



Forward. For all.

A3PS ECO-Mobility 2024

Battery Electric Trucks (BET) as part of Sustainable Transport Solutions

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Who we are and what we do.

Swamy Kotagiri CHIEF EXECUTIVE OFFICER
 Pat McCann CHIEF FINANCIAL OFFICER
 Eric Wilds CHIEF SALES & MARKETING OFFICER
 Aaron McCarthy CHIEF HUMAN RESOURCES OFFICER
 Boris Shulkin CHIEF DIGITAL AND INFORMATION OFFICER
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 Zhen Wu PRESIDENT MAGNA CHINA
 Jörg Grotendorst SENIOR VICE PRESIDENT, CORPORATE R&D

Magna leadership.

John Farrell | President

Tom Rucker | President

BODY EXTERIORS & STRUCTURES

SEATING SYSTEMS

POWER & VISION

COMPLETE VEHICLES

NEW MOBILITY

BODY & CHASSIS

EXTERIORS

SEATING

POWERTRAIN

ELECTRONICS

MECHATRONICS,
MIRRORS, LIGHTING

COMPLETE
VEHICLES

NEW MOBILITY



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PRESIDENT



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PRESIDENT



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EXECUTIVE VICE
PRESIDENT

Magna Powertrain Product Portfolio

High Voltage
Electrified
Products

eDrives, eBeam,
HV Transmissions

Conventional
and Hybrid
Products

Transmissions,
48V Transmissions,
AWD/4WD Systems

Modules &
Components

Motor Core Stacks,
eDecoupling, Differential
Modules, Clutch
Assemblies, Planetary
Carriers, Covers, Gears &
Shafts

Engineering
Services

Vehicle Engineering
Propulsion Engineering
Simulation Services
Software
Prototyping & Testing

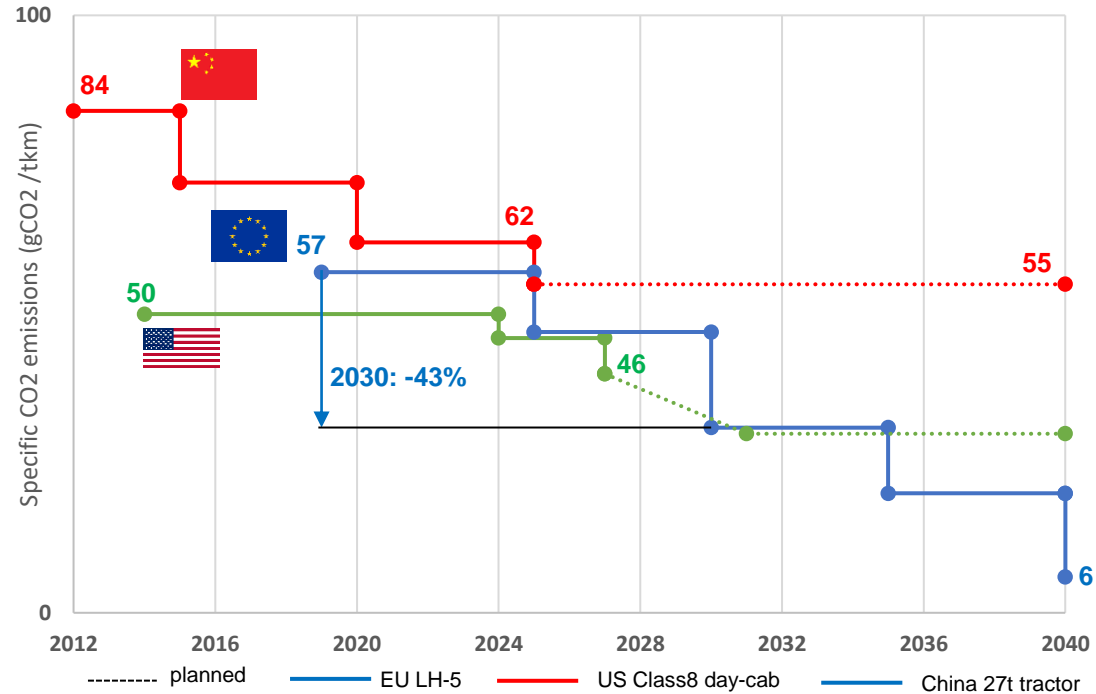
Common Knowledge - The Rising Emissions and Legislative Response



- Increase in the number of trucks
- Increase of CO2 emission
- Motivation for regulatory measures

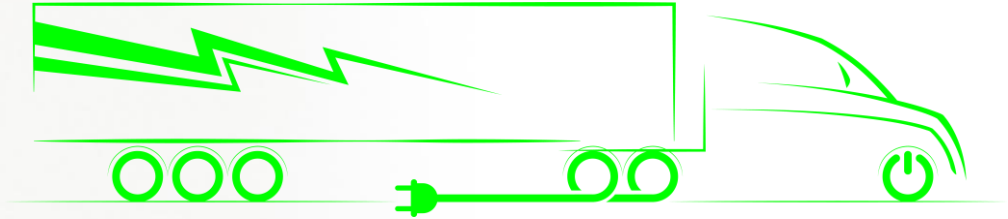
- Worldwide CO2 reduction targets defined / planned
- EU CO2 fleet target 2030 -43%*
- CO2 target refers to tailpipe emissions
- CO2 neutral fuels not considered yet
- EU with most stringent targets
- Regulatory worldwide enforces electrification

Global CO2 reduction forecast truck fleets



Source:
https://ec.europa.eu/commission/presscorner/detail/en/ip_23_762
<https://www.epa.gov/system/files/documents/2024-04/420f24018.pdf>

*Baseline 2019 fleet values



Skepticism and diverse Opinions

“Legislation demands electrification”

“Prognostications are always wrong”

“Customers uninterested”

“eTrucks are not the future...”

Exploring Customer Interest: Is the Market Real?

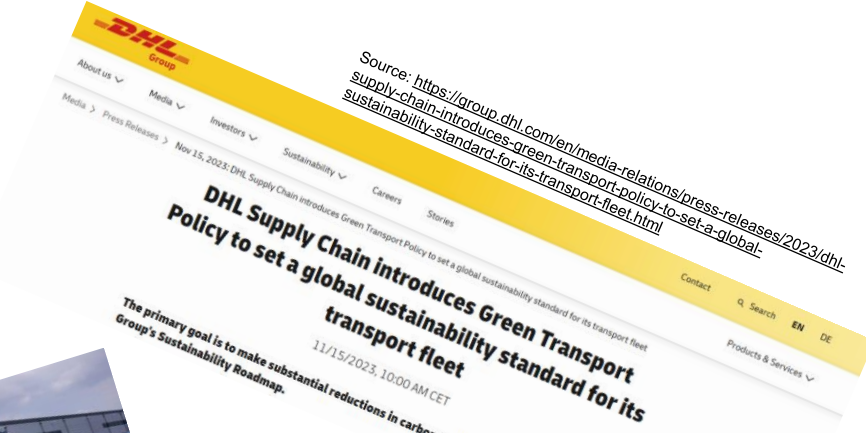


Source: <https://www.dsv.com/en/sustainability-esg>

Sustainable Transportation
Transportation is a key part of our plan to meet net-zero carbon by 2040. We are committed to optimizing and transforming our transportation network through innovations in electrification, efficiency enhancements, and alternative delivery methods.



Source: <https://www.aboutamazon.com/news/sustainability/electric-trucks-southern-california-sustainability>
<https://sustainability.aboutamazon.com/2023-report>



Source: <https://group.dhl.com/en/media-relations/press-releases/2023/dhl-supply-chain-introduces-green-transport-policy-to-set-a-global-sustainability-standard-for-its-transport-fleet.html>

DHL Supply Chain introduces Green Transport Policy to set a global sustainability standard for its transport fleet
The primary goal is to make substantial reductions in carbon emissions in line with the Group's Sustainability Roadmap.



Major transportation sustainability initiatives

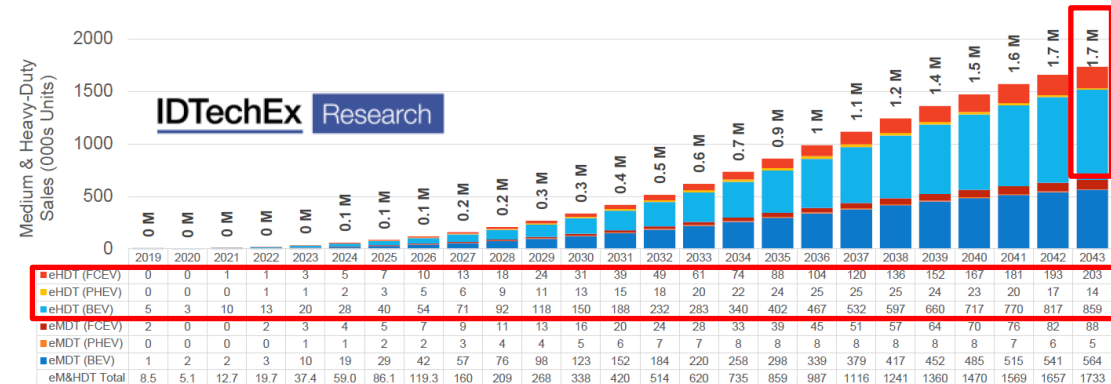
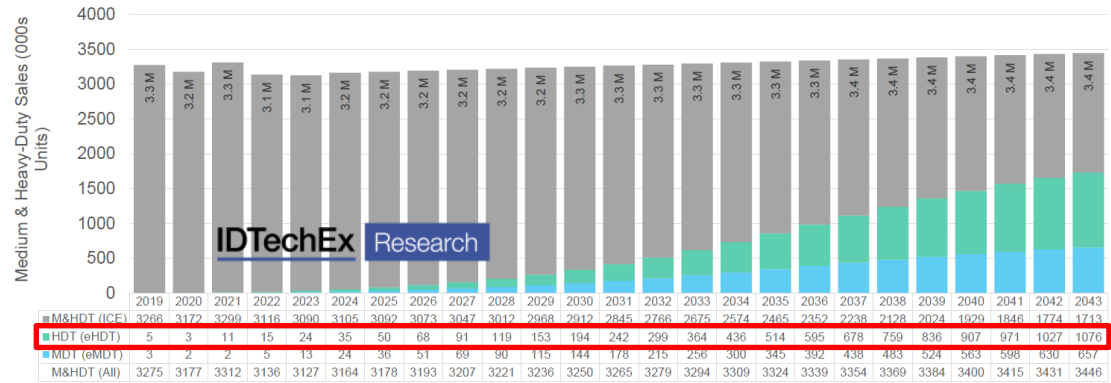


Forces deployment of BET's

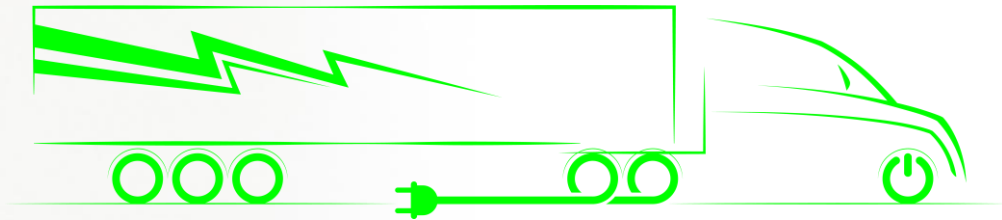
Medium & Heavy-Duty Truck Sales Forecasts

IDTechEx forecasts for HD in 2043:

- 1.7 Mio ZEV trucks!
- Market share to rise to 50% ZEV
- ZEV technologies
 - FCEV
 - BET



Source: IDTechEx_Fullreport_ElectricandFuelCellTrucks20232043.pdf

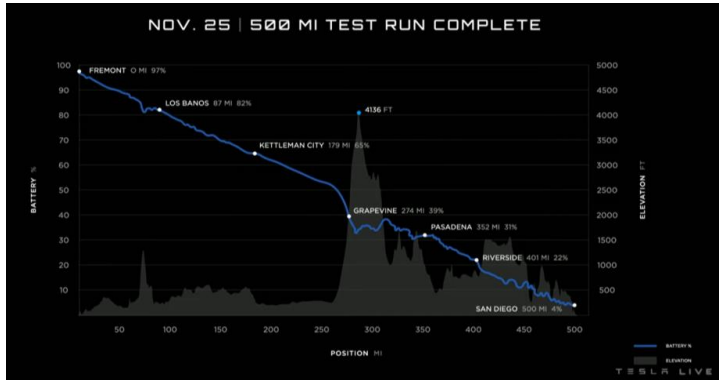


Skepticism

”...but can a class 8 BET truck run 500 miles? ”

Can a BET truck run 500 miles?

- Tesla Semi Delivery Event on December 2nd, 2023
- Tesla announced that the Semi Truck can run 500 miles with a single battery charge
- Elon Musk: “There are people out there they say it can’t be done – we did it”



Can a BET truck drive 500 miles without charging?

Simulation boundaries

Assumptions:

Component	Parameter	Class 8 6x4
Battery	Capacity net	900 kWh
	Voltage	800 V
Transmission	Gears	2
Electric motor	Max. torque	2x735 Nm peak
	Max. power	2x216 kW cont.
Resistance	Drag cd	0.36
	Frontal area	9.7 m ²
	Rolling cr	0.0048
Weight	Full load	82000 lbs

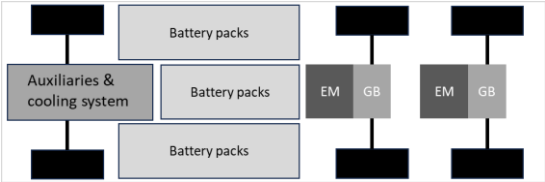
Source: <https://www.tesla.com/semi>
Source: NREL

Example of class 8 truck:



Source: Magna design study

Class 8 Truck PT architecture:



Simulation was done for a 6x4 class 8 truck with full load

Driving cycle generation

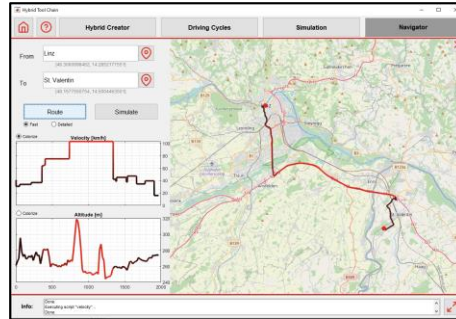
- Investigated Route:
Tesla Plant in Fremont → Tesla Plant in San Diego

Open Street Map:
Route: Fremont → San Diego:

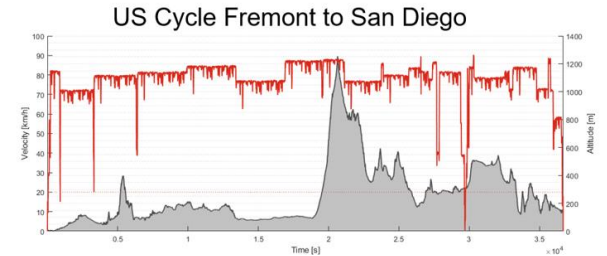


Source:
https://www.openstreetmap.org/directions?engine=fossgis_osrm_car&route=37.5483%2C-121.9886%3B32.7174%2C-117.1628#map=5/38.100/-95.581

Magna driving cycle generator:



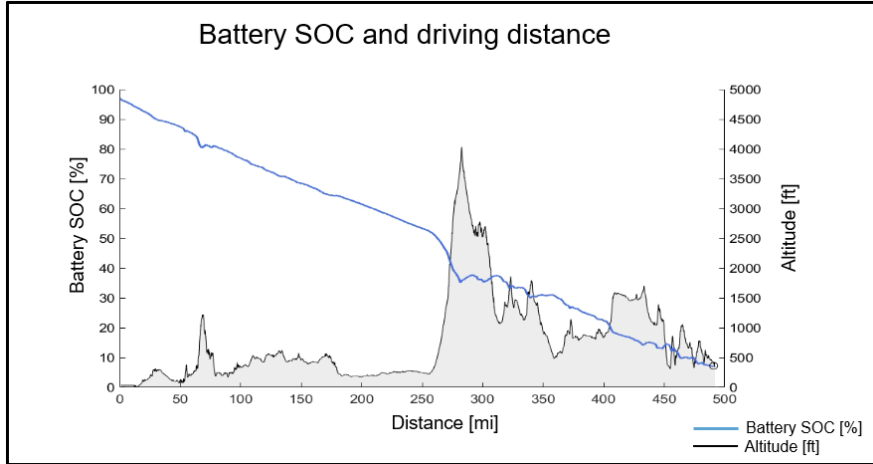
Generated Driving cycle:



Fremont to San Diego driving cycle was created based on map data

Can a truck run 500 miles?

Magna simulation results:



Source: <https://www.tesla.com/semi>

Data presented by Tesla:



Simulation result is comparable to the data presented Tesla

Question:
What if ambient conditions are not perfect?

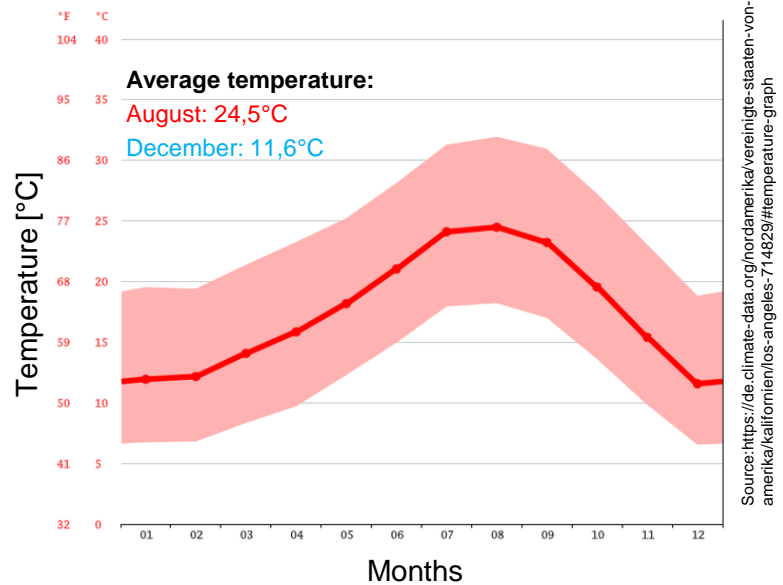
California

- The environment temperatures in California provide almost perfect conditions for a BET Truck...



Source: Microsoft PowerPoint Picogramme

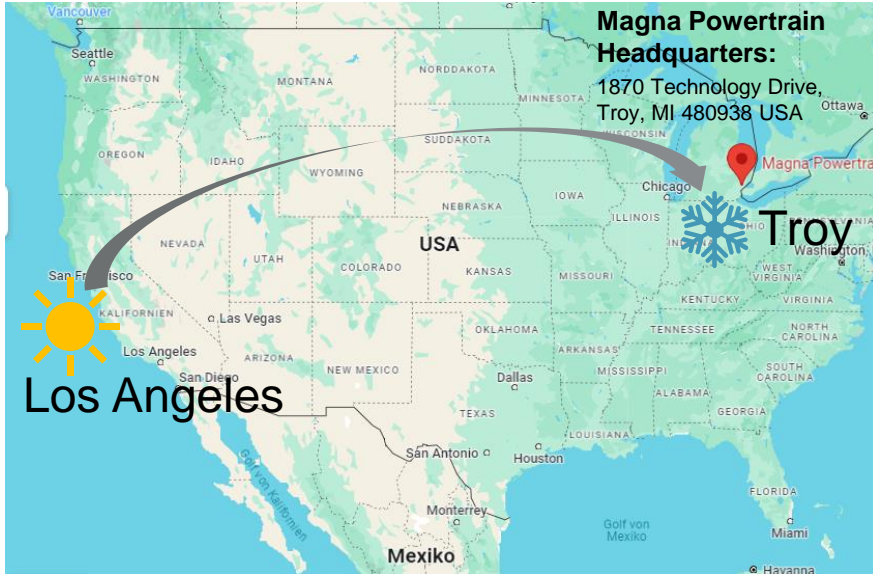
Temperature diagram Los Angeles:



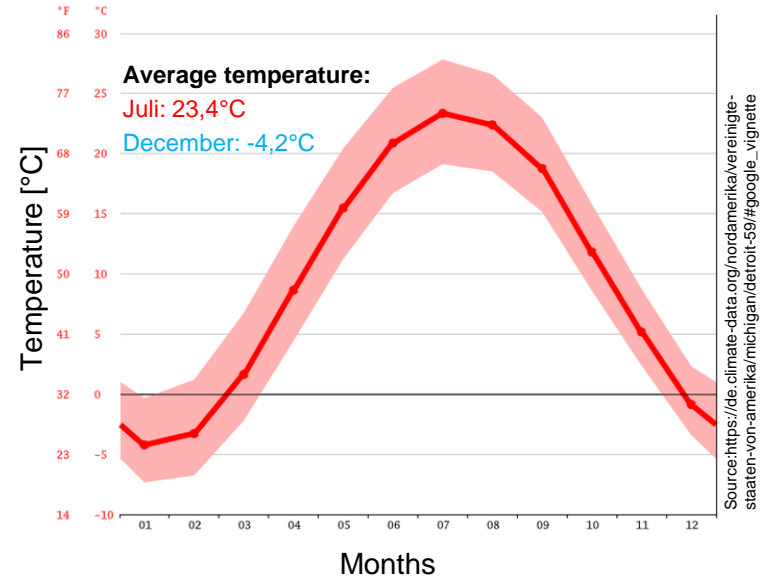
The average temperature range in Los Angeles is between 24 to 11°C

How about Michigan?

- Magna Powertrain headquarter is located in Michigan
- Trucks are operated globally in all kind of use cases and climatic conditions



Temperature diagram of Troy:

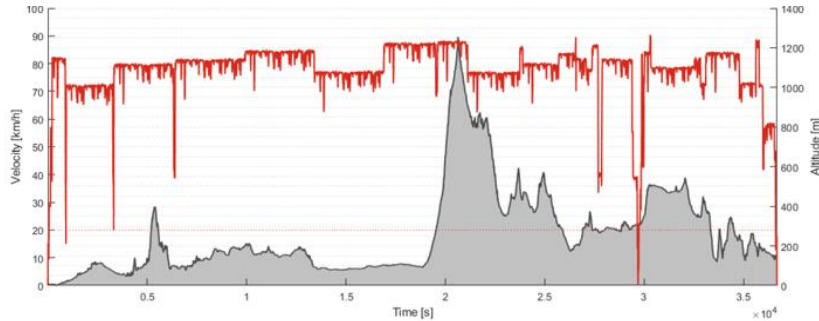


The average temperature range in Troy is between 23 to -4°C

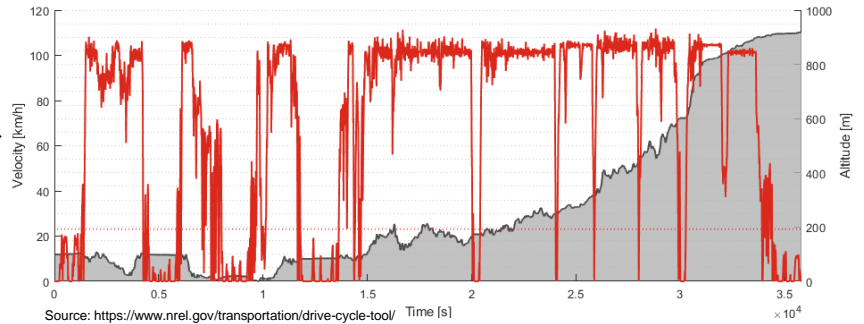
How about representative US driving cycle?

- For further investigation, following cycle developed by NREL was used

Driving cycle Fremont → San Diego



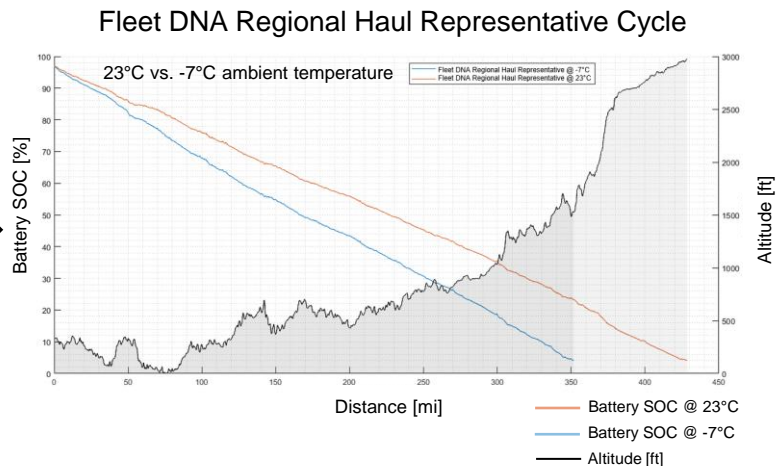
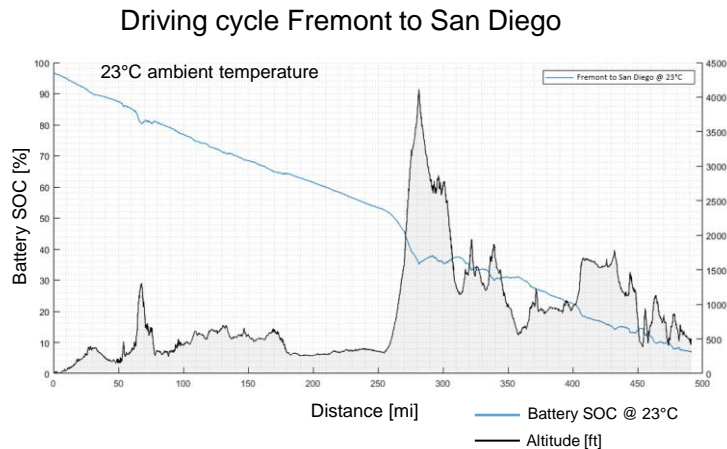
Fleet DNA Regional Haul Representative Cycle



Fleet DNA Regional Haul Representative Cycle used for further investigation

Simulation Result

- Tesla cycle compared to Regional Haul Representative Cycle
- 23°C ambient temperature compared to -7°C ambient temperature



Simulation results:

- Maximum range is reduced from 500mi (Tesla Cycle) to 428mi (Regional Haul Cycle) at 23°C ambient temperature
- Winter conditions (-7°C) further reduce the range by around 18%
- Maximum winter range is limited to 352 miles at Fleet DNA Regional Representative Haul Cycle
- Range reduction mainly caused by limited recuperation and heating

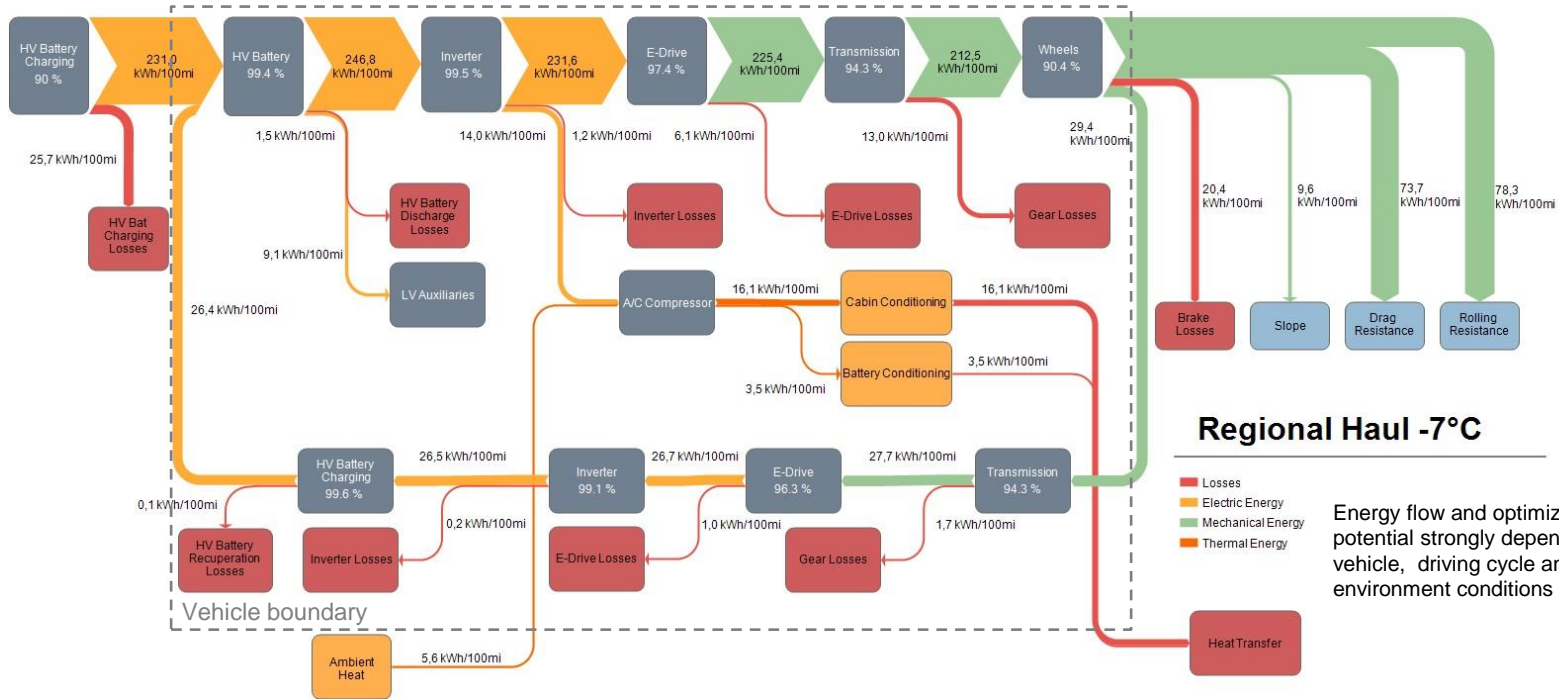
In winter conditions (-7°C) the vehicle range is reduced by around 18%.

Question:
What are the potentials?

Potentials of Intelligent Energy Management



Energy flow of class 8 truck driving Fleet DNA Regional Haul Cycle at -7°C

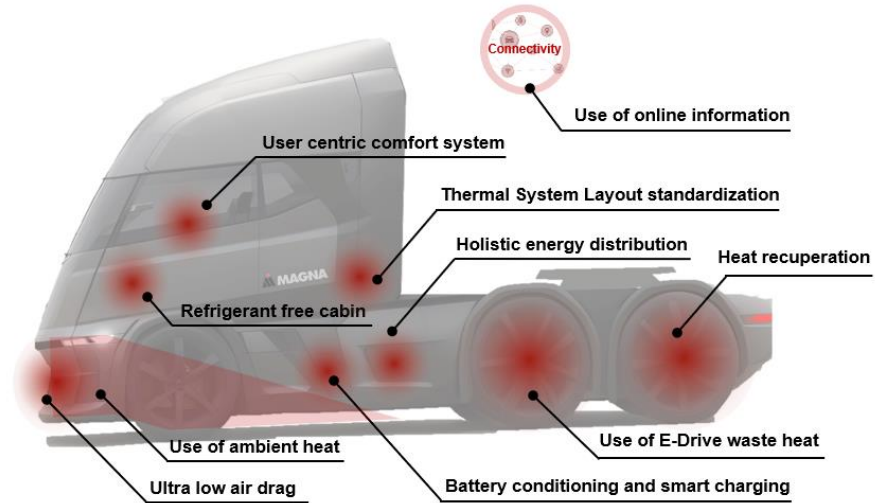


Energy flow and optimization potential strongly depending on vehicle, driving cycle and environment conditions

Holistic view required to enable full efficiency potential

Summary

- The **transition** from ICE to electric trucks is **on-going**.
- Second generation trucks with **higher range** and **charging performance** are entering the market
- **Electric trucks work** and will prevail, but they do not replace diesel trucks one-to-one. Operation and infrastructure have to be adjusted.
- Based on simulation results the investigated BET truck is **capable to drive 500 miles** without charging
- If the driving cycle and environment **conditions are not optimal**, the range and **efficiency** can be **significantly reduced** (500→35 miles in this investigation)
- **Intelligent energy management** functions can reduce this limitations
- A holistic approach and innovations considering the **complete truck specific eco system** (vehicle, energy management, charging strategy, infrastructure, fleet operator, payload, route planning and trustful SW functions) is required to enable **high efficiencies**
- To make **electric trucks a success** and to gain customer trust **efforts are required** across the industries





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