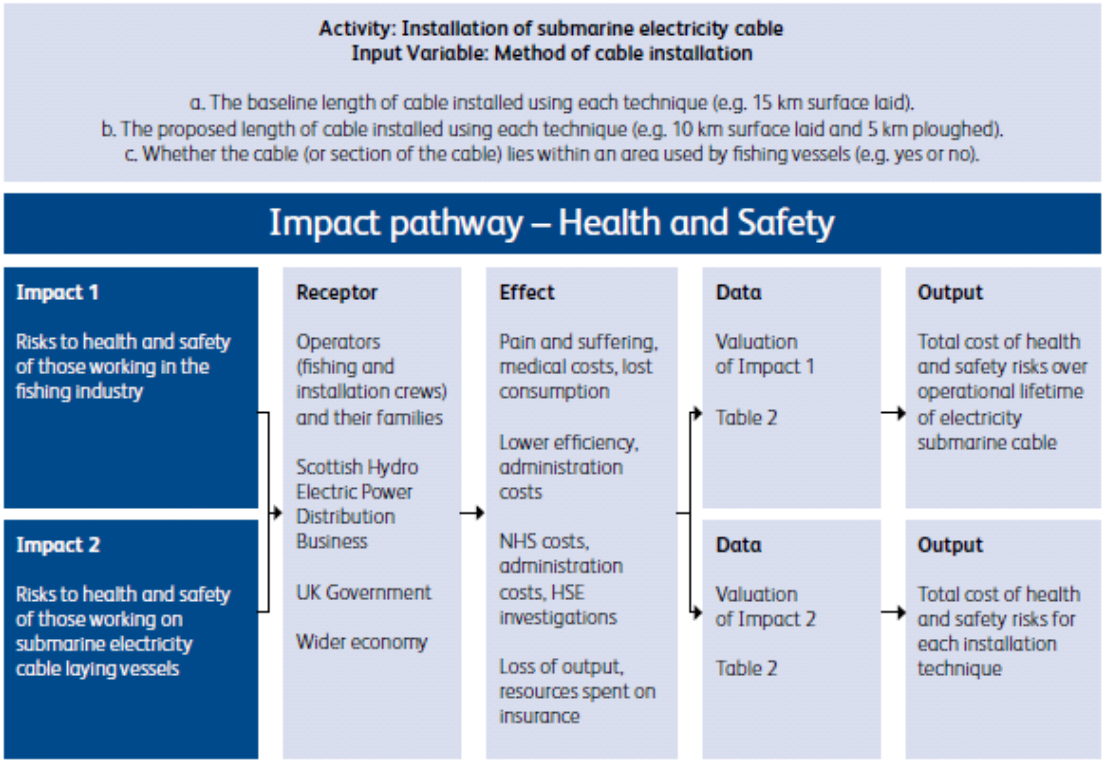
Scottish Hydro Electric Power Distribution Electricity Submarine Cables Consultation

Figure 2: Impact pathway to output – Health and Safety



1. **Do impacts one and two reflect the health and safety impacts of submarine electricity cable installation?**

Agree **Disagree** **No comment**

Reasoning:

2. Are all the receptors included?

Agree Disagree No comment

Reasoning:

3. Are the outputs that we consider encompass your main concerns about our engineering activities?

Agree Disagree No comment

Reasoning:

Table 4: Data used to support environmental estimates

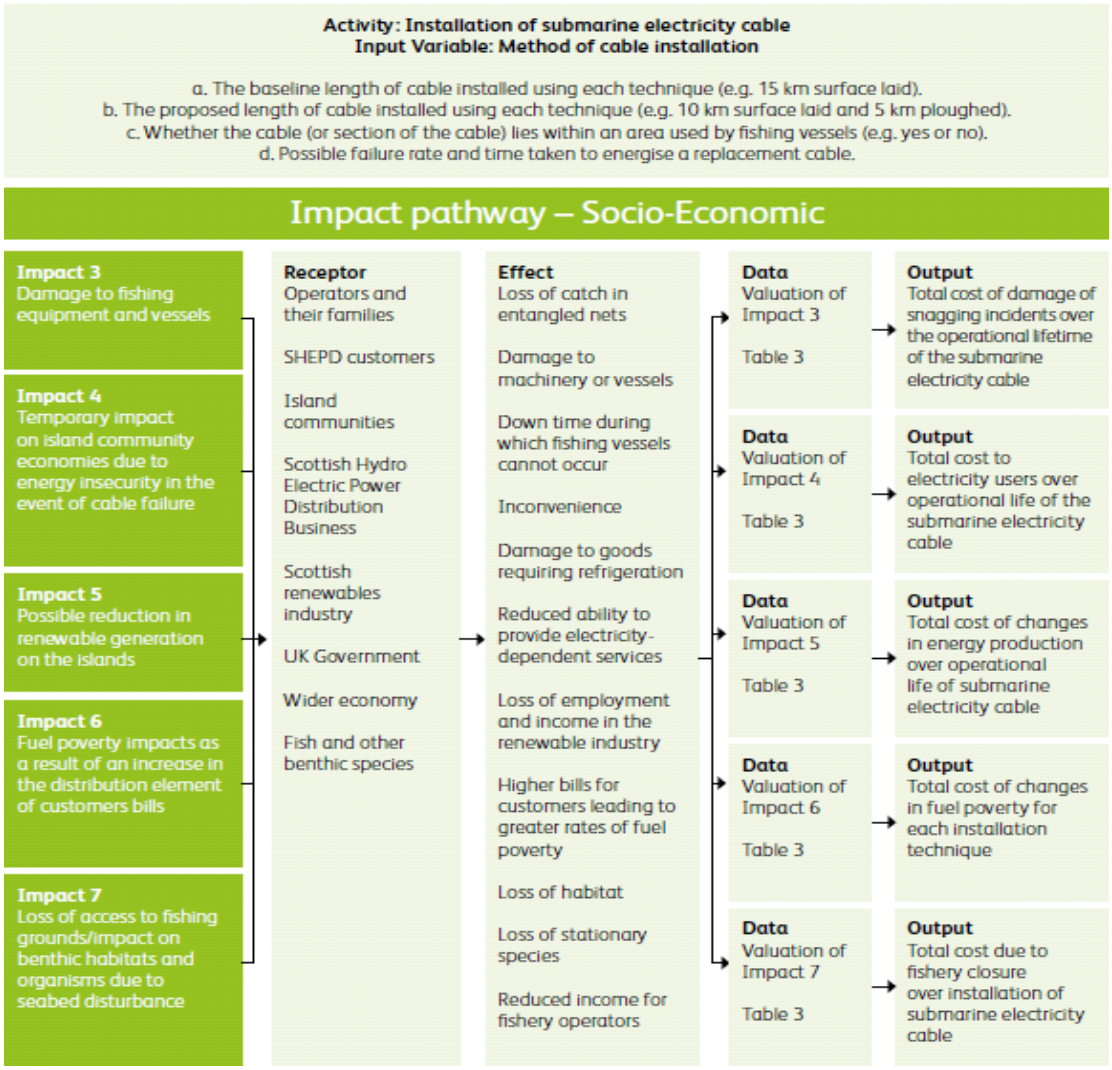
Impact	8	9
	Possible increase in greenhouse gas emissions from a reduction in renewable generation	**Greenhouse gas emissions from use of diesel generators during cable faults**
Input	The proposed length of cable installed with each technique (e.g. 10 km surface laid and 5 km ploughed)	The possible failure rate and the time taken to energise a replacement cable.
Data	Database in the model contains information on: a. Costs of cable protection type (e.g. £10 per km per year) b. Proportion of costs passed on to renewable generators (e.g. 50%) c. Existing renewable capacity connecting to SHEPD grid (e.g. 1,000 MW per year) d. Existing grid connection costs (e.g. £100 per MW per year) e. Impact of costs on generation capacity (e.g. 1% increase in costs leads to 0.5% decrease in generation) f. Impact on GHG emissions from reduction in renewables (e.g. 1GWh:237tCO^2e) g. DECC estimates of the cost of GHG emissions (e.g. £5 tCO^2e) h. The length of time for the assessment period (e.g. 45 years) i. Discount rate (e.g. 3.5% for years 0–30 and 3.0% for years 30–45)	Database in the model contains information on: a. Failure rate of different cable types (e.g. 0.005 failures per km per year) b. Time taken to fix each type of cable (e.g. 24 days per failure) c. Rate of fuel use in backup generators and repair vessels (e.g. 1 tonne per day) d. Carbon intensity in generators (e.g. 0.5 tonnes CO^2e per tonne of fuel) e. The length of time for the assessment period (e.g. 45 years) f. DECC carbon price (e.g. £50 per tonne of CO^2) g. Discount rate (e.g. 3.5% for years 0–30 and 3.0% for years 30–45)
Output	Total cost of greenhouse gas emissions from the reduction in renewables	Total cost of greenhouse gas emissions over period of cable fault

4. Do you agree with the data that is used to quantify impacts?

Agree Disagree No comment

Reasoning:

Figure 3: Impact pathway to output – Socio-Economic



5. Do impacts three to seven reflect the socio-economic impacts of submarine electricity cable installation?

Agree **Disagree** **No comment**

Reasoning:

6. Are all the receptors included?

Agree Disagree No comment

Reasoning:

7. Are the outputs that we consider encompass your main concerns about our engineering activities?

Agree Disagree No comment

Reasoning:

Table 3: Data used to support socio-economic estimates

Impact	3	4
	Damage to fishing equipment and vessels	**Temporary impact on island community economies due to energy insecurity in the event of cable failure**
Input	a. The baseline length of cable installed with each technique (e.g. 15 km surface laid) b. The proposed length of cable installed with each technique (e.g. 10 km surface laid and 5 km ploughed) c. Whether the cable (or section of the cable) lies within an area used by fishing vessels (e.g. yes or no)	a. The baseline length of cable installed with each technique (e.g. 15 km surface laid) b. The proposed length of cable installed with each technique (e.g. 10 km surface laid and 5 km ploughed) c. The island to which the cable connects (e.g. Shetland)
Data	1. Frequency of damage to machinery (e.g. 0.01339 incidents per km per year) 2. Cost of machinery damage (e.g. £7,500 per incident) 3. Frequency of damage to vessels (e.g. 0.00893 incidents per km per year) 4. Cost of vessel damage (e.g. £1,500 per incident) 5. Frequency of incidents where fishing days are lost (e.g. 0.00893 incidents per km per year) 6. Cost of lost time (e.g. £5,214 per incident) 7. Frequency of incidents where catch is lost (e.g. 0.01786 per km per year) 8. Cost of lost catch (e.g. £1,750 per incident) 9. The length of time for the assessment period (e.g. 45 years) 10. Discount rate (e.g. 3.5% for years 0–30 and 3.0% for years 31–45)	1. Fault rate for different cable installation techniques (e.g. 0.05 faults per km per year) 2. Average length of outage during faults (e.g. 0.5 MWh per fault) 3. Number of domestic, SME, and C&I users on each island (e.g. on Isle of Barra 845 domestic) 4. Value of Lost Load for domestic, SME, and C&I users (e.g. £9,888 per MW/h for domestic users) 5. The length of time for the assessment period (e.g. 45 years) 6. Discount rate (e.g. 3.5% for years 0–30 and 3.0% for years 31–45)
Output	Total cost of damage of snagging incidents over the operational lifetime of the submarine electricity cable	Total cost to electricity users over the operational life of the submarine electricity cable

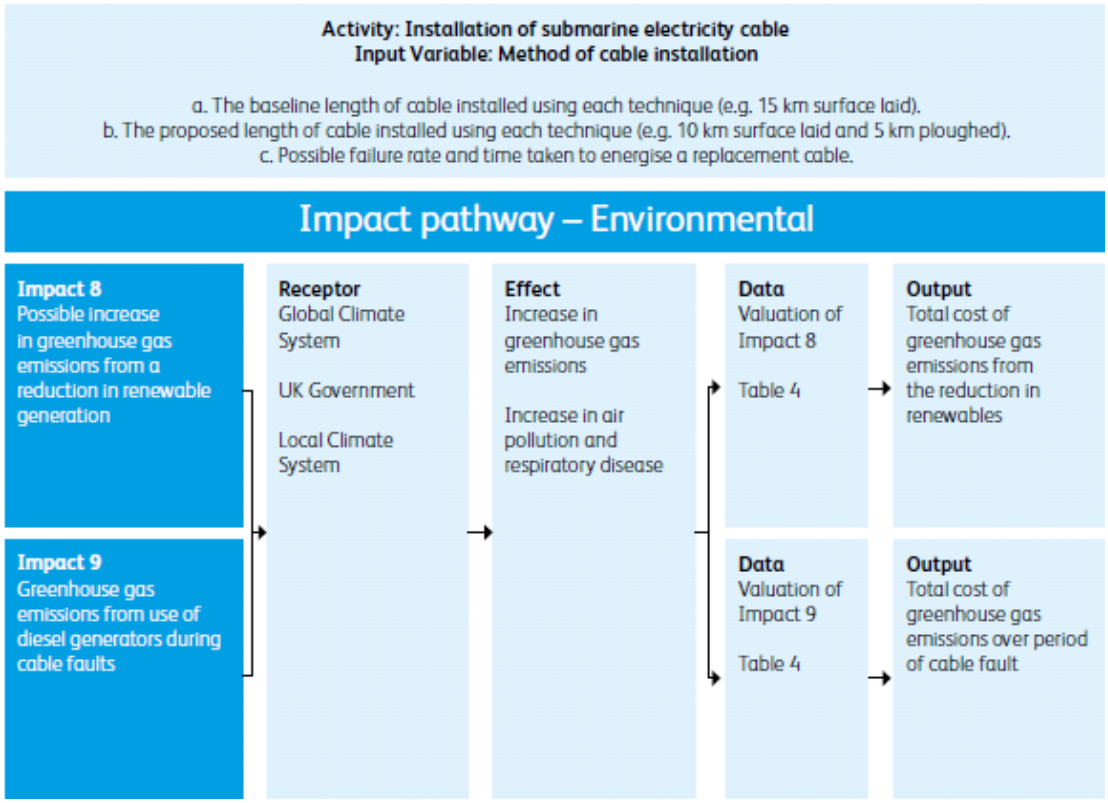
5	6	7
Possible reduction in renewable generation on the islands	**Fuel poverty impacts as a result of an increase in the distribution element of customers' bills**	**Loss (temporary/permanent) of access to fishing grounds/impacts on benthic habitats and organisms due to seabed disturbance**
a. The proposed length of cable installed with each technique (e.g. 10 km surface laid and 5 km ploughed)	a. The proposed length of cable installed with each technique (e.g. 10 km surface laid and 5 km ploughed)	The proposed length of cable installed with each technique (e.g. 10 km surface laid and 5 km ploughed) Economic value of fisheries crossing each section of the cable route (e.g. £150,000 per year)
1. Costs of cable protection type (e.g. £10 per km per year) 2. Proportion of costs passed on to renewable generators (e.g. 50%) 3. Existing renewable capacity connecting to SHEPD grid (e.g. 1,000 MW per year) 4. Existing grid connection costs (e.g. £100 per MW per year) 5. Impact of costs on generation capacity (e.g. 1% increase in costs leads to 0.5% decrease in generation) 6. GVA per unit of renewable energy generated (e.g. £200,000 per MW per year) 7. The length of time for the assessment period (e.g. 45 years) 8. Discount rate (e.g. 3.5% for years 0–30 and 3.0% for years 31–45)	1. Costs to SHEPD of cable installation technique (e.g. £ per km) 2. Proportion of costs allocated to end users (e.g. 50%) 3. Existing average fuel bill (e.g. £500 per household per year) 4. Ratio of changes in fuel prices to changes in fuel poverty (e.g. 1:0.4) 5. Existing level of fuel poverty (e.g. 39.1%) 6. Number of SHEPD domestic customers (e.g. 683,831 households) 7. Investment required to remove a household from fuel poverty (e.g. £7,800 per household)	Database in the model contains information on: a. Time taken for cable installation for each technique (e.g. 5 days per km)
Total cost of changes in energy production over the operational life of submarine electricity cable	Total cost of changes in fuel poverty for each submarine electricity cable installation technique	Total cost due to fishery closure over installation of submarine electricity cable

8. Do you agree with the data that is used to quantify impacts?

Agree **Disagree** **No comment**

Reasoning:

Figure 4: Impact pathway to output – Environmental



9. Do impacts eight to nine reflect the environmental impacts of submarine electricity cable installation?

Agree **Disagree** **No comment**

Reasoning:

10. Are all the receptors included?

Agree **Disagree** **No comment**

Reasoning:

11. Are the outputs that we consider encompass your main concerns about our engineering activities?

Agree **Disagree** **No comment**

Reasoning:

Table 4: Data used to support environmental estimates

Impact	8	9
	Possible increase in greenhouse gas emissions from a reduction in renewable generation	**Greenhouse gas emissions from use of diesel generators during cable faults**
Input	The proposed length of cable installed with each technique (e.g. 10 km surface laid and 5 km ploughed)	The possible failure rate and the time taken to energise a replacement cable.
Data	Database in the model contains information on: a. Costs of cable protection type (e.g. £10 per km per year) b. Proportion of costs passed on to renewable generators (e.g. 50%) c. Existing renewable capacity connecting to SHEPD grid (e.g. 1,000 MW per year) d. Existing grid connection costs (e.g. £100 per MW per year) e. Impact of costs on generation capacity (e.g. 1% increase in costs leads to 0.5% decrease in generation) f. Impact on GHG emissions from reduction in renewables (e.g. 1GWh:237tCO^{2}e) g. DECC estimates of the cost of GHG emissions (e.g. £5 tCO^{2}e) h. The length of time for the assessment period (e.g. 45 years) i. Discount rate (e.g. 3.5% for years 0–30 and 3.0% for years 30–45)	Database in the model contains information on: a. Failure rate of different cable types (e.g. 0.005 failures per km per year) b. Time taken to fix each type of cable (e.g. 24 days per failure) c. Rate of fuel use in backup generators and repair vessels (e.g. 1 tonne per day) d. Carbon intensity in generators (e.g. 0.5 tonnes CO^{2}e per tonne of fuel) e. The length of time for the assessment period (e.g. 45 years) f. DECC carbon price (e.g. £50 per tonne of CO^2) g. Discount rate (e.g. 3.5% for years 0–30 and 3.0% for years 30–45)
Output	Total cost of greenhouse gas emissions from the reduction in renewables	Total cost of greenhouse gas emissions over period of cable fault

12. Do you agree with the data that is used to quantify impacts?

Agree Disagree No comment

Reasoning:

Figure 5: Impact pathway to output – Wider Economic and Engineering

Activity: Installation of submarine electricity cable
Input Variable: Method of cable installation

a. The baseline length of cable installed using each technique (e.g. 15 km surface laid).
b. The proposed length of cable installed using each technique (e.g. 10 km surface laid and 5 km ploughed).
c. Possible failure rate and time taken to energise a replacement cable.

Impact pathway – Wider Economic and Engineering

	Receptor	Effect	Data	Output
Impact 10 Increase installation costs (including specialist equipment, raw materials, and use of extra vessels)	Scottish Hydro Electric Power Distribution Business SHEPD customers Local economy Scottish economy	Permanent increase in costs Removal of protection before fault can be repaired Hire of specialist equipment and vessels Further vessels for restatement of protection Reduced risk of third party faults Increased mean time between failures Increased maintenances and related survey costs	**Data** Valuation of Impact 10 Table 5	**Output** Total engineering cost incurred during installation of submarine electricity cable
Impact 11 Impacts due to increased repair costs (should the cable fault)			**Data** Valuation of Impact 11 Table 5	**Output** Total engineering costs incurred during repair of submarine electricity cable
Impact 12 Impacts on reduced fault rate and increased cable mean time between failure			**Data** Valuation of Impact 12 Table 5	**Output** Total cost in regard to the decreased need to repair electricity submarine cable faults
Impact 13 Change to operating, maintenance and decommissioning costs			**Data** Valuation of Impact 13 Table 5	**Output** Total engineering cost of changes in operation, maintenance and decommission of alternative submarine cable installation methods

13. Do impacts ten to thirteen reflect the wider economic and engineering impacts of submarine electricity cable installation?

Agree **Disagree** **No comment**

Reasoning:

14. Are all the receptors included?

Agree **Disagree** **No comment**

Reasoning:

15. Are the outputs that we consider encompass your main concerns about our engineering activities?

Agree **Disagree** **No comment**

Reasoning:

Table 5: Data used to support wider economic and engineering estimates

Impact	10	11	12	13
	Increased installation costs (including specialist equipment, raw materials, and the use of extra vessels)	**Impacts due to increased repair costs (should the cable fault)**	**Impacts on reduced fault rate and increased cable mean time between failure**	**Changes to operating, maintenance and decommissioning costs**
Input	a. The proposed length of cable laid with each technique (e.g. 10 km surface laid and 5 km ploughed)	a. The baseline length of cable laid with each technique (e.g. 10 km surface laid and 5 km ploughed) b. The proposed length of cable laid with each technique (e.g. 10 km surface laid and 5 km ploughed)	a. The length of cable laid with each technique (e.g. 10 km surface laid and 5 km ploughed)	a. The proposed length of cable laid with each technique (e.g. 10 km surface laid and 5 km ploughed)
Data	1. Time taken for laying for each technique (e.g. 5 days per km) 2. Day rates for cable laying vessels (e.g. £1,000 per day) 3. Day rates for additional vessels for protection installation (e.g. £1,000 per day) 4. Price of cable (e.g. £1,000 per km)	1. Time taken for recovering the cable for each technique (e.g. 5 days per km) 2. Cost of recovering cable (e.g. £1,000 per km) 3. Time taken to relay cable including reinstallation of protection (e.g. 5 days per km) 4. Cost of relaying cable including protection (e.g. £1,000 per km)	1. Fault rate (e.g. faults per year per km)	1. Typical operation and maintenance costs (e.g. £1,000 per km per year)
Output	Total engineering cost incurred during installation of submarine electricity cable	Total engineering costs incurred during repair of submarine electricity cable	Total cost in regard to the decreased need to repair electricity submarine cable faults	Total engineering cost of changes in operation, maintenance and decommission of alternative submarine cable installation methods

16. Do you agree with the data that is used to quantify impacts?

Agree **Disagree** **No comment**

Reasoning: