ENGINEERING
A BRIGHTER FUTURE

QUARRYNZ
IQQ/AQA ANNUAL CONFERENCE

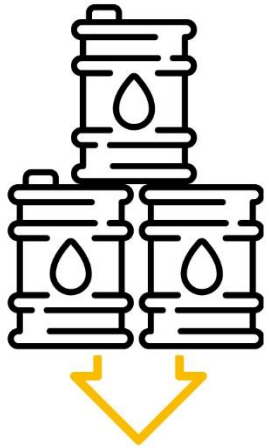
CAT®

AGENDA

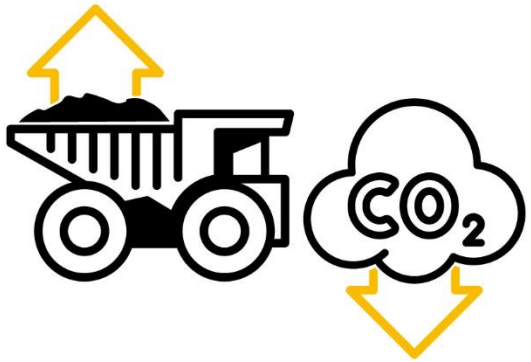
- Product Innovations
- Sustainability- Road to Carbon Zero
- Automation
- Site Management Applications
- Site Efficiency tools

PRODUCT INNOVATIONS

Driving productivity up



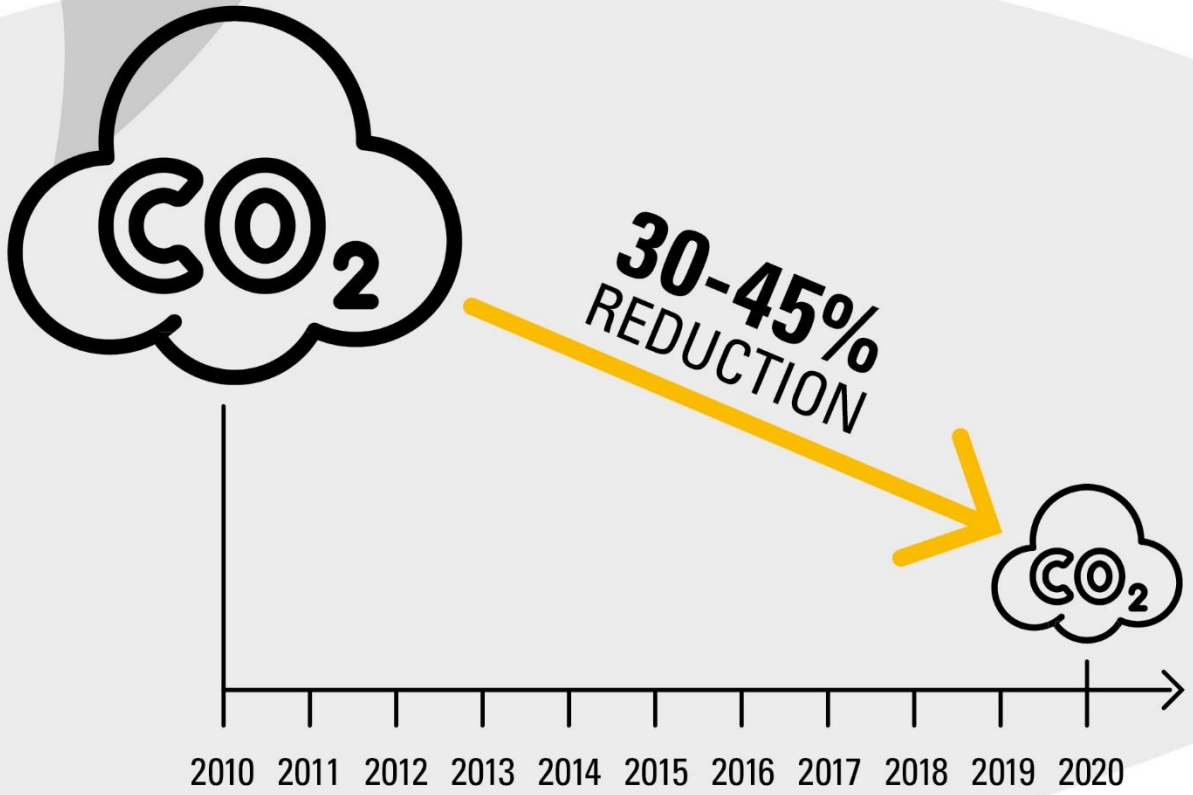
Reducing fuel consumption



Maximizing ton/hour while minimizing liter or CO_2/hour

PROGRESS TO DATE

Over the last decade we have reduced CO_2 emissions by 30-45% on some of our high-volume core construction products. Over a year, this means these machines now emit about 20 to 30 ton less CO_2*



*Productivity, fuel consumption and CO_2 emissions vary by application. Estimated average fuel consumption improvements are based on tests or Product Link® data where available. Productivity improvements are based on test data.
Over 1200 hours of operation, it is estimated current 320 consumes up to 9,000 litres of diesel less than a 2010-built 320D, equivalent to 23 ton of CO2.

966M XE

ADVANCED SYSTEMS WITH INNOVATIVE INTEGRATION

UP TO **25%**
LOWER FUEL CONSUMPTION

UP TO **30%**
MORE PRODUCTIVE

UP TO **35%**
LESS CO_2 PER TON

Deep system integration

Deep Integration of the engine and emissions system, power train, hydraulic system, and cooling system, lowers engine speeds and heat loads, resulting in reduced emissions, improved performance and increased fuel economy.

966H (2010)

966K (2011) — **13**% LESS CO_2 PER TON

966M (2014) — **20**% LESS CO_2 PER TON

966M XE (2016) — **35**% LESS CO_2 PER TON

EVOLUTIONARY REDUCTION IN CO_2

*Productivity, fuel consumption and CO_2 emissions vary by application. Estimated average fuel consumption improvements are based on tests or Product Link® data where available. Productivity improvements are based on test data.

NEXT GEN HEX

ADVANCE HYDRAULICS, SYSTEMS INTEGRATION AND CAT ASSIST TECHNOLOGY

UP TO **45%** INCREASED OPERATOR EFFICIENCY

UP TO **25%** LOWER FUEL CONSUMPTION

UP TO **30%** LESS CO_2 PER TON

336E (2010)

336F XE (2015) — 21% LESS CO_2 PER TON

336 (2019) — 30% LESS CO_2 PER TON

EVOLUTIONARY REDUCTION IN CO_2

320D (2010)

320E (2013) — 15% LESS CO_2 PER TON

320F (2016) — 16% LESS CO_2 PER TON

320 (2018) — 30% LESS CO_2 PER TON

EVOLUTIONARY REDUCTION IN CO_2

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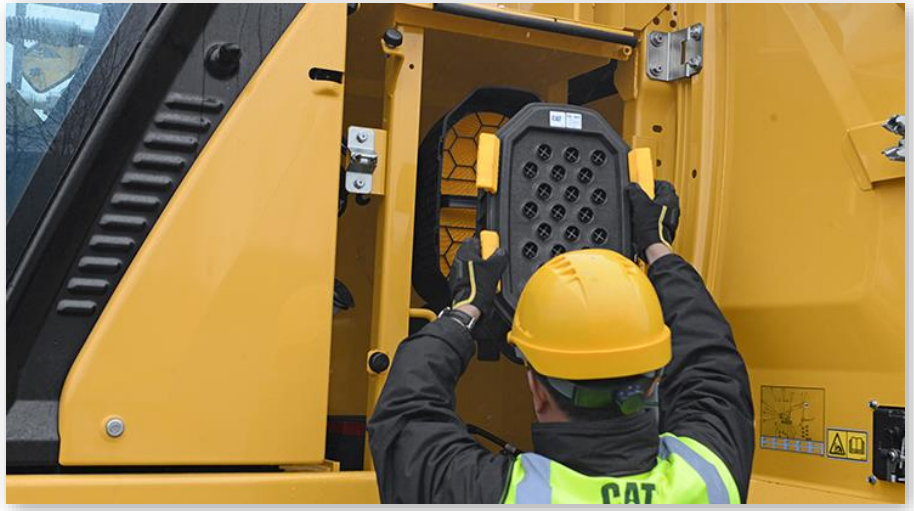
NEXT GEN HEX

KEY FEATURES

- Lower engine RPMs reduce fuel consumption with no reduction in productivity or cycle times
- Choice of engine modes (Eco, Smart and Power) optimize settings for any application
- Hydraulic Pumps - Larger displacement allowing engine to run at a lower rpm for reduced consumption
- Electro-Hydraulic Main Control Valve increases hydraulic efficiency and eliminates unnecessary load on the pump – 60m less hose
- Factory Grade and Payload and E Fence
- Grade Assist achieves target grades quickly, saving fuel and reducing emissions



NEXT GEN LOADERS

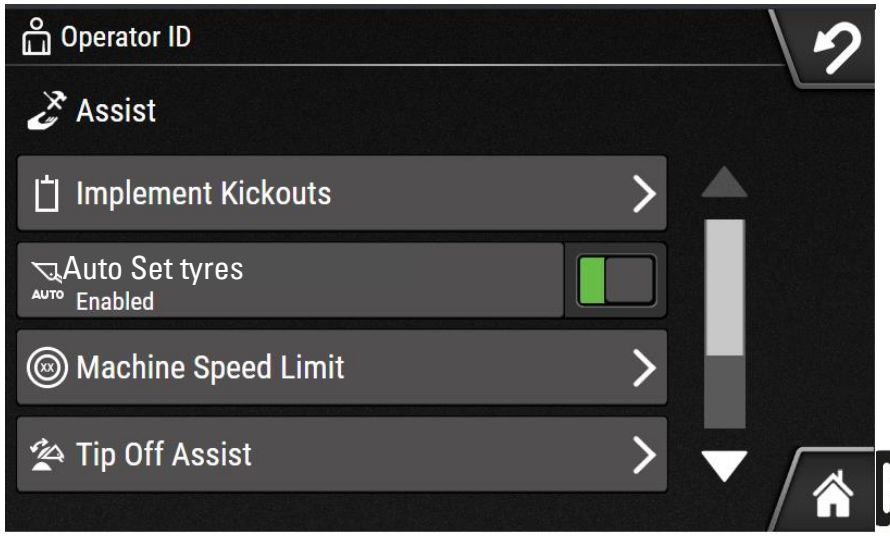
980 980 XE & 982,982 XE KEY FEATURES

- New Cab Environment with or Productivity Enhancements
- Tip Off Assist
- Auto Set Tires
- 360 Degree Vision system with radar system
- Advanced Payload system
- XE CVT Transmission
- Operator Job Aids

NEXT GEN LOADERS

Auto-Set-Tyres

- New Auto Dig aids operators in proper digging technique
- Detects pile engagement, limits rack functions and ensures initial lift command to set tyres
- Lifting to set tyres provides the following benefits
    - Reduced wheel slip -> longer tyre life
    - Improved pile penetration and larger payload Reduced fuel consumption (shorter time in the dig)

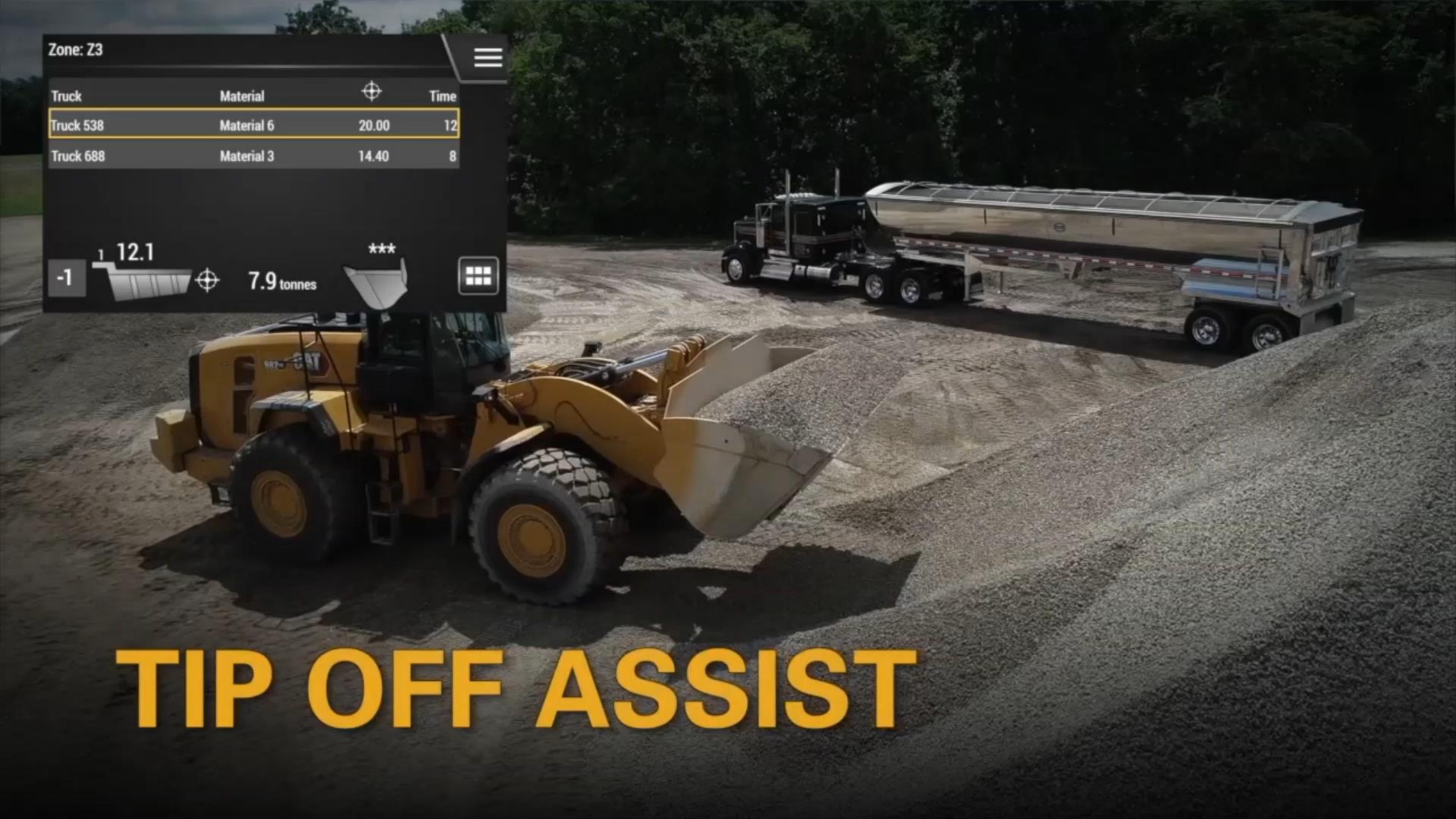


NEXT GEN LOADERS

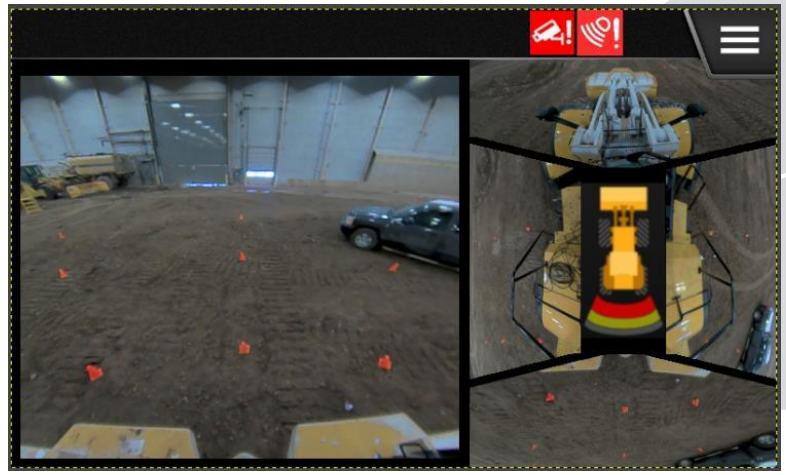
TIP OFF ASSIST

- Automates Tip Off to target weight on final pass for truck
- Can be used with Manual or Auto Trigger in Pile Mode

- **Example** –
- Target weight is entered as 25 ton and is 18 ton already in the truck.
- Operator fills a bucket and gets a low lift weight of 9 ton.
- Tip Off Assist would ***automatically*** tip 2 ton back to the pile, leaving 7 tons in the bucket to meet the 25-ton target.


Zone: Z3
Truck
Material
Time
Truck 538
Material 6
20.00
12
Truck 688
Material 3
14.40
8
1
12.1
-1
7.9 tonnes
***
TIP OFF ASSIST

SAFTEY
OPERATOR ASSIST

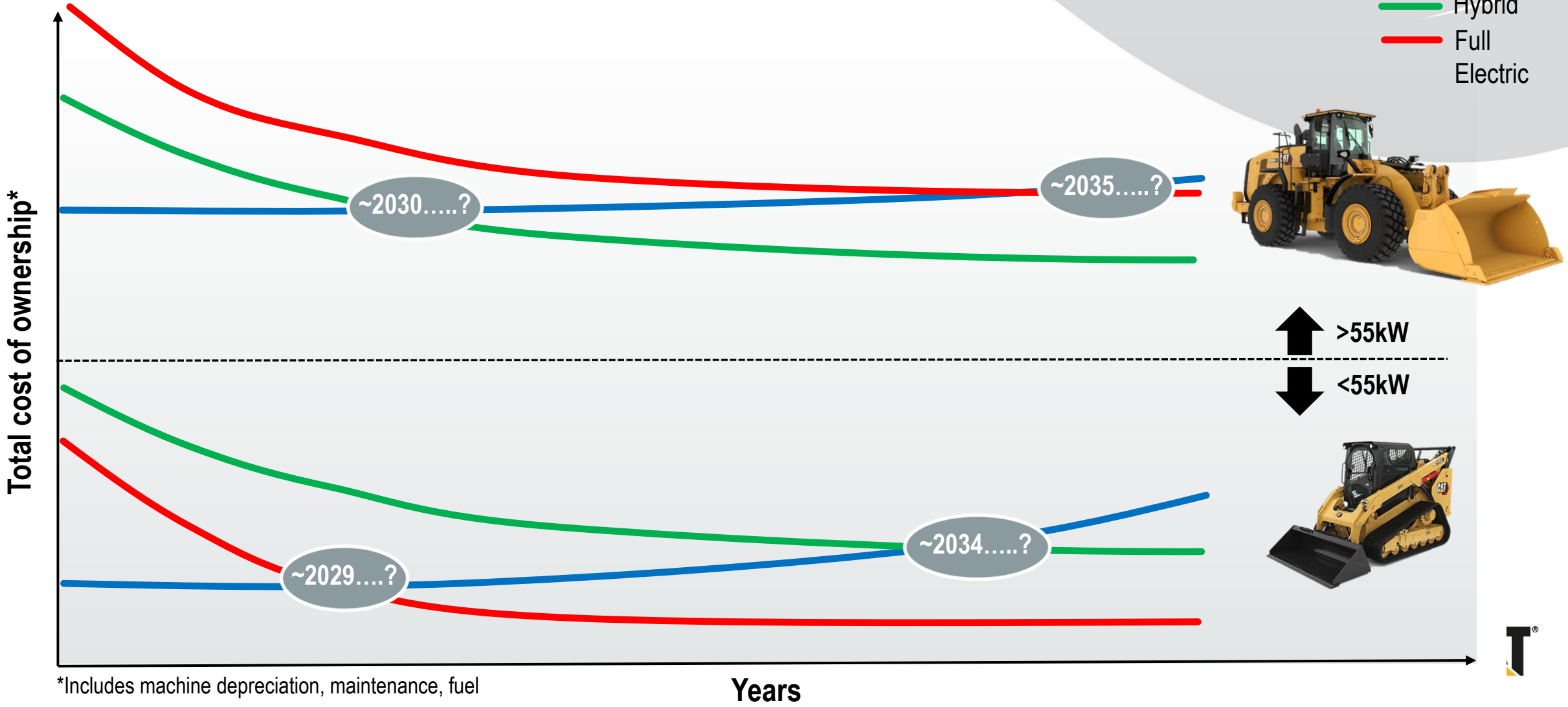


Cameras and Radar
Can be combined with Rear or Multiview (360º) Camera system
Visual alarms
Audible alarms
Discrete, Discrete with retrigger or Continuous
Alarm levels are DISTANCE AND SPEED sensitive
Works on grades with Ground Plane Filtering

Stability Assist warns the operator if machine is approaching a pre-set angle during operation.
The machine will stop hoisting the body and give an audible and visual warning. The system monitors angles of tractor, trailer and grade independently.
All tractor and/or trailer rollover events are logged and reported via VisionLink

TRANSITION TO ELECTRIFICATION

TOTAL COST OF OWNERNERSHIP



*Includes machine depreciation, maintenance, fuel

ELECTRIC & HYBRID POWERTRAINS AT WORK TODAY

Our electrification strategy is built on decades of experience of making industry-leading diesel-electric products. Many of our advanced power offerings are already **AT WORK**.

- Electric drive dozers, loaders, trucks and locomotives that reduce greenhouse gas emissions through more efficient fuel burn
- Hybrid mini excavators that run on diesel fuel or 100% electric power when connected to a remote hydraulic power unit
- Electric drive mining trucks with a hybrid power system that combines electric power via a trolley and diesel engine

ELECTRIC & HYBRID POWERTRAINS AT WORK TODAY

- 3 hybrid concepts launched at Bauma, April 2019
  - Electric / Kinetic / Hydraulic
  - Evolution of diesel range, harnessing hybrid opportunities
- 100hp engine performance from a 73hp engine
  - 55hp diesel power with 26hp hybrid power
  - Allows the deletion of SCR and DEF – lowering TCO
  - Reduces fuel consumption by up to 20%
- Hybrid energy recovery takes place on engine

988K XE

DIESEL ELECTRIC – ADVANCED ELECTRIC DRIVE TECHNOLOGY

UP TO 25%

INCREASED OPERATOR EFFICIENCY

UP TO 25%

LOWER FUEL CONSUMPTION

UP TO 45%

LESS CO_2 PER TON

988H (2010)

988K (2013) — **20**% LESS CO_2 PER TON

988K XE (2017) — **45**% LESS CO_2 PER TON

EVOLUTIONARY REDUCTION IN CO_2

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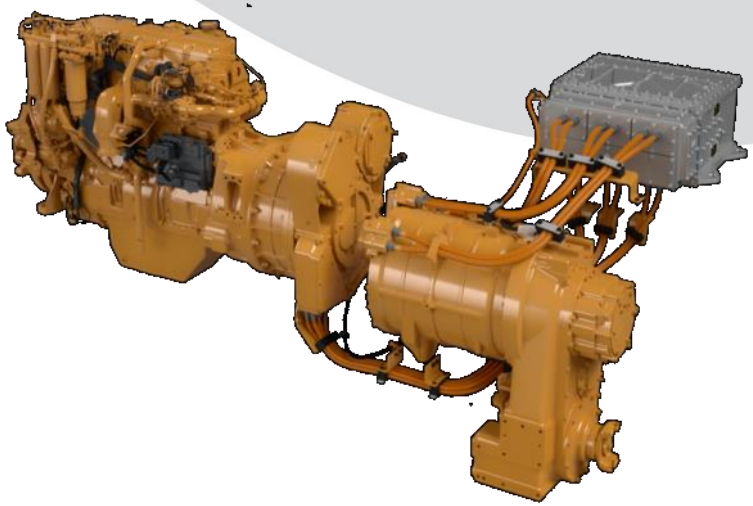
988K XE

DIESEL ELECTRIC – ADVANCED ELECTRIC DRIVE TECHNOLOGY



- Efficiency improvement of up to 49% in tough applications
- Up to 10% increase in productivity in load and carry applications
- No mechanical gears, clutches or valves for torque conversion and transmission
- Up to 25% longer engine life – 50% longer for electric components
- Engine runs in the optimal setting for every application saving fuel, energy and CO_2

BATTERIES AT WORK TODAY

Many of our advanced power offerings are already **AT WORK**.

- Battery-electric underground mining machines that eliminate engine emissions and reduce dust and heat
- Land drilling solutions that combine battery systems with natural gas generators instead of traditional diesel engines

R1700 XE ELECTRIC MINING LOAD HAUL DUMP LOADER

CAT® COMMAND FOR HAULING

Command for Hauling

383+
CAT CMD TRUCKS ON CUSTOMER SITES

8+
YEARS IN OPERATION

0
LOST-TIME INJURIES

110+
MILLION KILOMETERS SAFELY TRAVELED

16
SITES OPERATING 24/7 ON THREE CONTINENTS

3,091,000,000+
TONNES SAFELY HAULED BY AUTONOMOUS TRUCKS

CAT® COMMAND

Remote Control

Line of Site

Non Line of Site

Dozers & Excavators

Wheel Loaders

Skid Steer Loaders

Keeps operator out of the machine when in a high risk areas

- Steep side slopes
- Rough terrain
- Hazardous

AUTONOMY FOR QUARRY

Product Link | VisionLink | Cat Productivity Monitor | Cat Productivity Manage | Cat Productivity Autonomy

EVOLVE TELEMATICS INTO JOBSITE MANAGEMENT

Line of Sight | Non Line of Sight

TURN THE OPERATOR INTO A COMMANDER

Grade Control | Assist Features | Task Automation *(User Dependent)* | Autonomous *(Single Machine)*

TRANSFORM MACHINES INTO ROBOTS

SITE AUTONOMY

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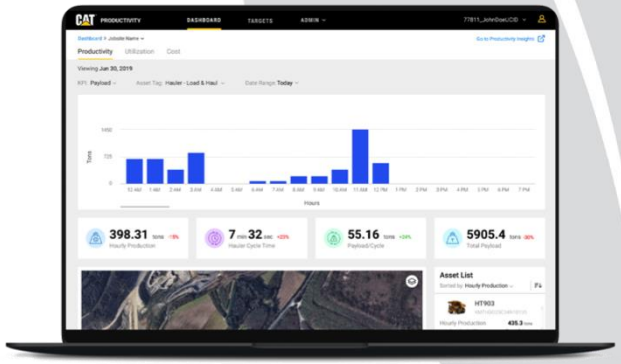
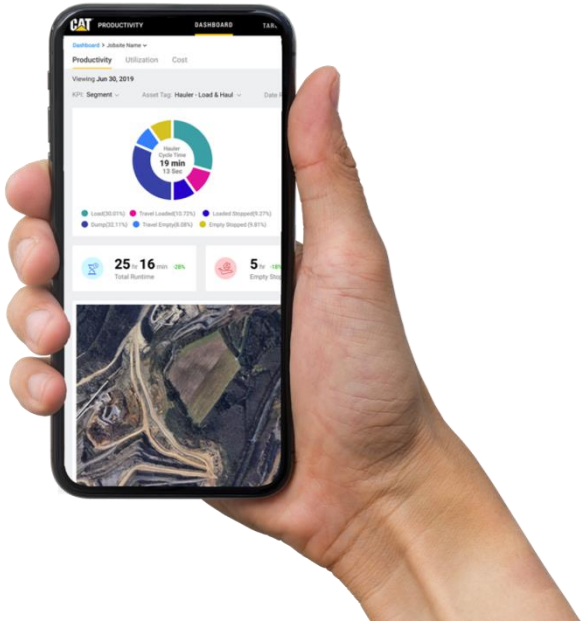
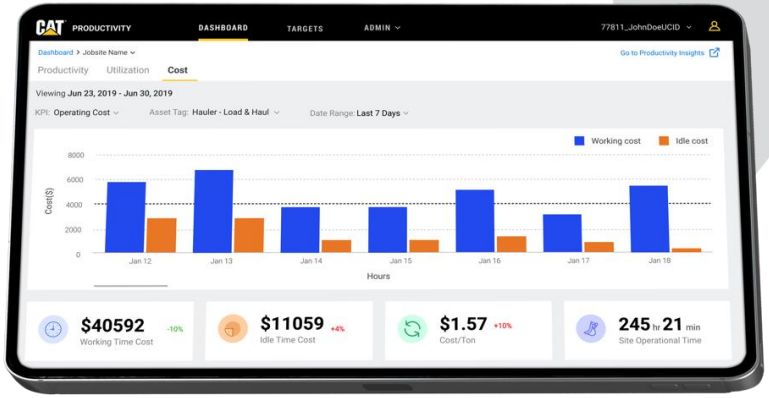
CAT®PRODUCTIVITY



A digital productivity overview allowing you connect a mixed fleet of equipment using GPS through an onboard cellular Product Link device. Cat Productivity allows customers to efficiently manage their site throughout the day using the machine data effectively:

+ Productivity Dashboard
  - Load Counts
  - Payload (if applicable)
  - Segments/Cycle Segmentation
  - Volume (estimated)
+ Utilization Dashboard
  - Working & Idling hours
  - Working & Idling fuel
+ Productivity Insights
+ Shift Reports





CAT®PRODUCTIVITY

Asset Procurement

What machine does the site need?

What is the current production and application?

Are they achieving production with new asset?

Asset Health / Yellow Fleet Managers

Is the site looking after the machine?

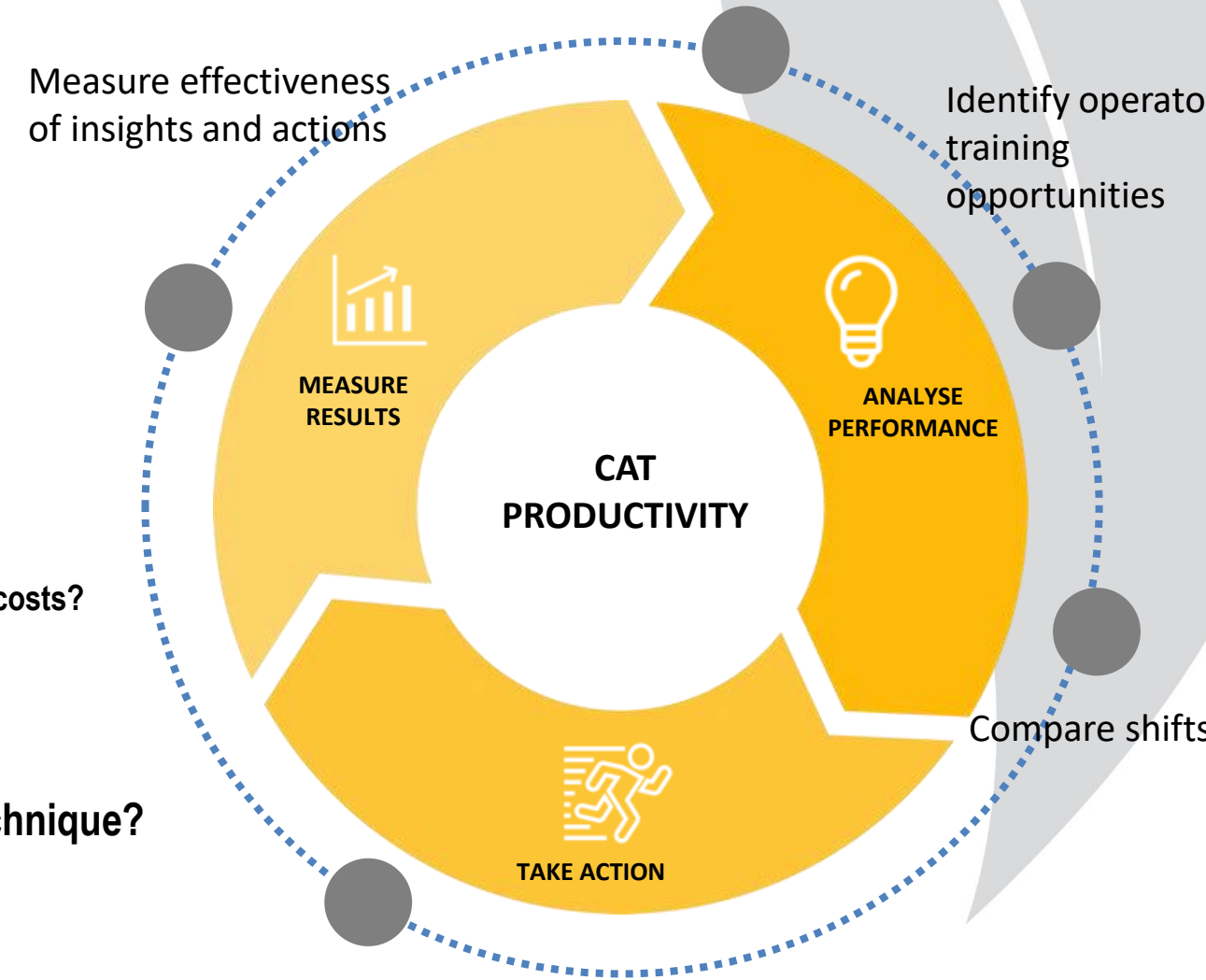
Payload overloads, Overheats, Excessive Travel,

Is the customer going to achieve the lowest owing and operating costs?

Operator Trainers

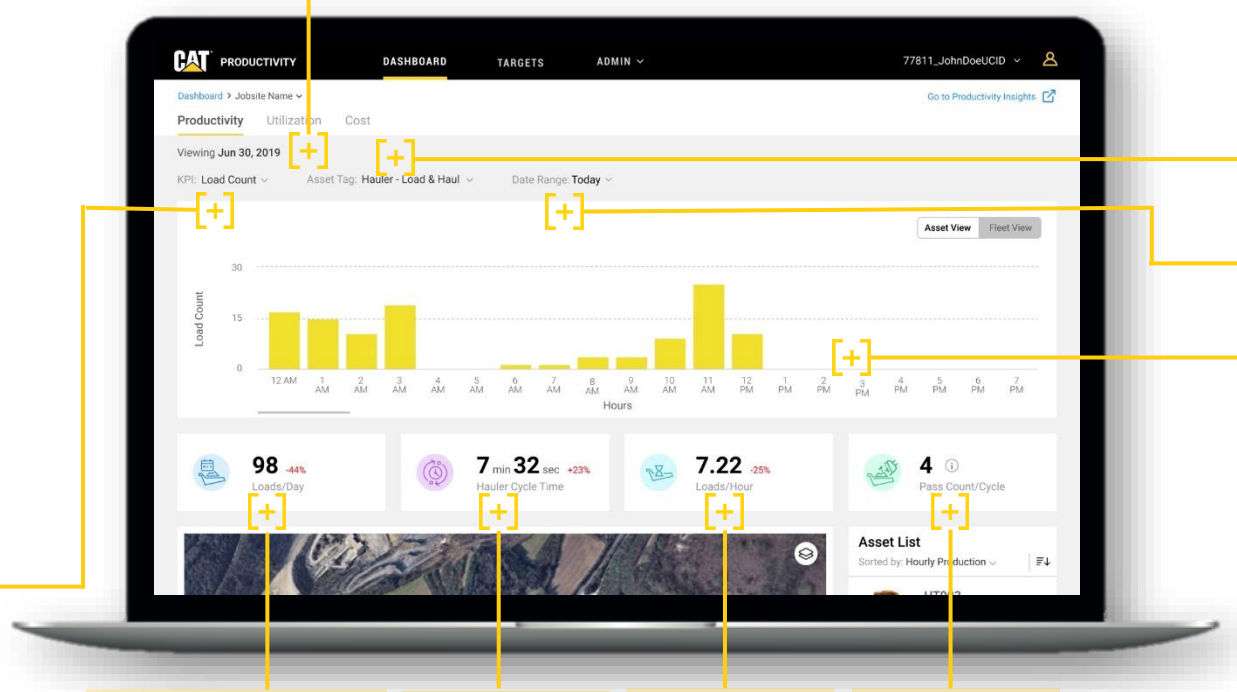
Are the operators using the machines correctly?

Can they improve productivity by looking at operator technique?



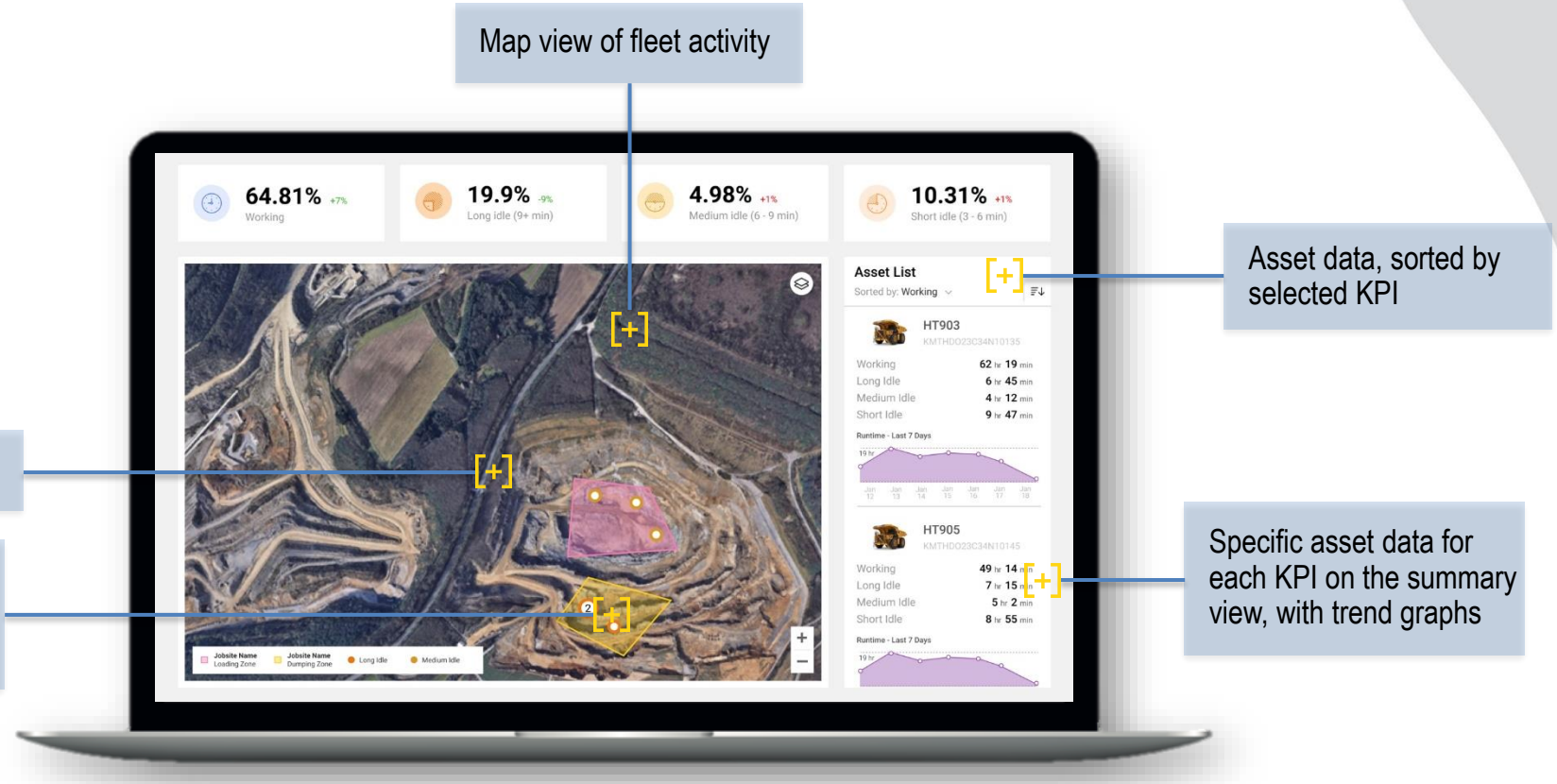
CAT®PRODUCTIVITY

Remote job site and fleet management

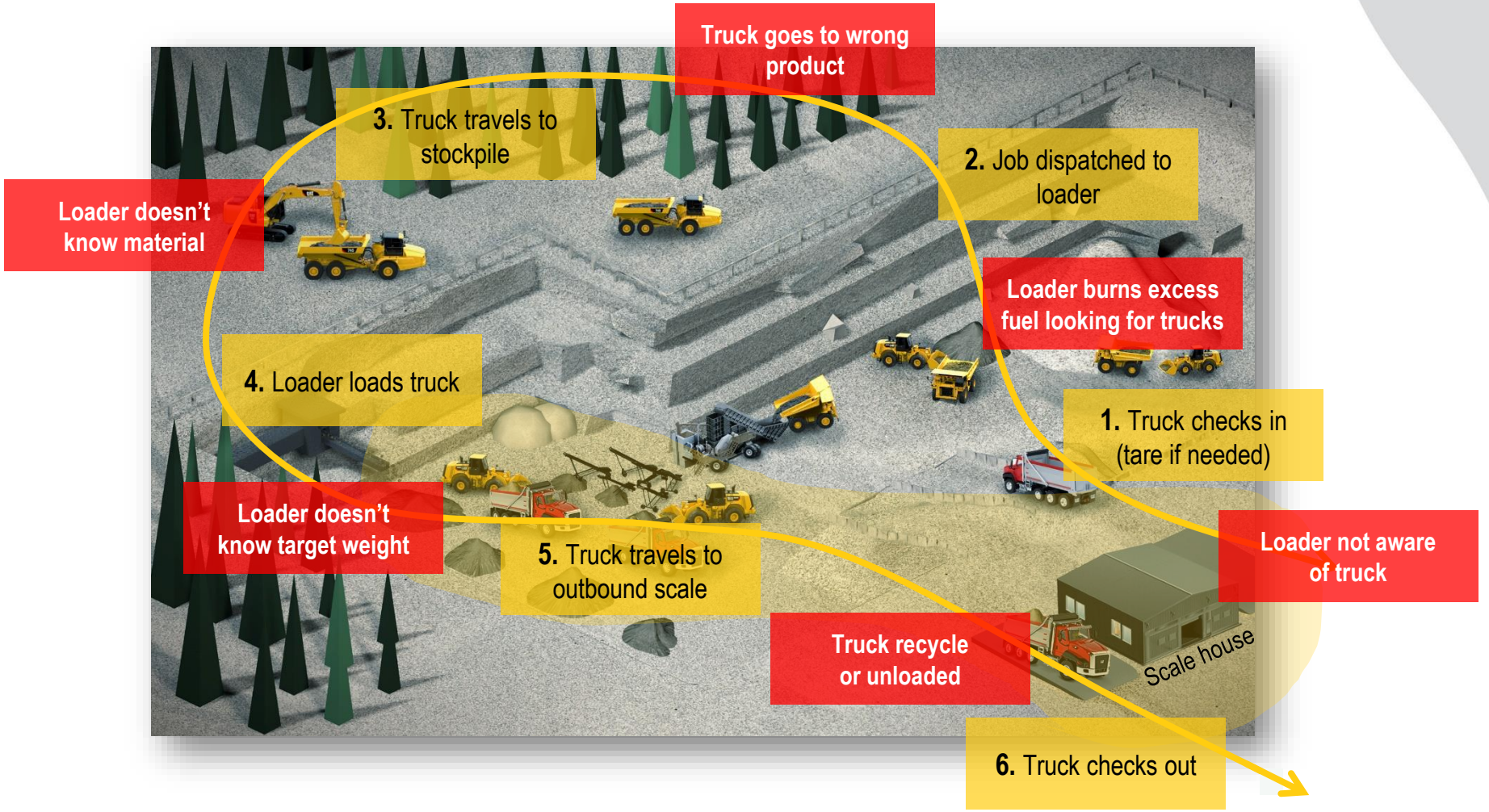


CAT®PRODUCTIVITY

Remote job site and fleet management



CAT® DISPATCH FOR LOADING

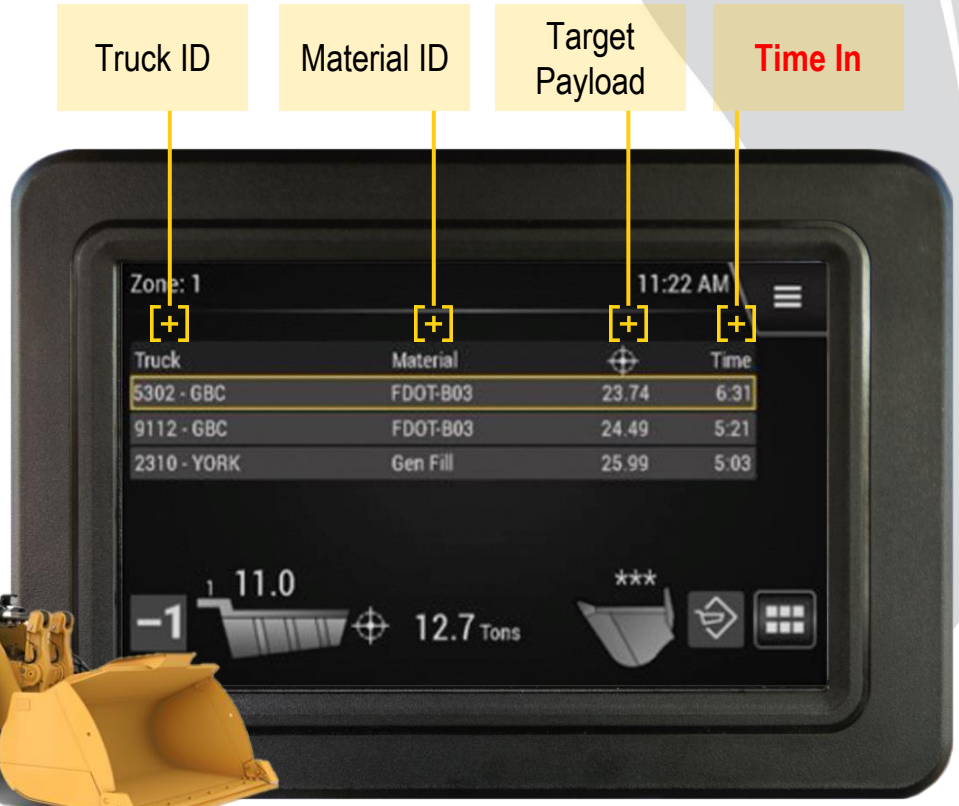


CAT® DISPATCH FOR LOADING

CAT® DISPATCH FOR LOADING

Inbound Trucks

As trucks enter the yard, key information is sent to the loader display. Cellular first.



Loader (list of trucks in the yard waiting to be loaded)

ENGINEERING
A BRIGHTER FUTURE

- From 2010 to 2020 we have reduced CO_2 emissions on high-volume core products by 30-45%
- Over the past two years we have invested $3.5 billion in R&D to innovate for our customers
- we've been investing in electrification for decades and Cat® electrified products are at work on customer sites around the globe
- We bring new technologies to market when they are commercially and economically viable
- We partner with our dealers and customers on maintenance practices and jobsite efficiency improvements that reduce the environmental impact

THANK YOU

ENGINEERING
A BRIGHTER
FUTURE

CAT®