ASFALTDAGEN 2024

CO2 - reduksjon
– hva snakker vi om, og er maskinparken en avgjørende miljøfaktor?

OSLO 25. JANUAR 2024

PER OLAV LISTOU

Norsk Asfaltforening

CO2 Mystisk ……Nei?

Hva er Co2?

Komplisert, Nei.

1 liter diesel forbrennt = 2,66 kg Co2

- **Det spiller ingen rolle hvordan du brenner den**

Hvor mye Co2 slipper du ut??

- **LITER forbrukt x 2,66 kg = kg Co2**

Null utslipp = ingen diesel

Myndighetene girer opp!

Statens vegvesen

Sammen skal vi jobbe for

2025 – nullutslippsløsninger tilgjengelig i alle vektklasser

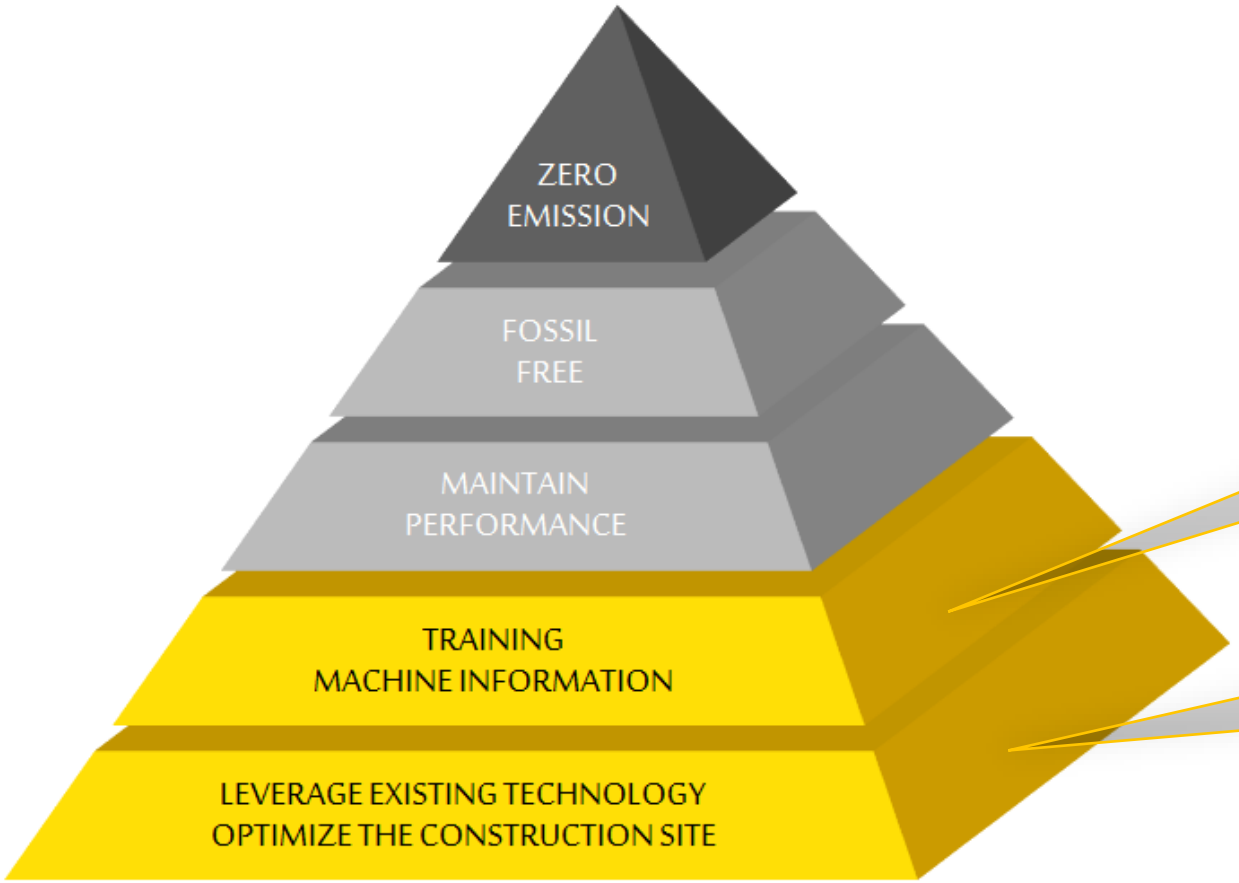
2027 – kun utslippsfrie maskiner i kravspesifikasjonen

2030 – 50 % kutt er nådd med god margin

2033 – alle anlegg er utslippsfrie eller på biogass

Kjell Inge Davik, Direktør, Utbyggingsdivisjonen, Statens vegvesen

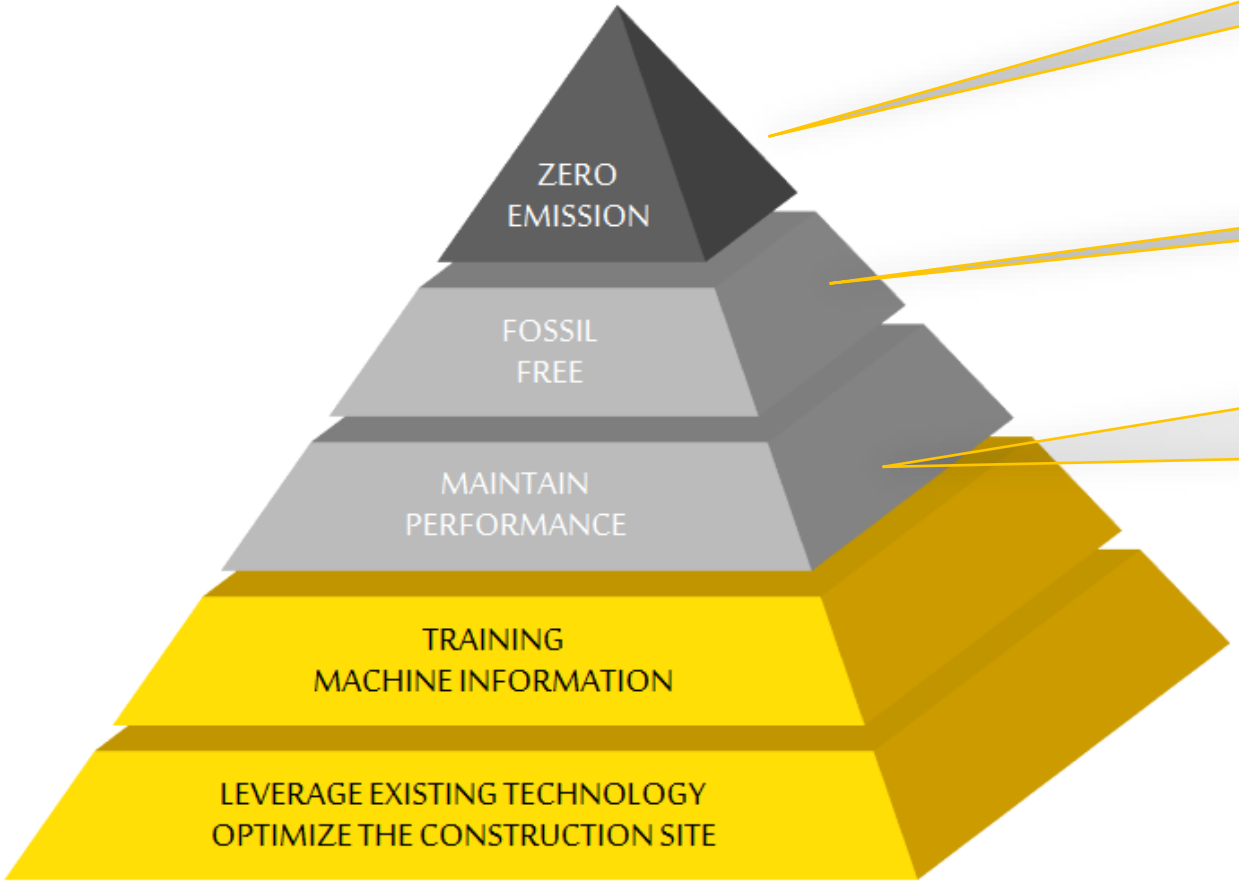
BÆREKRAFT….
“POWERED” BY KUNNSKAP & TEKNOLOGI



Insights in fuel consumption drivers
Converting data to decision-making information
Leveraging new integrated technology

Move as little as possible and as short as possible
Machine fleet composition
Latest available engine technology

BÆREKRAFT….
“POWERED” BY KUNNSKAP & TEKNOLOGI



Pon Z-line

All Cat machines can run on 2nd gen biofuel today

More than 4.100 Cat machines with CSA in Norway

Optimal maintenance & up-to-date machine’s lower fuel consumption and improved resource utilization

Hva er teknologiutfordringene?

1 liter diesel ~ 0,84 kg

1 liter diesel ~ 10 kWh energi innhold

1 liter diesel i en motor ~ 4 kWh rotasjonsenergi + 6 kWh varme, lyd, friksjon osv

1 liter litium-ion batteri @ 600V - 0,2 kWh

Å erstatte 1 liter diesel krever 20 liter batteri med en vekt på 27 kg ved 600V

Batteri tilsvarende 1 liter diesel, ca 25 000 kr (600€ pr kWh)

Hvor mange liter diesel bruker du mellom hver stopp?

Hvor lang tid tar det å fylle batteriet?

Vi lader med ca 0,5C for maks batterilevetid, dvs 150kW ladeeffekt med 300kWh batteri

Hvor stort batteri trenger vi? Hvor fort kan vi lade? Hvor mye strøm har vi tilgjengelig?

- **150 kW ~ 220A ved 400V**

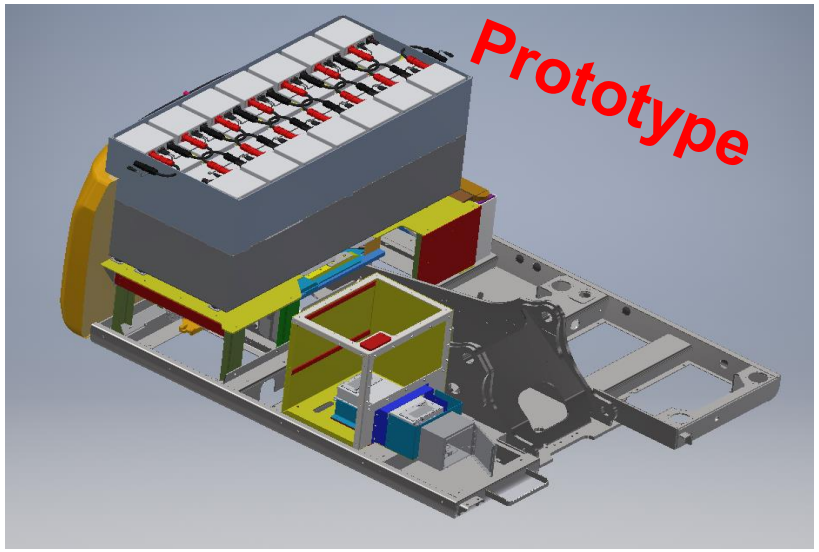
Z-LINE MAKES ZERO EMISSION REALITY 2018

- 25 ton-class, largest industry segment in Norway
- Multi-purpose machine for efficient loading of trucks, digging and levelling for small to large construction sites
- Identical performance as diesel powered
- Fully battery-powered for 5-7hrs operation
- Supported by Cat
- Standardized heavy duty components
- Integrated 230-400V charger (11-150kW)

4 år med utvikling

323F Z-Line Prototype.

- Start i 2016 med en maskin produsert.
- Nært samarbeid med Cat for å integrere teknologien I maskinen.
- Beholde full 323F funksjonalitet og effektivitet, kun endre rotasjonsenergien til pumpeakslingen
- Standardiserte løsninger og komponenter for sikker drift
- Luftkjølte batterier. Begrensede muligheter til å varme batteriene om vinteren, eller å kjøle i varme perioder.
- "Built-in" lader med 43kW max. ladeeffekt.
- I drift ca. 600 timer.



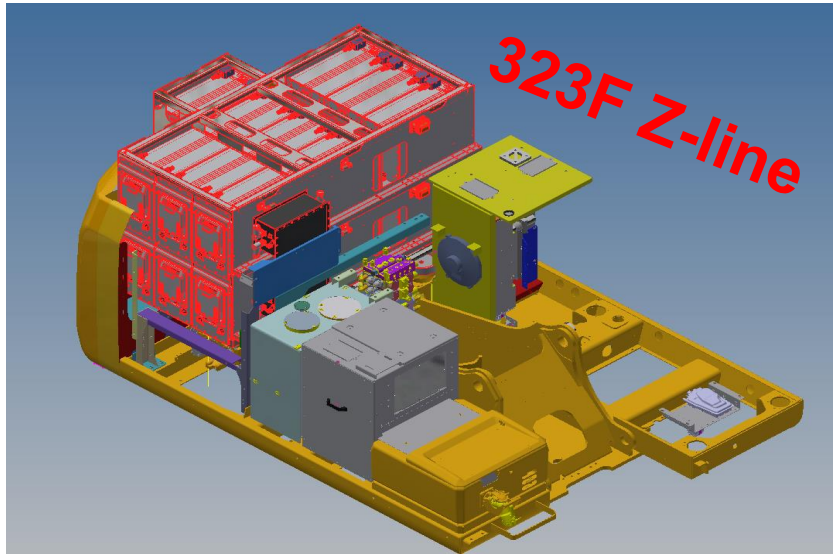
4 år med utvikling

323F Z-Line, 1. Generation el HEX

- 8 maskiner i drift, totalt mer enn 16.000 driftestimer.
- Avansert batteriteknologi, Væske-kjølt / oppvarmet gir betydelige fordeler I alle temperaturer.
- Revidert ladestrategi med “on-board” hurtiglader med regulerbar ytelse opp til 150kW. 400Vac.
- Erfaringer med forbruk over 16.000 timer viser at 6 - 8 timers drift pr. lading stemmer.

- En av de store utfordringene er tilgjengelig elektrisk effekt / infrastruktur på anleggsplassen!!!

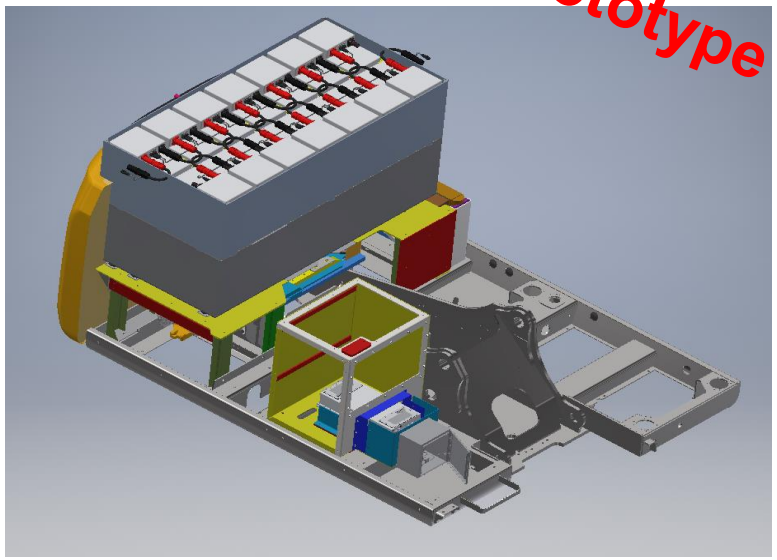
- Erfaring hentet fra drift, elektrisk infrastruktur, klima og applikasjon er tatt med i utviklingen av 2.re generasjon Z-Line.



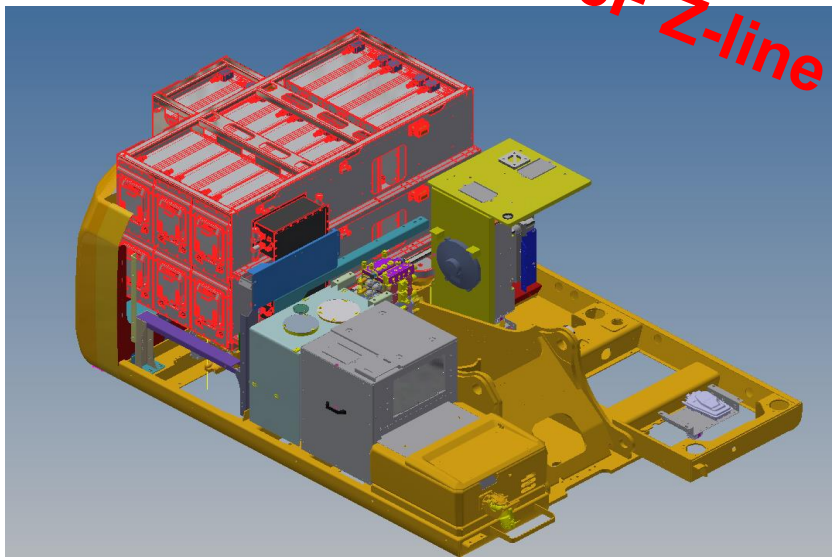
4 år med utvikling

- Software
- Komponentutvikling
- Batteri Management
- Ladestrategi

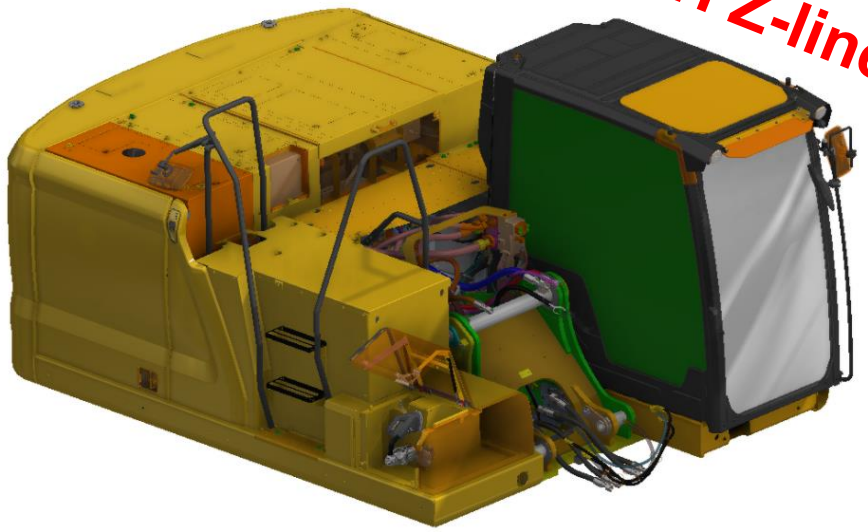
Prototype



323F Z-line

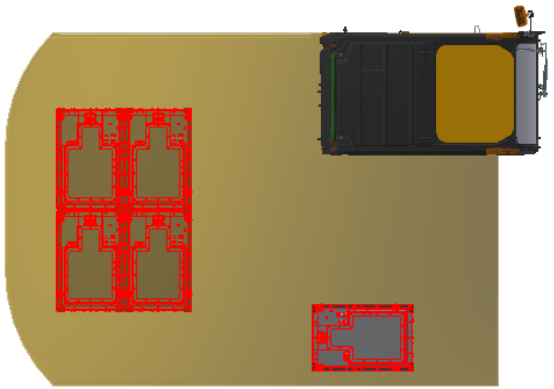


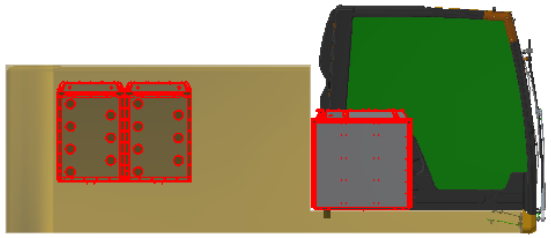
320 NGH Z-line

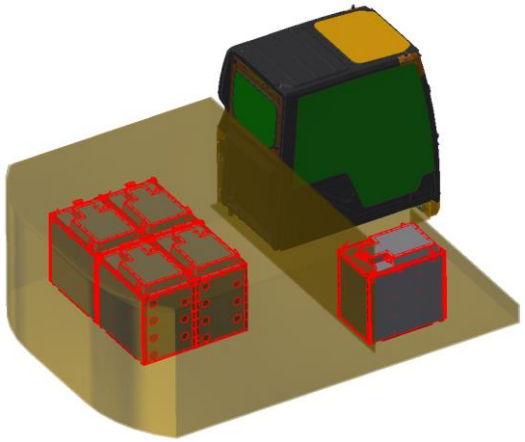


330 Z-Line

- **Bygges nå sammen med Pon Holland.**
- **6 stk. solgt.**
- **Norge, den første er leveret 2023.**

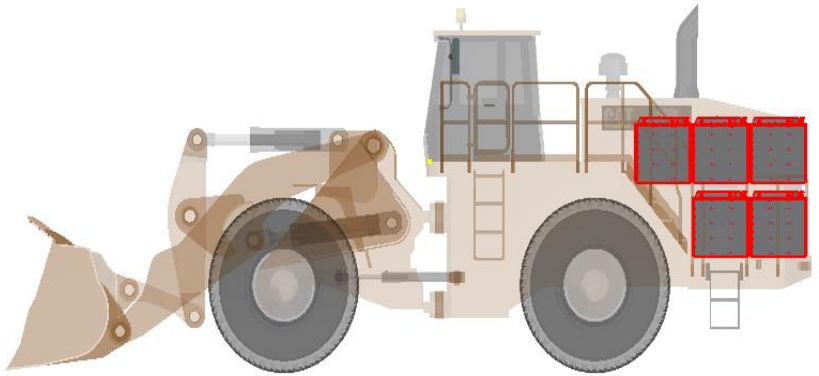


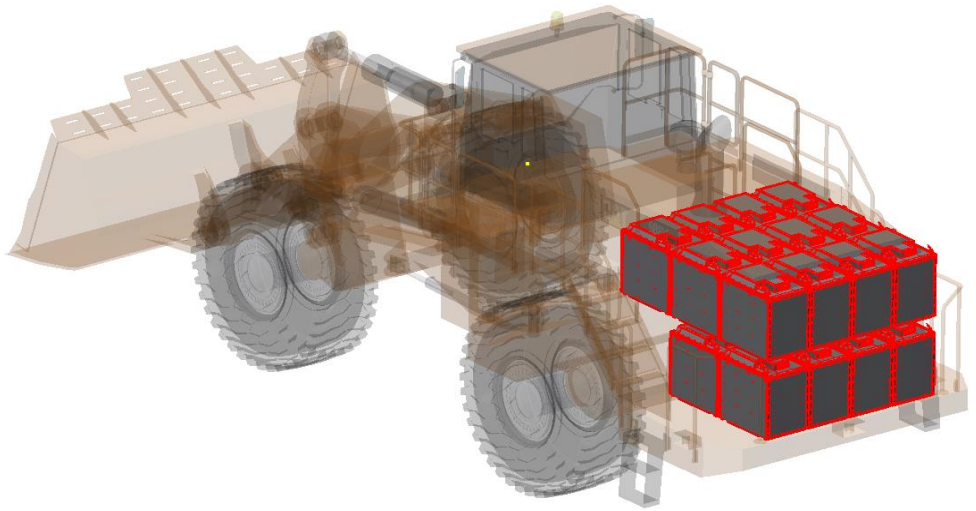




988 Z-Line

Average fuel consumption:	**40 L/h (3kW/ton)**
Equivalent in kW:	**152 kW**
Batteries installed:	**15 (~9500kg)**
Capacity installed (usable):	**1270kWh**
Battery life time (one charge):	**8h 20min**
Battery cycles a day :	**~1**
(8 hours = full day)	





ØKONOMIEN ‘’FLYR’’ IKKE….

DA HELLER IKKE BÆREKRAFTIG

Caterpillar Expands…..Bauma 2022

Caterpillar Expands Construction Industries Portfolio with Four Battery Electric Machines

October 4, 2022

FOR IMMEDIATE RELEASE

IRVING, Texas – To support customers during the energy transition to a lower-carbon future, Caterpillar (NYSE: CAT) will display four electric machine prototypes, including battery prototypes, at bauma 2022 Oct. 24-30 in Munich, Germany.

Caterpillar is focused on delivering purpose-built solutions to help customers achieve their sustainability goals by geography, by jobsite and specific customer need. One of many solutions, the battery electric machine prototypes include the 301.9 mini excavator, 320 medium excavator, 950 GC medium wheel loader and 906 compact wheel loader. The machines are powered by Caterpillar battery prototypes and include an onboard AC charger. The company also plans to offer an offboard DC fast charging option.

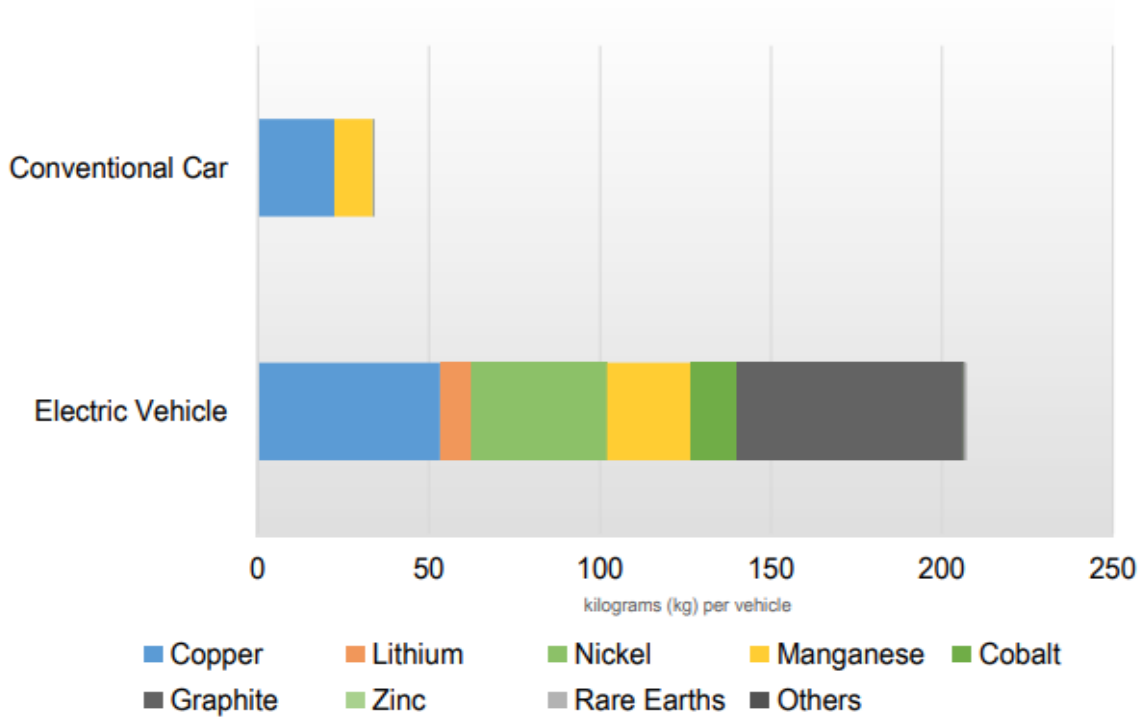
"Caterpillar is well positioned to help customers reach their sustainability goals, including lowering emissions on the jobsite," said Construction Industries Group President Tony Fassino. "It's important we meet customers on their sustainability journey today with a variety of solutions including machines that run on renewable fuels or technology that increases fuel efficiency, as well as supporting them into the future as we power our next generation of machines."

The Caterpillar-designed batteries in these machines will also be available to power other industrial applications. Built on proven Caterpillar technology, the lithium-ion battery range features a modular design that offers flexible configurations across multiple applications. The batteries are engineered to be scalable to industry and customer performance needs and maximize sustainability throughout their lifecycle, including recycling and reuse at the end of life.

"Our electrified products leverage our deep system integration experience and are designed to meet the performance expectations that customers have come to expect from Caterpillar," said Joe Creed, Energy & Transportation Group President. "We're focused on helping our customers achieve the optimal product and jobsite energy lifecycle, allowing them to maximize value and minimize their total cost of operation."

The 301.9 and 906 are expected to be the first commercially available models.

Electric Vehicle Growth Accelerating Key Commodity Demand



6x

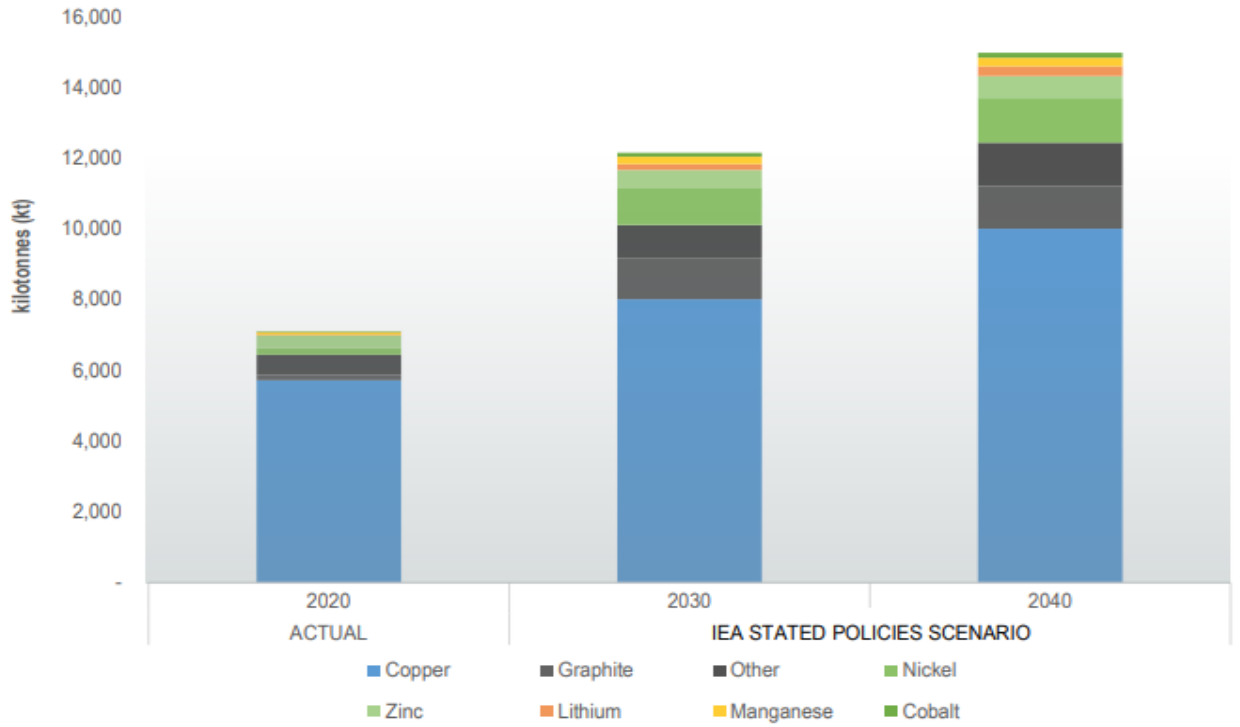
EVs Use More Minerals Today

8x

Global EV Stated Policies Scenario: 2030 vs. 2020

Source: International Energy Agency (IEA) data based on the IEA Stated Policies Scenario, addendum dated March 2022; IEA (2021), The Role of Critical Minerals in Clean Energy Transitions, IEA, Paris; IEA, Minerals used in electric cars compared to conventional cars, IEA, Paris; IEA uses terms "electric car" and "electric light-duty vehicle (LDV)" for the data above. For consistency, terms "EV" and "Electric Vehicle" are used interchangeably for "electric car" and "electric LDV."

Energy Transition Accelerates Demand for Key Commodities



Source: International Energy Agency (IEA) data based on the IEA Stated Policies Scenario, addendum dated March 2022; IEA (2021), The Role of Critical Minerals in Clean Energy Transitions, IEA, Paris

Minerals Usage Increasing:

Electric vehicles

Battery storage

Wind and solar power

Grid modernization/stability

Investing in Lower-Carbon Advanced Power Technology

ADVANCED POWER

ESTABLISHED POWER SOURCES

More efficient and fuel-flexible

Low-Carbon Intensity Fuels

Increased use of reduced-carbon options and hydrogen blends

HYBRID

Established power sources coupled with new technologies

Electric and Hybrid Powertrains

Electric drive transmission with power components

Microgrids

Integrate renewable energy sources into electric power systems

NEW TECHNOLOGIES

Replacing established power sources

Batteries

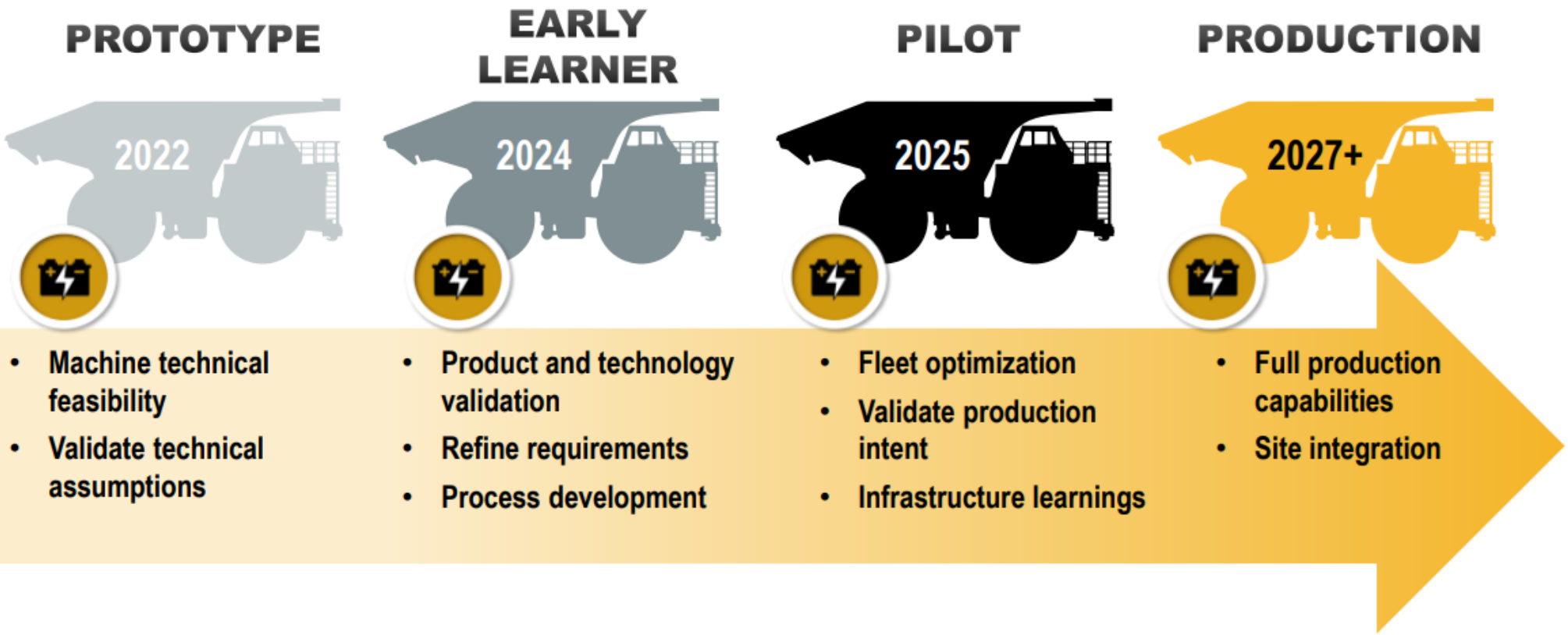
Stored electrical energy

Fuel Cells

Renewable hydrogen fuel as a scalable source

Battery Electric Mining Truck Accelerated Development Strategy

Close Collaboration with Customers



Up to 85% Lower CO_2 Today, 100% Reduction in the Future

ESTABLISHED POWER SOURCES

Low Carbon Intensity Fuels

HVO + BRADLEY DEMOLITION

- Cat fleet running Hydrotreated Vegetable Oil (HVO)
- **85% CO_2 reduction**[1] compared to conventional fuel

HYBRID

Electric & Hybrid Powertrain

D6 XE + GOODFELLOW BROS

- Advanced electric drive technology
- **35% CO_2 reduction** over 911 hours of operation compared to other D6 machines

ADVANCED POWER SOURCES

Batteries **Fuel Cells**

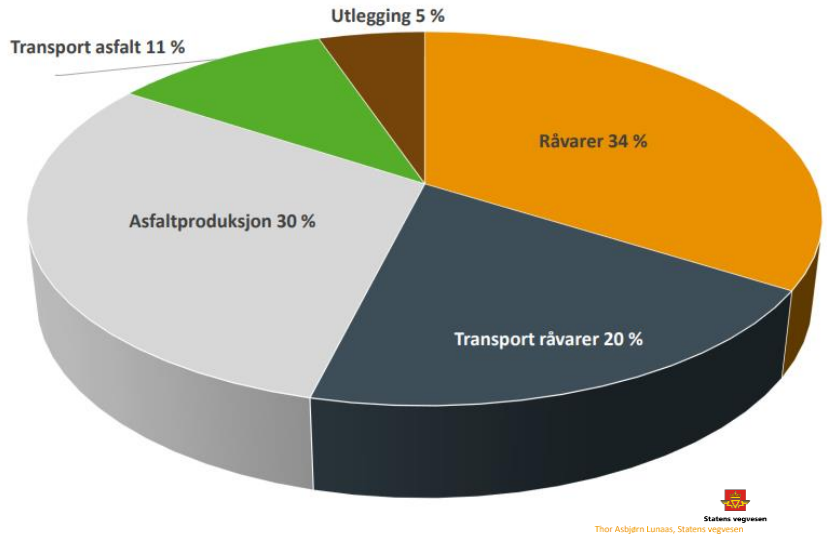
PRODUCTS IN DEVELOPMENT

- Battery and fuel cells technology will deliver **100% CO_2** reduction compared to conventional fuel
- Wheel loaders and excavators

[1] Based on fuel source or lifecycle analysis

…….. og er maskinparken en avgjørende miljøfaktor?

- Co2 i alle ledd
- 2,66 kg for hver liter diesel
- Maskinvalg påvirker EPD'en



…….. og er maskinparken en avgjørende miljøfaktor?

- XE vs. Standard modell
- Sparte kroner
- Redusert Co2
- Bedre EPD verdier
- Økt konkurransekraft
- Maskinvalg er en ***MEDVIRKENDE*** miljøfaktor!

Hours pr year	2 000
Diesel price(NOK)	15
Addblue price(NOK)	13
Addblue pr unit of fuel	3,0 %
Co2 Calculation (Physics)	2,66

			Savings according to hours pr year(B1)							
Location	Machine	Estimated fuel l/h	Litre diesel	Litre Add Blue	Litre Total fluid c.	Total Cost	Savings XE (Kr)	Co2 Reduction (Kg)	Total Co2 (Kg)	% - Co2 Reduction
Standard maskin	972	16	32 000	960	32 960	492 480	92 340	15 960	85 120	19 %
XE - teknologi	972 XE	13	26 000	780	26 780	400 140			69 160	
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ASFALTDAGEN 2024

TAKK FOR OPPMERKSOMHETEN !!!!

PER OLAV LISTOU

Norsk Asfaltforening