global energy mix
- 15.2 restore degraded forests and substantially increase afforestation and reforestation globally
- 8.5 achieve full and productive employment and decent work for all women and men
Appendix 5 – LCOE Comparison

LCOE by technology, discount rate of 7%
Appendix 6 – Standard BECCS Structure
## Appendix 7 – Assumptions

<table>
<thead>
<tr>
<th>Assumptions</th>
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<tbody>
<tr>
<td>Carbon Price (EUR/TCO2)</td>
<td>5</td>
</tr>
<tr>
<td>Carbon Price Growth</td>
<td>10%</td>
</tr>
<tr>
<td>Initial Carbon Price</td>
<td>5</td>
</tr>
<tr>
<td>Go Certificate (EUR/MWh)</td>
<td>5</td>
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<tr>
<td>Power Density of Tonnes of Wood (GJ/Tonnes)</td>
<td>16</td>
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<tr>
<td>MWh Price fixed by a Concession Agreement</td>
<td>60</td>
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<tr>
<td>Loan Interest Rate</td>
<td>3%</td>
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<tr>
<td>WACC</td>
<td>10%</td>
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<tr>
<td>GDP Growth</td>
<td>3.01%</td>
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<table>
<thead>
<tr>
<th>Energy Capacity</th>
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</thead>
<tbody>
<tr>
<td>Wood Production Per Hectar Per Annum</td>
<td>13 Tonnes</td>
</tr>
<tr>
<td>Land Size</td>
<td>20,000 Hectars</td>
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<tr>
<td>Annual Wood production</td>
<td>260,000.00 Tonnes</td>
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<tr>
<td>Power Density Of Tonnes of Wood</td>
<td>16 Giga Joules</td>
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<tr>
<td>Giga Joules to MWh</td>
<td>0.277778</td>
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<tr>
<td>Power Desity of Tonnes of Wood</td>
<td>4,444448 MWh</td>
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<td>Maximum Annual Power Output</td>
<td>1,155,556.48 MWh/pa</td>
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<td>Load Factor</td>
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<td>Adjusting for Load Factor</td>
<td>1,444,445.60 MWh</td>
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<td>Nameplate Capacity</td>
<td>165 MW</td>
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## Appendix 8 – Financial Forecast

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<th>2023</th>
<th>2024</th>
<th>2025</th>
<th>2026</th>
<th>2027</th>
<th>2028</th>
<th>2029</th>
<th>2030</th>
<th>2031</th>
<th>2032</th>
<th>2033</th>
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<tr>
<td>Carbon Offset Revenue</td>
<td>-</td>
<td>327,250.00</td>
<td>359,975.00</td>
<td>395,972.50</td>
<td>435,569.75</td>
<td>479,126.73</td>
<td>527,039.40</td>
<td>579,743.34</td>
<td>637,717.67</td>
<td>701,489.44</td>
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<tr>
<td>Carbon Price per Tons of CO2</td>
<td>5</td>
<td>5.5</td>
<td>6.05</td>
<td>6.65</td>
<td>7.3205</td>
<td>8.05255</td>
<td>8.857805</td>
<td>9.7435855</td>
<td>10.7194405</td>
<td>11.78973846</td>
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<tr>
<td>Carbon Price growth rate</td>
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<td>CO2 Tons p.a.</td>
<td>85,000</td>
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<td>Electricity Revenue</td>
<td>75,111,171.20</td>
<td>75,111,171.20</td>
<td>75,111,171.20</td>
<td>75,111,171.20</td>
<td>75,111,171.20</td>
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<td>MWh</td>
<td>1,155,556</td>
<td>1,155,556</td>
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<tr>
<td>Price of Electricity</td>
<td>60</td>
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<td>60</td>
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<td>60</td>
<td>60</td>
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<tr>
<td>GO Certificate Revenue</td>
<td>5,777,782.40</td>
<td>5,777,782.40</td>
<td>5,777,782.40</td>
<td>5,777,782.40</td>
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<td>5,777,782.40</td>
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<tr>
<td>Total Revenue</td>
<td>-</td>
<td>327,250.00</td>
<td>81,248,928.60</td>
<td>81,284,926.10</td>
<td>81,324,523.35</td>
<td>81,368,080.33</td>
<td>81,415,993.00</td>
<td>81,468,696.94</td>
<td>81,526,671.27</td>
<td>81,590,443.04</td>
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<tr>
<td>EBIT (Taxable income)</td>
<td>-</td>
<td>327,250.00</td>
<td>18,218,575.15</td>
<td>18,254,572.65</td>
<td>18,294,169.90</td>
<td>18,337,726.87</td>
<td>18,385,639.54</td>
<td>18,438,343.48</td>
<td>18,496,317.82</td>
<td>18,560,089.58</td>
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<td>NOPAT</td>
<td>-</td>
<td>258,527.50</td>
<td>14,392,679.34</td>
<td>14,421,112.39</td>
<td>14,452,394.22</td>
<td>14,486,804.23</td>
<td>14,524,655.24</td>
<td>14,566,291.35</td>
<td>14,612,091.07</td>
<td>14,662,470.77</td>
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<tr>
<td>Operating Cash Flow</td>
<td>-</td>
<td>258,527.50</td>
<td>19,077,079.20</td>
<td>19,105,517.23</td>
<td>19,136,799.05</td>
<td>19,171,209.06</td>
<td>19,209,060.07</td>
<td>19,250,695.91</td>
<td>19,296,495.91</td>
<td>19,346,875.61</td>
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<td>Cashflow from Asset</td>
<td>-62,458,731.15</td>
<td>-62,458,731.15</td>
<td>-62,200,203.65</td>
<td>19,077,079.20</td>
<td>19,105,517.23</td>
<td>19,136,799.05</td>
<td>19,171,209.06</td>
<td>19,209,060.07</td>
<td>19,250,695.91</td>
<td>19,296,495.91</td>
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<td>Terminal Value</td>
<td>276,779,336.29</td>
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