

Kellogg-Morgan Stanley Sustainable Investing Challenge



Fund for E-Bus Batteries (FEB)

Our fund aims to accelerate the **adoption of electric buses (e-bus)** in **The Netherlands (NL)** while dealing with **used batteries** by creating a solution for a more **valuable second-life application** and **monetizing** on that. On the top of **investors' returns**, greenhouse gas (**GHG**) and **local air pollutant** emissions will be **reduced**, leading to positive social and health impacts.

Challenges

NL is committed to an **entirely zero-emission bus (ZEB) fleet by 2030**, starting with allowing **only ZEB additions** to existing fleet **after 2025**. Private bus operators are awarded with **franchised concessions** to provide public transport, and they will need to **upgrade ~ 4000 non-ZEB** in the **next 6-7 years**. E-bus technology is best positioned to take the majority of market share, but there are several hurdles for adoption:

Lower TCO but ~2x **higher CAPEX** (of which **battery is ~10%**)

Lack of technology knowledge e.g. 2ry market for batteries; degradation profiles

Quickly **maturing battery technology** → risk of buying **obsolete technology**

Lack of **charging infrastructure** and **grid issues** i.e. no **energy storage**

Solution & Value Proposition

We propose a fund that creates an SPV to **buy and lease e-bus batteries** to the transport operators, **maintenance** included in the contract. Details of the fund are as follows:

- 1 Fund is financed by **equity investors** and **asset finance facility** for lease leverage (to enhance equity return)

SPV is to offer the following to bus operators:

- 3 Up to **12y-long e-bus battery operating lease, maintenance** & real-time **battery degradation analytics** included in service contract
Lease contract structured and priced as **one initial battery purchase**, and one battery **replacement** after ~6y (average e-bus battery lifetime); when battery with **equivalent attributes** (energy, power) **procured** for the second half of the contract

To capture value the SPV conducts the following:

- 4 Takes on **predictive maintenance (PM)** service from **3rd party** (e.g. Eaton, ION Energy) to optimize the **battery health** for running **operation & residual value** i.e. sales price at 6th year

SPV manages the lease contract:

- a Buys **1st battery**, and sells at 6thy for second-life application (e.g. storage) w/ **premium** due to the **PM**
- b Buys **2nd battery** at 6thy, at a **lower price** than the first one, and **sells w/ premium** at 12thy for second-life application
- c

Value proposition for **bus operator**:

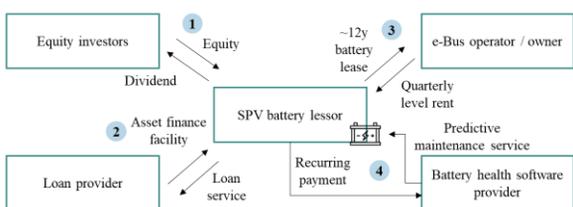
- **Lower CAPEX** per bus, more can be purchased → higher **OPEX saving** and easier **compliance**
- SPV captures & **shares tax credit** (EIA) that would be **lost** if battery and bus bought together → leasing can be priced **competitively**
- Certainty on capturing **battery cost decrease**, technology price risk transferred to the fund
- **Automated maintenance** & some **value** captured from battery optimization **shared** w/ operator

Value proposition for **investors**:

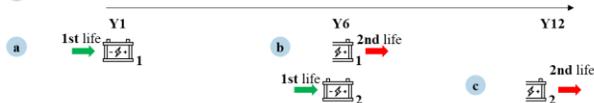
- **Secure asset-backed loan** with high residual value
- **Stable base-case CF to equity**; **option** to participate in **upside** i.e. value increase from battery health optimization when sold for second-life
- Strategic equity investor: vehicle to drive e-bus sales

Fund and battery lifecycle diagram

Fund diagram



3 Battery and lease lifecycle



Key Details

Fund Investment Profile	
Fund type	Leveraged Leasing & Priv. Equity
Geography	The Netherlands
Fund size	€60M; leverage 20:80 (debt: equity)
Fund life	17y: 5y (investment period) + 12y to cover all contracts; dividend from 6th year
Target IRR	9-13% (gross of fees)
Fees	2% mgmt fee on committed capital, 10+10% ¹ perf. fee on returns >15%
Target Investors	Pension funds, insurance co w/ higher risk tolerance; strategic investors (e-bus manuf.); credit institutions Min. equity investment: €5M
Revenue	Leasing fee, sale of used batteries
Investment criteria	Minimum contract size of €3M; contract w/ operational covenants; creditworthy lessee / guarantee & battery warranty
Target impact	3.5 MtCO ₂ e _q reduction in 12 years from fleet application by reaching target to lease ~1200 e-bus battery ²⁾



How is this new?: Battery leasing funds and business model has started up recently, but our fund takes it further by being the first to offer **real-time predictive maintenance opportunities** and **monetize PM** and specifically focus on **optimization for battery sales for second-life application**

1) 10% performance fee over >15% return will be donated to pre-selected NGO; 2) Calculated with the understanding that reduction comes from entire e-bus, not only from the financed battery

Target market size and potential for scaling

	2020	2030	CAGR	Notes
Fleet size	5 000	~7 500	7%	1:1.5 diesel-e-bus replacement ratio
e-Bus fleet size	1 000	~7 000	30%	e-bus lowest TCO tech → 95% mkt share

NL has globally fifth highest business leasing rate, therefore battery leasing market could grow up to 75%

This means a total of ~5k e-bus batteries leased, yearly ~1k replacement in 2030, and significant ramp up concurrently



2025: e-bus sales dipped due to Covid-19, but city e-bus mkt share is estimated to be at 40% in Western EU (WE) and UK → ~55k e-bus

2030: penetration could go up to 75% → ~100k e-bus

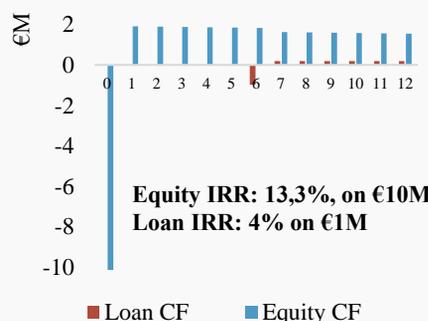
Next market to consider: UK

- (1) Similar bus franchise model
- (2) Deep leasing and storage market
- (3) Ambitious public e-bus policy

Potential for **£150M fund** to finance 5k e-bus battery

Financial projections and major assumptions

Equity and Loan CF of a representative 12y €10M lease contract (~200 e-bus battery)



Financial assumptions:

- **Maintenance** (10% of asset value) charged, **indexed** to 2% inflation
- Leasing contract priced with **5% return**; debt priced at **4%**
- Batteries sold with **0.5% premium to secondary mkt**; actual maintenance costs kept **constant** due to **automated PM**

Business model & technology assumptions:

- ~ **30% mkt share** captured for newly financed e-bus batteries
- ~ 50-50% opportunity and depot charging type of bus financed
- **1200 bus financed**, with **0,45GWh battery capacity**
- Battery prices will **drop by 1.5% CAGR**; batteries sold for **40 €/kWh** price point, at around **30% of original value**
- AI-based Battery Mgmt System providers' technology will **effectively** work e.g. AI-driven hardware can **identify & repair** defects in batteries based on **predictive cell diagnosis, accurate** remaining useful life **estimation**

ESG considerations

Transition to electricity-driven transport and clean energy storage combats climate change and its impacts, in line with three SDGs: **13 (climate action)**, **3 (good health and well-being)**, **7 (affordable and clean energy)**.



Environmental:

Dependent on variable factors such as electricity **supply mix**, bus model, distance travelled, weather. Emission reduction during fund lifetime estimated as:

- **3.5 MtCO₂e_q reduction** from fleet operations with further reductions from battery energy storage in 2nd life application
- Average **noise reduction** of 6 db(A) and significant **NO_x** (~10%) and **particulates air pollution reduction**

Social:

- Contribute towards further development of NL's cutting-edge green initiatives and ZEB commitments
- Minimized **safety concerns** through AI tracking to prevent usage past **safe levels of degradation**
- Decrease the disproportionately high exposure to pollution experienced by those of **lower socio-economic status**

Due diligence & risk management

Fund design	Risk	Mitigation strategy
Technology risk		
Battery life average of 5 to 8 years	Faster reduced battery lifetime due to unfavorable usage patterns or external conditions	Sourcing batteries from certified battery manufacturers w/ credible warranties; contract covenants w/ operators to incentivize favorable use
Hardware and software solution to automate identification & repair	Tested technology has been done for only lithium-ion batteries, probably other batteries procured as well; external solution does not meet expectations	Allocation of 10% of fund capital towards building expertise on AI software in collaboration with 3rd party companies (in JV)
Market risk		
Quick demand build up for e-bus in NL and relatively low competition to finance	Postponed e-bus purchases due to lower public transport demand (COVID-19) / expectations for declining e-bus & battery prices High interest & competition to finance batteries	Development of battery re-financing leasing product for batteries in running e-bus Start focusing on other Western European markets (e.g. UK) with localized pricing and contracts
Quick build up of leasing contracts	Procurement cycles can linger on as several stakeholders participate in complicated setting	
Relatively stable, growing and profitable secondary market	2nd life battery for storage might become less attractive compared to 1st life batteries, due to cost decline	Recycling could make up for lost sales, hedging recycling revenues with cobalt and copper futures could provide revenue stability
Policy risk		
Tax credits for sustainable investments	Requirements for the Energy Investment Allowance change in next update or tax credit cannot be utilised as currently understood	Validation of assumption w/ tax experts, if negative outcome → contract & pricing redesign
Stable policy environment	Upcoming March elections disrupt policy, newly elected officials will change current legislation	Quite unlikely as NL's Supreme Court strengthen case for emission decrease in NL (Urgenda case ruling), in any case other countries can be targeted