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EcoRoute

Methodology and Business Model

FOR19: Green Digitalization and App Development

Group 1

NORWEGIAN SCHOOL OF ECONOMICS

Contents

Introduction

Transport accounts for roughly 21% of global CO_2 emissions, with road freight, maritime shipping, and cargo aviation together responsible for a large and growing share (Ritchie, 2020). For companies that move goods across borders, freight emissions have shifted from an environmental concern to a regulatory and financial obligation. The Corporate Sustainability Reporting Directive requires detailed Scope 3 transport disclosures (European Parliament and Council of the European Union, 2022), and the EU Emissions Trading System now extends to maritime shipping, with full allowance surrender obligations from 2026 (European Parliament and Council of the European Union, 2023). Every tonne of CO_2 carries a price on the open EU allowance market, recently trading at 77 EUR per tonne (Trading Economics, 2026).

EcoRoute is a B2B web application that translates shipment-level decisions into traceable emission figures and a concrete carbon cost in Norwegian kroner. Users register road, sea, and air routes, log shipments with mode-specific parameters, and receive automatic CO_2 calculations with an EU ETS permit cost. By grounding calculations in tonne-kilometres and converting emissions into a financial figure, the tool is designed for operational planning and carbon cost accounting for companies.

This paper accompanies the working application developed and deployed on Amazon Web Services during the FOR19 Green Digitalization and App Development course at NHH. The first section of this paper presents the methodology: emission factors by mode, subcategory, and fuel type, the calculation logic, and the translation of CO_2 into a carbon cost. The following section presents the proposed business model for a complete product, including target market, value proposition, and revenue structure.

Methodology

Approach and Data Sources

EcoRoute calculates emissions using the activity-based formula distance $\times$ cargo weight $\times$ emission factor, expressed in tonne-kilometres (tkm). This is the standard form in freight emission accounting and allows consistent comparison across transport modes.

Emission factors come from the GLEC Framework v3.2 (Smart Freight Centre, 2025), the industry standard aligned with ISO 14083:2023. GLEC reports factors under three system boundaries: Well-to-Tank (WTT), Tank-to-Wheel (TTW), and Well-to-Wheel (WTW). EcoRoute applies TTW across road, maritime, and air. TTW covers the direct combustion emissions the operator

is responsible for. Upstream emissions from fuel production are excluded. This matches the EU ETS scope, which regulates only combustion emissions from fuel used on board. EcoRoute's NOK figure therefore reflects actual allowance exposure rather than a broader lifecycle estimate.

Carbon pricing uses the EU ETS allowance price at 77 EUR per tonne (Trading Economics, 2026), with EUR/NOK fixed at 11.20 as of 17 April 2026.

Core Formula and Worked Example

Every shipment calculation applies the same structure:

$$\text{CO}_2 = \text{Distance (km)} \times \text{Cargo (tonnes)} \times \text{Emission Factor}$$

- **Distance:** route length in kilometres
- **Cargo:** shipment weight in metric tonnes
- **Emission Factor:** kg CO_2e per tkm (TTW), by transport type, subcategory, and fuel

The user selects transport type and subcategory when creating a route and fuel type when logging each shipment. Subcategory is fixed for all shipments on that route, ensuring consistency across historical records.

Worked example: Bergen → Amsterdam (General cargo, Small)

Distance = 1,120 km | Cargo = 0.5 t | Fuel = HFO

$$\text{CO}_2 = 1{,}120 \times 0.5 \times 0.0203 = 11.37 \text{ kg CO}_2$$

$$\text{Carbon Cost} = (11.37/1{,}000) \times 77 \times 11.20 = 9.80 \text{ NOK}$$

The same shipment sent by air, below the 1,500 km threshold, uses the short-haul factor of 1.255 kg CO_2e per tkm:

Contrast: Bergen → Amsterdam (Short-haul air)

Distance = 837 km | Cargo = 0.5 t | Fuel = Jet A-1

$$\text{CO}_2 = 837 \times 0.5 \times 1.255 = 525.2 \text{ kg CO}_2$$

$$\text{Carbon Cost} = (525.2/1{,}000) \times 77 \times 11.20 = 453.0 \text{ NOK}$$

The same shipment costs 9.80 NOK by sea and 453.0 NOK by air. The 46-fold difference reflects the shorter but far more carbon-intensive flight path.

Road Freight

Road freight emissions scale sharply with vehicle size. A Large truck emits roughly 64% less CO_2 per tkm than a Small truck. EcoRoute groups the GLEC vehicle classes into three tiers:

Subcategory	**GVW**	**Diesel**	**CNG**	**LNG**
Small	3.5–7.5 t	0.258	0.229	—
Medium	7.5–20 t	0.160	0.142	—
Large	20–40 t	0.094	0.085	0.090

Table 1: CO_2e emission factors for road freight (kg CO_2e per tkm, TTW). Source: Smart Freight Centre (2025), GLEC Framework v3.2, Table 8, p. 101. Each tier is an unweighted average of the underlying GLEC GVW classes.

Each EcoRoute tier aggregates specific GLEC vehicle classes. Small uses the rigid truck 3.5–7.5 t GVW class directly. Medium is the unweighted mean of the 7.5–12 t and 12–20 t rigid classes. Large is the unweighted mean of the 20–26 t and 26–32 t rigid classes together with the articulated $\leq$34 t and 34–40 t classes.

LNG is offered only for Large trucks because fuel system weight and range make it impractical for light-duty or urban distribution. Petrol is excluded as it is not used commercially in freight and does not appear in GLEC data.

Maritime Shipping

EcoRoute models two vessel types that together cover most non-container shipping: general cargo vessels (project loads, non-containerised break bulk, building materials) and bulk carriers (dry bulk commodities such as grain, coal, ore, and cement). Each type is split into two size classes by deadweight tonnage (dwt). Larger vessels achieve higher capacity utilisation and run more efficient engines, producing substantially lower emissions per tonne moved.

Vessel type	Size class	HFO	VLSFO	MDO
General cargo	Small ($\leq$ 9,999 dwt)	0.0203	0.0203	0.0197
General cargo	Large ($\geq$ 10,000 dwt)	0.0122	0.0122	0.0119
Bulk carrier	Small ($\leq$ 34,999 dwt)	0.0169	0.0169	0.0164
Bulk carrier	Large ($\geq$ 35,000 dwt)	0.0039	0.0039	0.0037

Table 2: CO_2e emission factors for maritime shipping (kg CO_2e per tkm, TTW). Source: Smart Freight Centre (2025), GLEC Framework v3.2, Tables 14–15, pp. 107–108. Each class is an unweighted arithmetic mean of the underlying GLEC dwt classes. HFO = Heavy Fuel Oil, VLSFO = Very Low Sulphur Fuel Oil, MDO = Marine Diesel Oil.

Each size class aggregates specific GLEC dwt ranges. For general cargo, Small is the unweighted mean of the 0–4,999 and 5,000–9,999 dwt classes. Large is the unweighted mean of 10,000–19,999 and 20,000+ dwt.

For bulk carriers, Small covers 0–9,999 and 10,000–34,999 dwt. Large covers 35,000–59,999, 60,000–99,999, 100,000–199,999, and 200,000+ dwt. All averages are unweighted.

Air freight

Air freight is split into short-haul ($<$ 1,500 km) and long-haul ($\geq$ 1,500 km), following the GLEC Framework v3.2, aligned with SBTi and ISO 14083 (Smart Freight Centre, 2025). Take-off and climb consume a disproportionate share of fuel on short routes, making them substantially less efficient per tkm.

Subcategory	Distance	Emission Factor
Short-haul	$<$ 1,500 km	1.255
Long-haul	$\geq$ 1,500 km	0.503

Table 3: CO_2e emission factors for cargo aviation (kg CO_2e per tkm, TTW). Source: Smart Freight Centre (2025), GLEC Framework v3.2, Module 2, Table 1, p. 94, dedicated freighter operations.

Factors apply to dedicated freighters. EcoRoute focuses exclusively on freighter operations because the planning context is dedicated cargo shipments, where the full flight emissions are allocated to cargo rather than shared with passengers.

GLEC's factors use IATA industry-average freight load factors, which reflect actual operational loading across the global freighter fleet rather than theoretical capacity. This provides a

defensible baseline when operator-specific data is unavailable. A +95 km distance uplift for taxiing, holding, and out-of-route deviations is already built into the factor, so EcoRoute uses the user's great-circle distance without further adjustment.

All commercial cargo aircraft essentially operate on kerosene-type jet fuel, either Jet A (standard in the United States) or Jet A-1 (standard internationally, including Europe), which differ only in freezing point (International Civil Aviation Organization, 2024). The GLEC Framework does not distinguish between the two grades and applies a single emission factor to all cargo aviation (Smart Freight Centre, 2025). EcoRoute follows this convention. When logging an air shipment, the user selects Jet A / Jet A-1 as the fuel. Hydrogen and electric cargo aircraft do not yet operate commercially and are excluded from the model.

From Emissions to Carbon Cost

EcoRoute converts emissions into a financial figure. For every logged shipment, CO_2 emissions are multiplied by the EU ETS allowance price and converted to Norwegian kroner:

$$\text{Carbon Cost (NOK)} = \frac{\text{CO}_2\text{ (kg)}}{1{,}000} \times 77\text{ EUR} \times 11.20$$

- **77 EUR:** EU ETS allowance price per tonne CO_2 (Trading Economics, 2026)
- **11.20:** EUR/NOK exchange rate as of 17 April 2026

Applied to the Bergen–Amsterdam sea freight example, 11.37 kg CO_2 equals 9.80 NOK.

Emissions and carbon cost are computed at logging using the factors and price in effect at that moment. Records remain editable for correction, but are not automatically recalculated when factors or prices change. This preserves the historical reference point for each shipment.

Assumptions and Limitations

EcoRoute is designed as a carbon cost accounting and planning system. The simplifications below define the boundaries of that scope.

Distance is user-provided rather than geocoded from origin and destination. This places responsibility for route realism on the user but avoids the geocoding errors and detour assumptions that automated systems introduce. Zero-emission fuels (electric and hydrogen) are modelled as zero under TTW, consistent with the absence of direct combustion. Upstream electricity or hydrogen production falls outside the TTW scope.

Road and maritime emission factors within each EcoRoute size class are unweighted arithmetic

means of the underlying GLEC vehicle or vessel classes. This assumes each class is equally represented in actual fleet distribution, which is rarely true. In global bulk shipping, 35,000–100,000 dwt vessels dominate while 200,000+ dwt vessels are rare, so a fleet-weighted mean would land slightly above the current 0.0039 kg/tkm for Large bulk. Fleet-weighted averaging would require AIS or IMO distribution data that is not available within the project scope. Unweighted aggregation is consistent with GLEC's own practice for class-level aggregates.

GLEC's non-container maritime factors include a 10% upward adjustment built in by GLEC to reduce underestimation risk. The aggregate approach does not model individual load factors, empty return legs, or voyage-specific conditions such as weather, currents, or routing choices. Operators with consistently high- or low-utilisation patterns may see real emissions diverge from the default figures.

EcoRoute's TTW boundary is deliberately aligned with the EU ETS scope, which regulates only direct combustion emissions. Scope 3 reporting under CSRD or the GHG Protocol typically uses WTW, which also includes upstream fuel production. Users who need WTW figures for sustainability reporting can apply a WTT uplift of approximately 20% for diesel and 25–30% for LNG to EcoRoute's outputs.

The EU ETS price (77 EUR/tonne) and EUR/NOK rate (11.20) are held constant rather than pulled from live feeds. Stable reference values produce comparable results across reporting periods without distortion from short-term market fluctuations.

EcoRoute's outputs are planning estimates. They are sufficient for comparing routes, choosing transport modes, and forecasting quarterly carbon exposure. Regulatory compliance or verified carbon reporting requires operator-specific data and certified validation against a reporting framework.

Business Model

Objective and Mission Statement

For any large company that moves goods across borders, freight emissions have become a reporting obligation. The Corporate Sustainability Reporting Directive requires detailed Scope 3 transport disclosures across all modes (European Parliament and Council of the European Union, 2022), and for freight-intensive companies, transport is typically the largest component of that disclosure. Measuring it accurately, and translating it into a financial figure, is no longer optional.

EcoRoute is built for this problem. The platform converts shipment-level decisions into traceable emission figures and a concrete EU carbon cost in Norwegian kroner, across all three transport modes, within a single workflow. Routes are registered once, shipments are logged as they occur, and accumulated carbon exposure is always visible through a live dashboard. This makes EcoRoute suited for financial planning and accounting under enforced regulations.

The maritime module reflects the particular urgency facing shipping operators. The EU ETS places a direct allowance surrender obligation on shipping companies operating in EU and EEA waters, with full coverage from 2026 (European Parliament and Council of the European Union, 2023). EcoRoute supports vessel type and size class selection, fuel-specific emission factors covering HFO, VLSFO, and MDO, and three distinct fuel options per vessel configuration. The GLEC emission factors are expressed in CO_2e, which accounts for the climate impact of methane slip and other greenhouse gases released in transport (Smart Freight Centre, 2025). This means a shipping operator can translate a single voyage into the NOK cost of the allowances they will need to surrender, turning EcoRoute from a reporting aid into a tool to forecast a direct financial liability.

Target Market and Customer Segments

EcoRoute's addressable market is markets that are dominated by organisations with material freight volumes subject to CSRD Scope 3 reporting, or companies under EU-ETS obligations.

Primary segment: freight-dependent companies subject to CSRD

Manufacturers, exporters, and logistics-heavy businesses that move goods by road, sea, or air and fall within CSRD scope face an annual obligation to measure and disclose their emissions. EcoRoute reduces the administrative cost of that obligation and surfaces the embedded carbon cost their carriers pass through in freight rates.

Secondary segment: maritime shipping operators with direct EU ETS obligations

Shipping companies operating vessels of 5,000 gross tonnage and above in EU and EEA waters must purchase and surrender allowances against their verified emissions. For this segment, accurate per-voyage emissions tracking is a compliance necessity, not just a reporting convenience.

Third segment: freight forwarders

Logistics service providers arranging freight across multiple clients face an aggregated version of the same reporting requirement. Delivering emissions and carbon cost data alongside shipment confirmation is a service clients increasingly require under CSRD.

Launch market: Norwegian freight-intensive exporters, with Bergen as entry point

Norway participates fully in EU ETS as an EEA member. Norwegian exporters, such as aquaculture companies, whose products travel by truck, vessel, and aircraft to markets across Europe and Asia, face both CSRD Scope 3 obligations and, for those operating their own vessels, direct EU ETS exposure. Bergen concentrates the headquarters of the industry's largest operators and provides a high-density, high-urgency entry point for EcoRoute. A validated Norwegian launch provides the reference cases needed to expand into the wider EU market, where the same regulatory frameworks apply to a significantly larger base of companies.

Value Proposition

Multi-modal Scope 3 accounting in one place

EcoRoute handles road, maritime, and air freight within a consistent tonne-kilometre framework, using mode-specific and fuel-specific emission factors from the GLEC Framework. A company using all three modes logs everything in one platform and sees combined carbon exposure in a single dashboard.

Emissions converted into financial terms, per shipment

Every logged shipment returns a carbon cost in Norwegian kroner against the EU ETS allowance price. This puts carbon cost in front of operations and procurement at the moment a route decision is being made, rather than appearing as a line item in an annual sustainability report.

A live carbon ledger

Each shipment record freezes the emission and cost calculation at the moment of logging. The historical record remains stable and traceable even as allowance prices or emission factors change. The dashboard aggregates accumulated KPIs, total carbon cost exposure, and full shipment history automatically.

Deeper maritime support for ETS compliance

Maritime shipments include vessel type, size class, and fuel selection that reflect the EU ETS compliance boundary directly. This gives shipping operators a per-voyage cost figure that maps onto their actual allowance obligation, not just a generic emissions estimate.

Business Model and Revenue

EcoRoute is designed as a B2B SaaS platform with tiered monthly subscriptions. The current version is a minimum viable product (MVP) developed and deployed during the FOR19 course. It implements route registration, shipment logging, automatic CO_2 and carbon cost calculation, and a dashboard with cumulative KPIs. Multi-user registration is supported, though users cannot yet view or edit each other's routes. Exportable reports and collaborative multi-user access are planned for a commercial release.

Free tier

A single-user account with route registration, shipment logging, automatic CO_2 and carbon cost calculation, and dashboard access, capped at five routes and fifty shipments. This is sufficient to evaluate the tool on a representative subset of a company's freight operations without replacing a paid subscription.

Professional tier

Removes usage caps and adds exportable shipment history. Targeted at single-site operators or freight forwarders managing a defined portfolio of routes. Pricing would scale with usage, implemented by an indicative rate of 5 NOK per logged shipment, with a monthly minimum of 1000 NOK per month.

Enterprise tier

Multi-user access with role-based permissions, designed for companies managing emissions across departments or subsidiaries. This tier would add integration capabilities for enterprise logistics systems and API access for automated shipment ingestion. Pricing would be negotiated per organisation based on volume and integration scope.

Retention logic

The SaaS model fits the use case. CSRD reporting is an annual recurring obligation, EU ETS allowance costs are ongoing, and the value EcoRoute delivers, a continuously updated carbon cost ledger, compounds with each logged shipment. As the historical record grows, it becomes increasingly costly for a customer to replicate the accumulated data in a spreadsheet, creating a natural switching cost that supports retention without contractual lock-in.

Current status

The MVP demonstrates the core calculation engine, data model, and dashboard. Exportable reports, collaborative multi-user access, and API integration are planned development items required before a commercial launch.

Positioning Against Existing Tools

Several freight carbon calculators exist in the market, ranging from free single-mode tools to enterprise API platforms. Table 4 summarises the positioning of three representative platforms against EcoRoute.

EcoTransIT World

EcoTransIT World is the most widely deployed freight emission calculator globally, certified under ISO 14083 and the GLEC Framework (EcoTransIT World, 2026b). It offers a free online calculator, but its business solutions are licensed on a SaaS basis and oriented toward large operators (EcoTransIT World, 2026a). It does not translate emissions into a per-shipment EU ETS cost.

Searoutes

Searoutes provides GLEC-accredited, API-based emission calculation with particular strength in maritime routing, calibrated against historical AIS vessel data (Searoutes, 2026a). Its ocean routing API starts at 400 EUR per month (Searoutes, 2026b), placing it out of reach for mid-size companies needing a self-service tool.

Carrier-provided calculators

Carrier-provided calculators, such as those offered by GEODIS (GEODIS, 2026) and Flexport (Flexport, 2026), provide free single-shipment estimates but typically cover only one mode, report emissions without financial translation, and maintain no historical record.

Table 4: Competitive positioning of freight emission tools.

Feature	EcoRoute	EcoTransIT	Searoutes
Road / Sea / Air	✓	✓	✓
EU ETS cost per shipment	✓	—	—
Persistent shipment log	✓	—	—
Self-service web UI	✓	✓	—
API for automation	—	✓	✓
GLEC/ISO accreditation	—	✓	✓
Free entry tier	✓	✓	Trial only

EcoRoute occupies the space between free single-shipment calculators and enterprise API platforms. Its differentiators are the EU ETS carbon cost per shipment, the persistent shipment ledger, and a self-service interface accessible without developer resources. The trade-off is that EcoRoute lacks GLEC accreditation, vessel-specific modelling, and system integration capabilities. Pursuing accreditation and API access would be natural next steps once the core product is validated with pilot customers.

Go-to-Market Strategy and Key Partnerships

A commercial launch would begin in Bergen, targeting three to five pilot customers among the most regulatory-exposed freight operators in the cluster. The immediate objective is structured product feedback and case studies that anchor subsequent sales conversations. Incubator programmes such as Startup Lab Bergen and the Bergen Chamber of Commerce would provide early visibility and access to the local business network.

Target partnerships for market access and methodological credibility include industry bodies such as Seafood Norway and the Norwegian Shipowners' Association. In the medium term, integration partnerships with enterprise logistics platforms would reduce manual entry friction for larger customers.

Because EU ETS and CSRD apply consistently across EU and EEA member states, a validated Norwegian launch provides a direct expansion path into freight-intensive markets in the Netherlands, Germany, Denmark, and beyond, without methodological reworking (European Parliament and Council of the European Union, 2022, 2023).

Summary

EcoRoute applies one consistent formula: Distance × cargo weight × emission factor, across road, sea, and air freight, using emission factors drawn from the GLEC Framework v3.2 under the TTW boundary aligned with the EU ETS scope. Factors are differentiated by transport mode, subcategory, and fuel type, and every shipment is converted into a carbon cost in Norwegian kroner at a reference ETS price of 77 EUR per tonne.

The financial translation is what separates EcoRoute from a generic emissions calculator. In the Bergen–Amsterdam example worked through in Section 2, the same 0.5-tonne cargo costs 9.80 NOK in carbon exposure by sea and 453.0 NOK by air, a 46-fold difference that reflects the carbon intensity gap between the two modes. EcoRoute puts trade-offs like these in front of the operator before the shipment is dispatched, but also as a means of tracking shipments that have been made.

The business model is built on this translation. EcoRoute is positioned as a B2B SaaS platform for freight-dependent companies facing CSRD Scope 3 obligations and, in the maritime case, direct EU ETS allowance costs. Bergen's aquaculture cluster provides a high-density launch market where regulatory exposure is immediate, with potential for expanding into a wider EU market.

What EcoRoute produces today is a planning estimate, not a certified report. User-provided distances, averaged emission factors, and a static carbon price all introduce uncertainty that a compliance-grade system would need to eliminate.

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