Vehicle Recycling
Dismantling The Future

Organised by ATF International
Advanced Propulsion Centre Warwick University

November 27- 2019

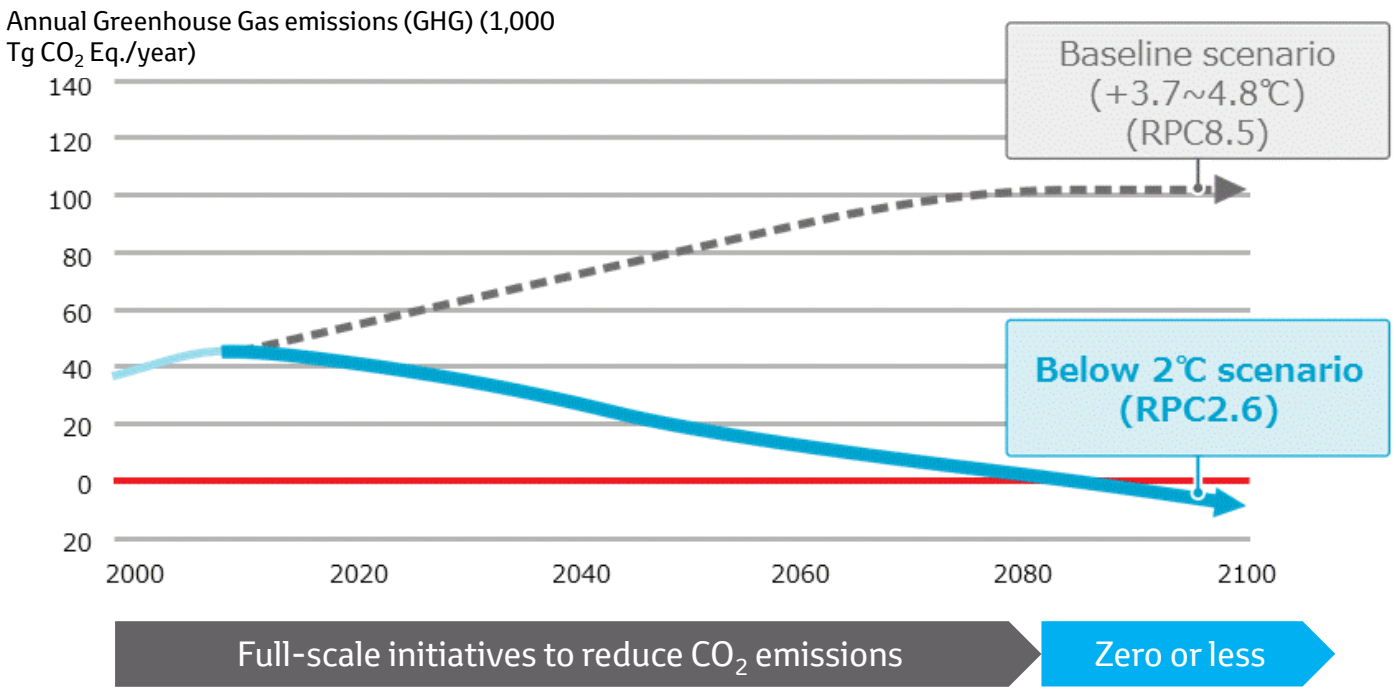
Steve Hope
General Manager – Environmental Affairs & Corporate Citizenship

Environmental Challenges

TOYOTA ENVIRONMENTAL CHALLENGE 2050

TOYOTA

Forecast International Climate Change



Source: From the IPCC Working Group III 5th Assessment Report (2014)

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CO_2 Emission Regulations Becoming Very Stringent

	2015-2019	2020	2021	2025	2030
CO_2 g/km	130 now	95 95% phase-in	XXg WLTP (95g NEDC equiv)	-15% (from 2021)	-37,5% (from 2021)
EURO standard	EURO 6			Post EURO 6?	

*NEDC

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Air Quality - NOx

New City Regulations are increasing

- Access **Regulations**
- Clean Air Zones
- Low Emission Zones
- Ultra Low Emission Zones
- Zero Emission Zones

Source: www.urbanaccessregulations.eu

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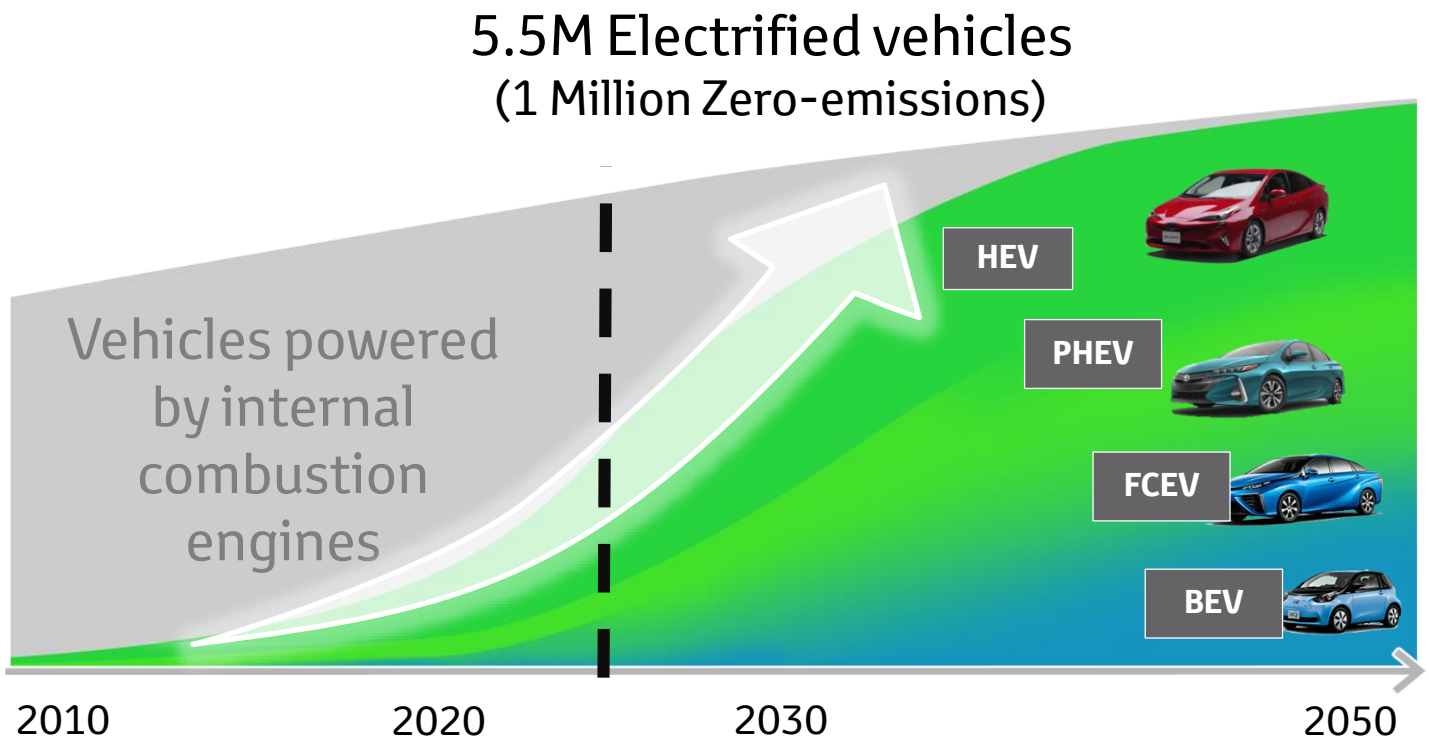
- New vehicle zero emissions
- Life cycle zero emissions (raw materials, parts & manufacturing, use, recycling)
- Plant zero emissions
- Minimizing and optimizing water usage
- Establishing a re-cycling based society
- Establishing a future society in harmony with nature

TOYOTA

Challenge 1:
New Vehicle Zero CO2



*This coloured graph is for illustrative purposes

Toyota – The Most Electrified Brand

21 HEV models
available today

46%
Hybrid mix
TTL TME
2018

61%
Hybrid mix
West Europe
2018

14Mtotal
Nov 2019

Hybrid Electric Vehicles (HEV) sold worldwide;
OVER 2.2M IN EU

5.5M/year
2030

Electrified vehicle sales / year
incl. 1M FCEV & BEV

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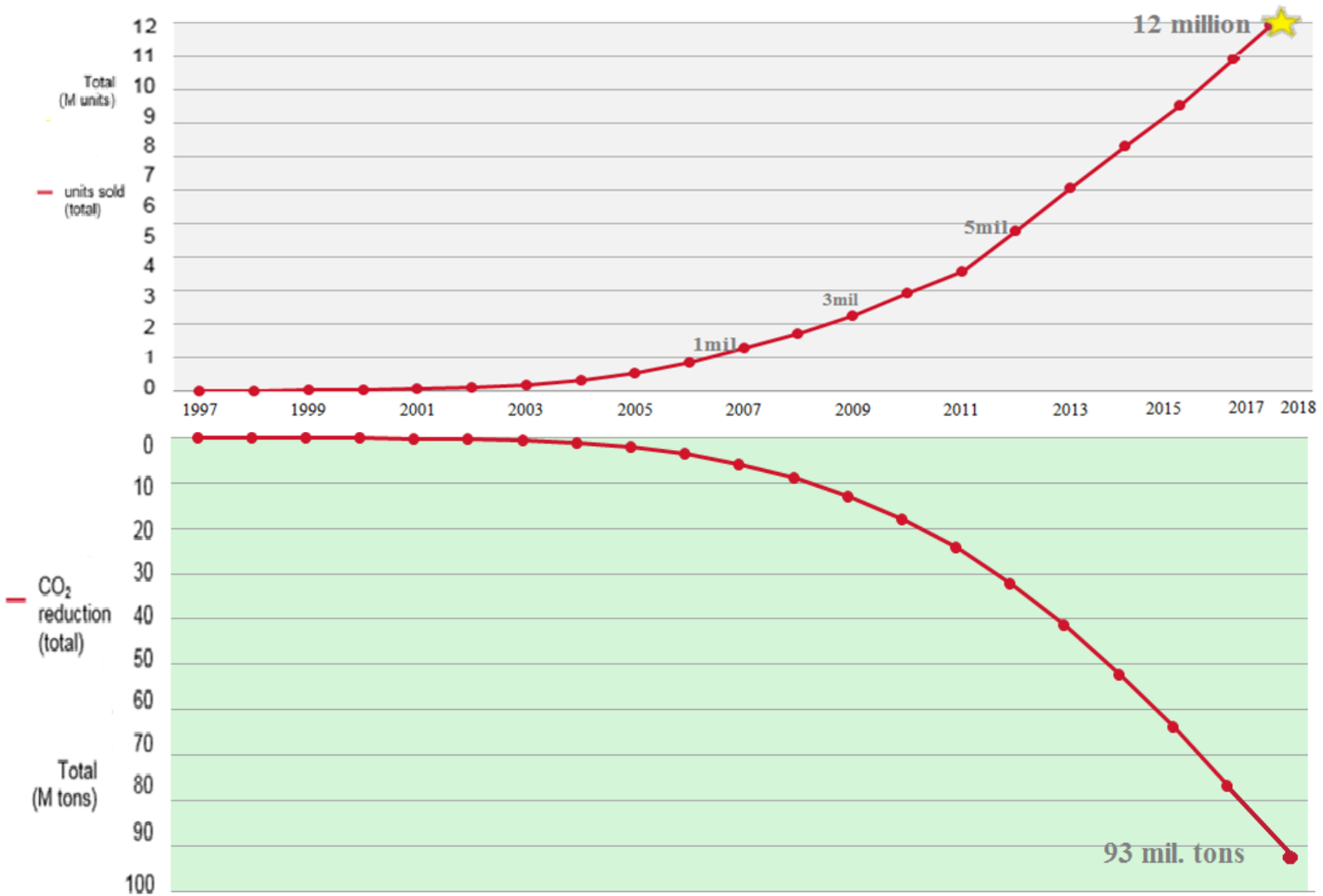
Toyota Cumulative HEV Sales & CO_2 Reduction



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Self Charging Hybrid Electric as Core Technology

Sustainable Mobility

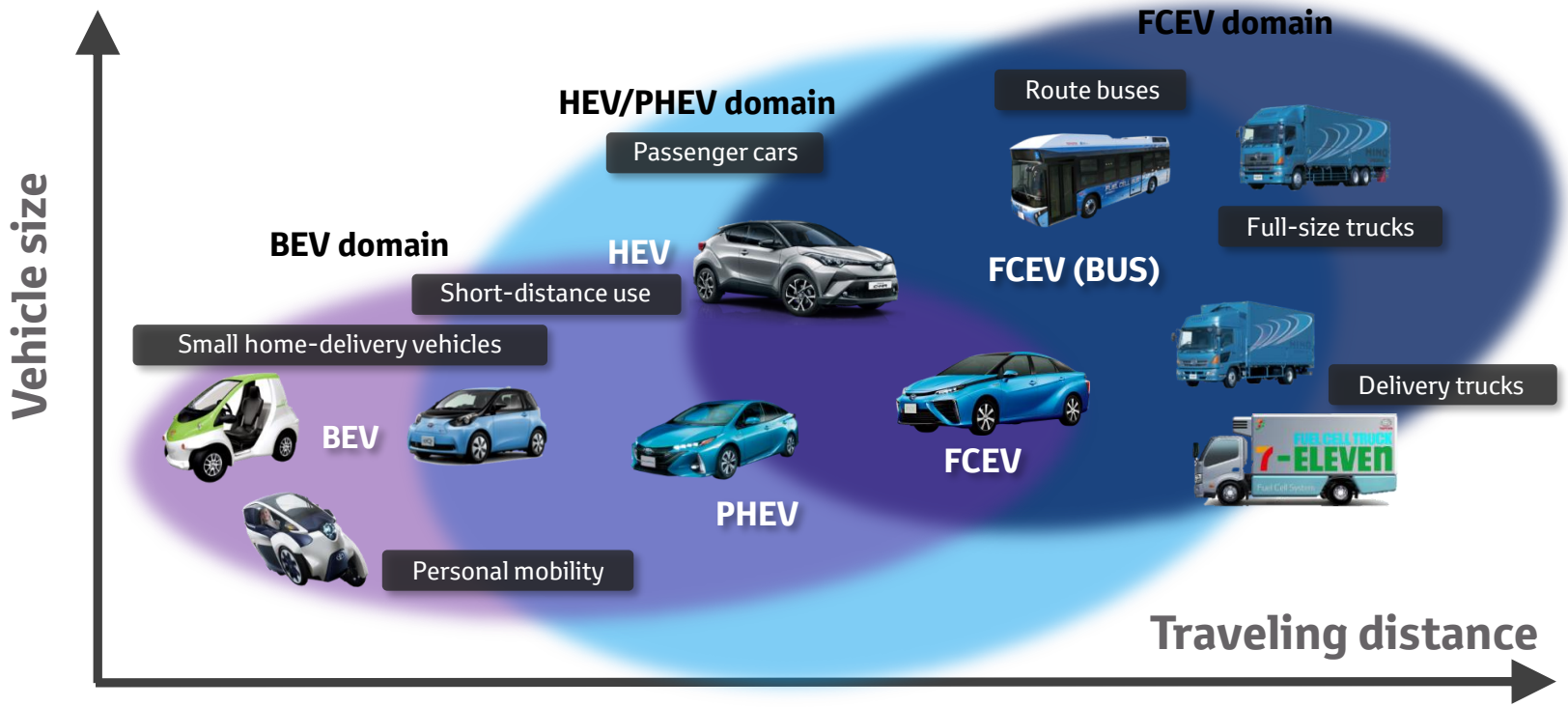
Energy diversity | CO_2 reduction | Air quality

HYBRID ELECTRIC TECHNOLOGY

Gasoline, diesel | Gaseous fuels | Biofuels | Synthetic fuels | Electricity | Hydrogen

Toyota's Sustainable Mobility Strategy

Technology diversification including self-charging HEVs allows customers to select a vehicle according to their needs (usage, size, distance, budget, etc. ...)



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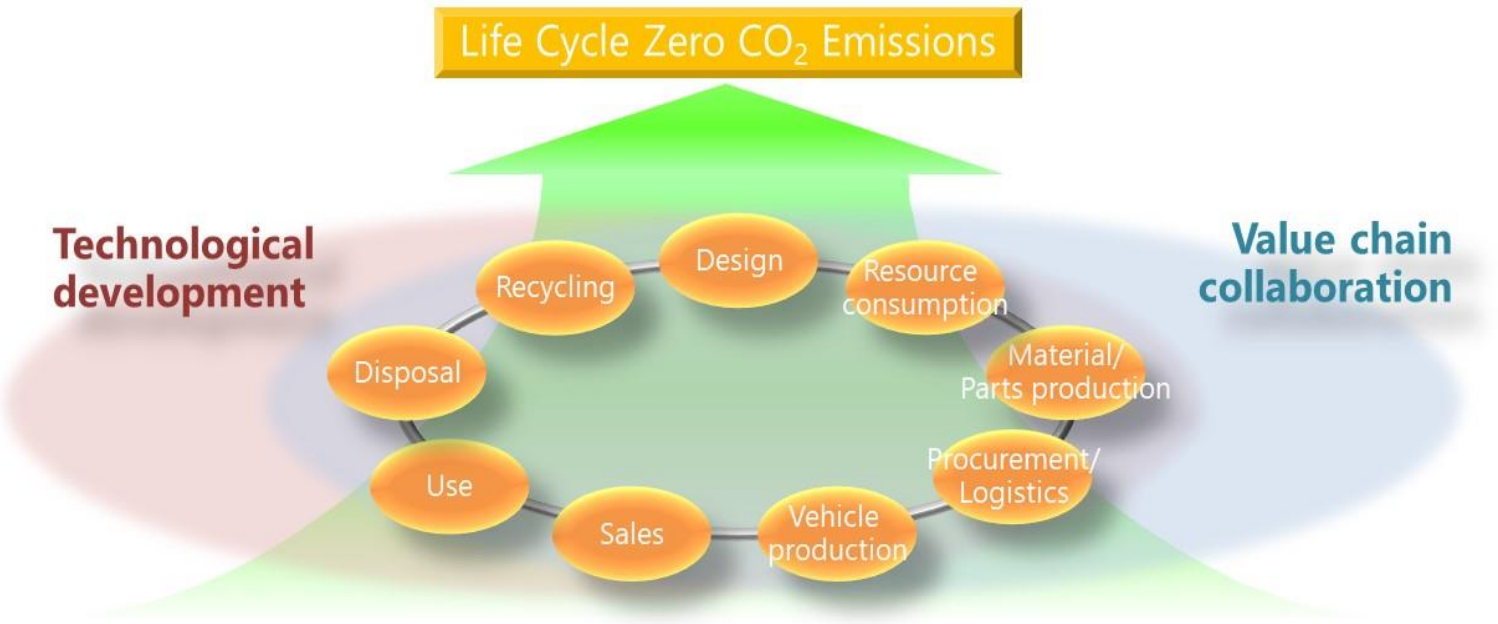
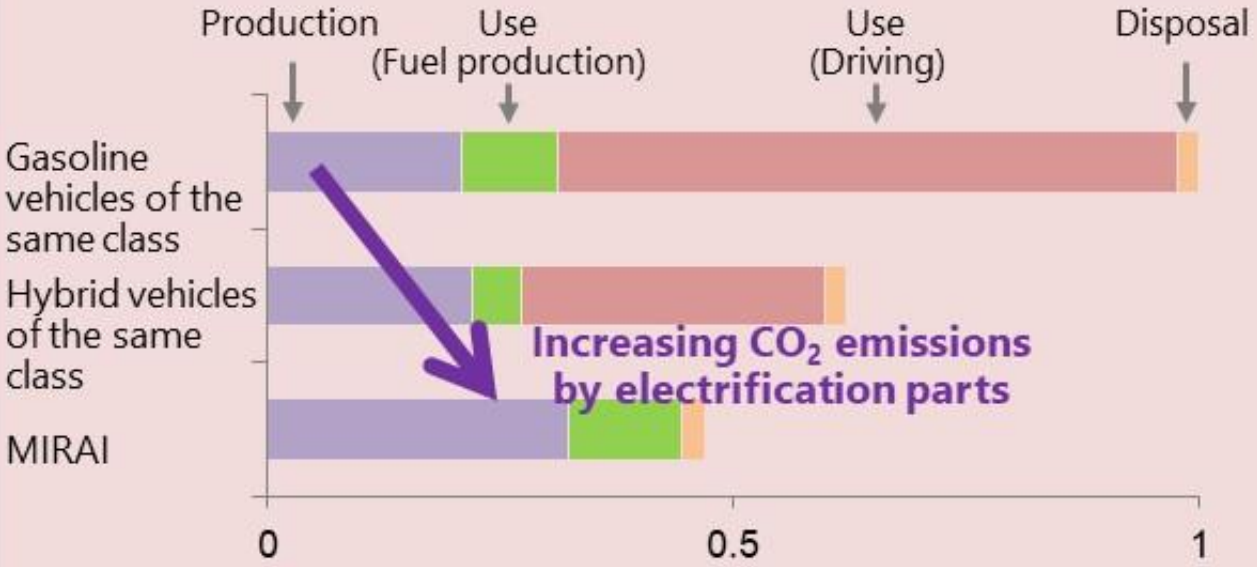
Challenge 2
Life Cycle Zero CO_2 Emissions



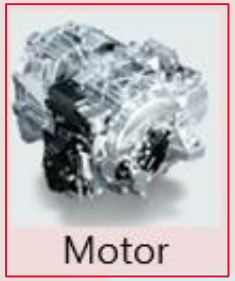
Reduction of CO_2 emissions in production of electrification parts

<MIRAI>

Increasing CO_2 emissions in production



Some electrification parts


Motor


Power control unit


Battery


FC stack


High-pressure hydrogen tank

by promoting eco-friendly design with focus on CO_2 emissions
(including limiting the extraction of virgin raw materials)

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Challenge 5: Establishing a re-cycling based society

Using Established Depollution, Dismantling, Shredding and Sorting Processes

96.9%
REUSE & RECOVERY

Unique Toyota PHEV Shredder Trial

Raw materials

CAR TO CAR

Battery collection via Dealer and Dismantler

Battery Recycling

Second-life vehicle reuse or for energy storage

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Li-ion battery disassembly

HV Battery
Voltage 350
Kg 77

Risks **A <u>damaged</u> battery can potentially lead to a range of problems:**

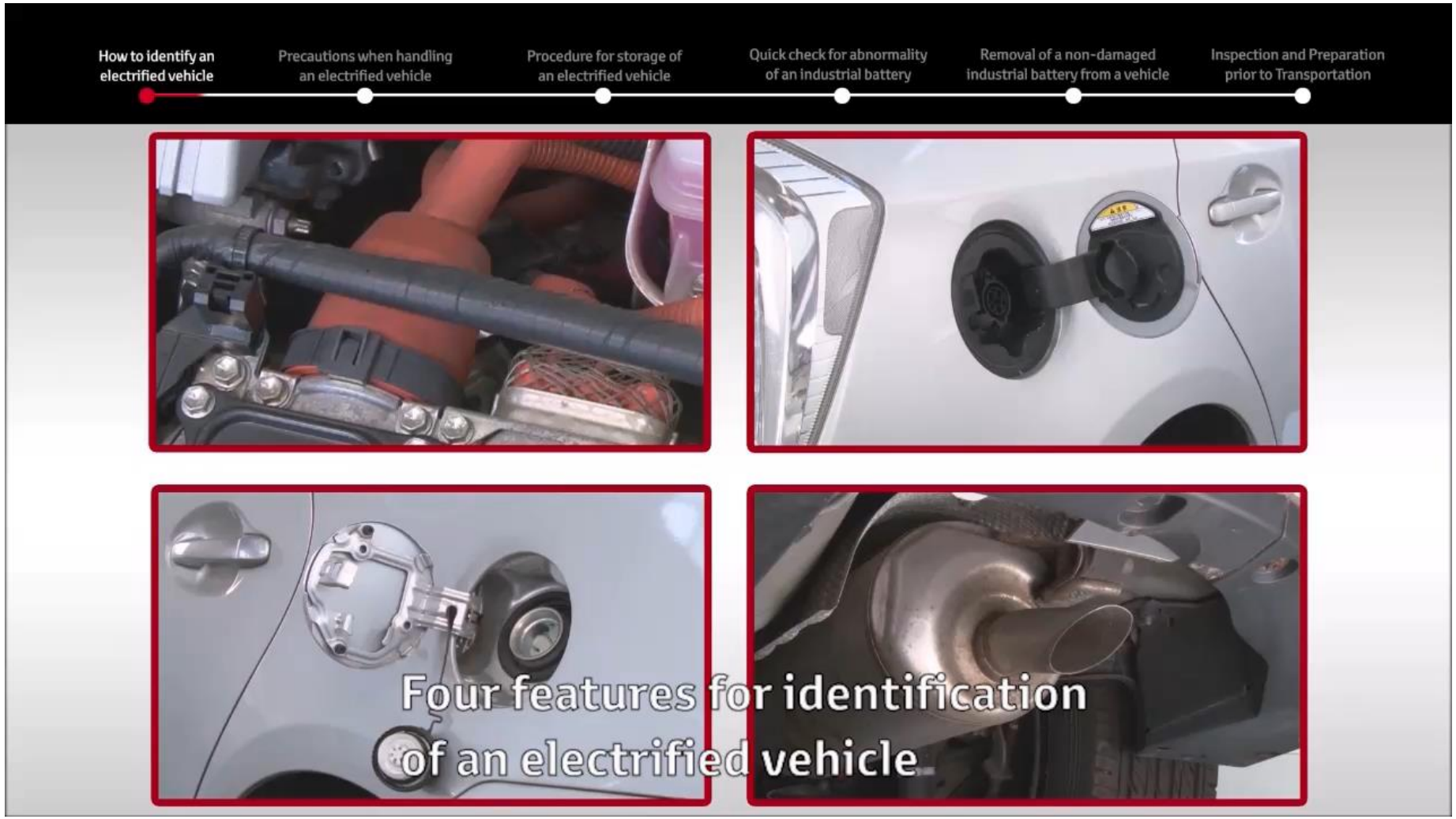
- 1. Electrical shock
- 2. Electrolytic fluid leakage
- 3. Handling
- 4. Fire

Toyota's approach to battery safety:
" PHEV High Voltage Battery Removal Video"

In order to prepare the dismantling video TME:

- Interviewed 7 Stakeholders in 5 developed countries
- Video will be integrated in the IDIS HVB general section
- Link: https://www.toyota-tech.eu/hvb/data/PHEV_HighVoltageBattery_Removal.mp4
- Also available on ATF Professional : Toyota video promotes safe handling of HV batteries | ATF Professional

How to identify an electrified vehicle



Precaution when handling an electrified vehicle

How to identify an electrified vehicle | **Precautions when handling an electrified vehicle** | Procedure for storage of an electrified vehicle | Quick check for abnormality of an industrial battery | Removal of a non-damaged industrial battery from a vehicle | Inspection and Preparation prior to Transportation

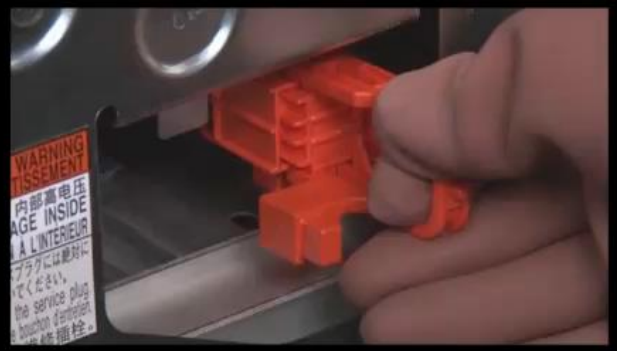
PROHIBITED

Please remove the industrial battery from the vehicle before starting any dismantling operation.
Do not remove the industrial battery from the vehicle with heavy duty machinery.

Procedure for storage an electrified vehicle

How to identify an electrified vehicle | Precautions when handling an electrified vehicle | **Procedure for storage of an electrified vehicle** | Quick check for abnormality of an industrial battery | Removal of a non-damaged industrial battery from a vehicle | Inspection and Preparation prior to Transportation

Before storing an electrified vehicle



Remove the service plug (wearing insulation gloves)

Disconnect the negative (-) terminal of sub-battery

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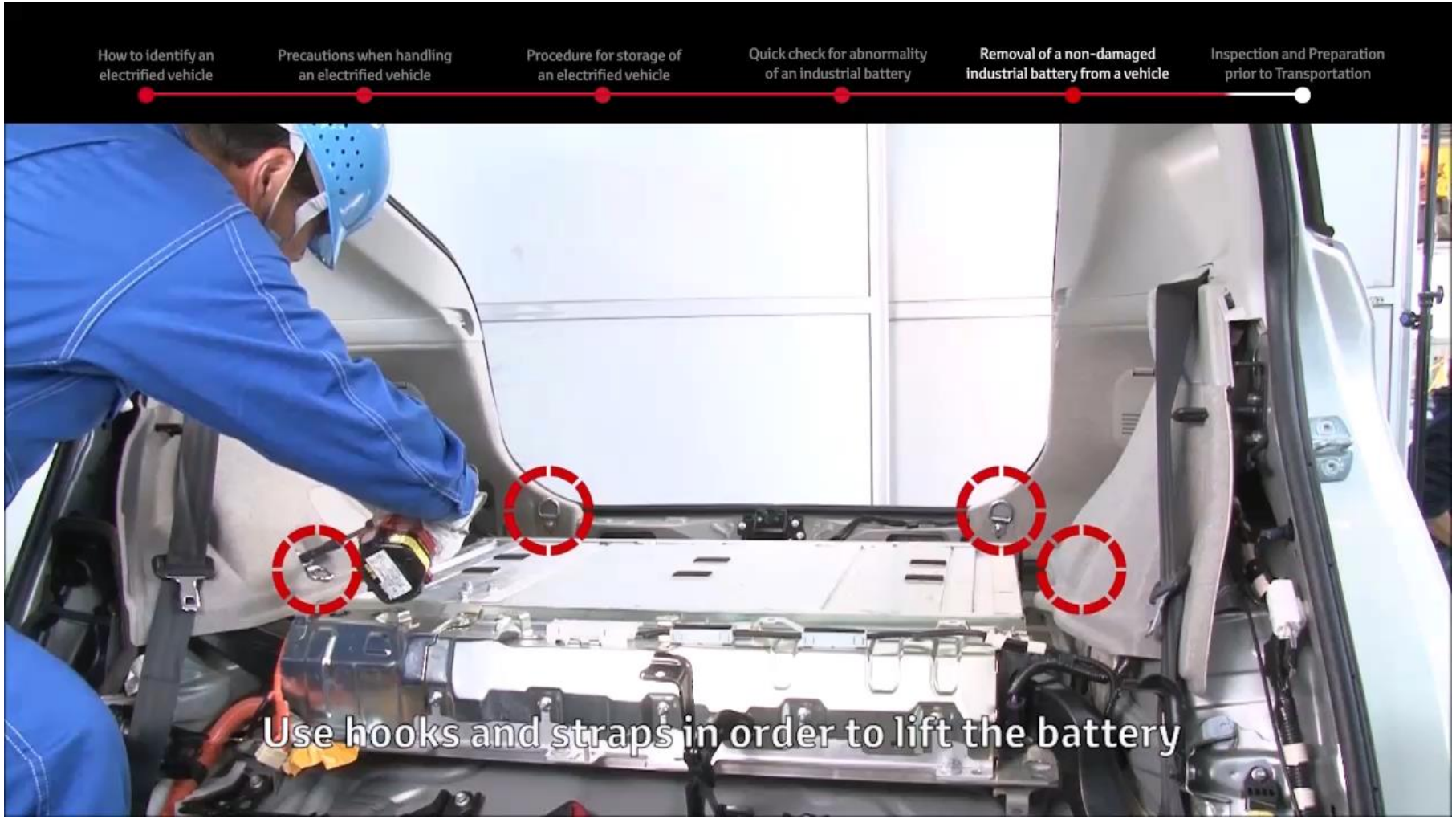
Quick check for abnormality of an industrial battery

Is there any evidence of damage, electrolyte leakage, abnormal heating ?

YES -> Store the vehicle by following the set procedure and contact the Toyota national distributor

NO-> Follow the set procedure for handling a non-damaged industrial battery

Removal of a non-damaged industrial battery from a vehicle



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Inspection and Preparation prior to Transportation

TME / NMSC* HV battery Collection Network

① Non-damaged / non-defective batteries

NiMH (nickel metal hydride battery)

Send order request for collection
(existing procedure)

Pick-up
of each individual battery

SNAM
FLORIDIENNE

*NMSC= National Marketing and Sales Company

① Non-damaged / non-defective batteries

LI-ion (Lithium-ion battery)

①

request for info
on what to do with the battery

NMSC

recommend to bring
battery to nearest retailer

③

④

bring battery to nearest retailer

②

get agreement with retailer
on acceptance

TPCE* (Diest – Belgium)

⑤

order packaging

&

send back the
battery through
reverse logistics

* TPCE= Toyota Parts Centre Europe

HYBRID BATTERY RECYCLING ROUTES

TPCE

TEST BATTERY PROPERTIES
(remaining capacity, ...)

From ATF

QUALITY INVESTIGATIONS (QD)

RE-USE / RE-MANUFACTURING
<vehicle to vehicle>

RE-USE / RE-MANUFACTURING
<vehicle to energy grid storage>

RECYCLING

NiMH hybrid batteries

TME is waste producer
= legal responsibility

Recycling company
SNAM
(France)

Lithium hybrid batteries

Recycling company
UMICORE
(Belgium)

under development

② Damaged / defective batteries

<NiMH>

Send order request for collection
(existing procedure)

- Provide appropriate packaging
- assure pick-up of each individual battery

SNAM
FLORIDIENNE

<Lithium>

② Damaged / defective batteries

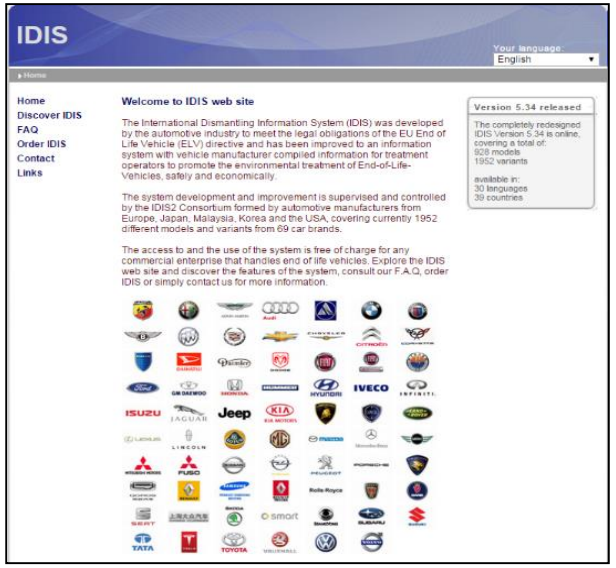
NMSC

Call National Distributor for:

- Advise
- Handling instruction
- Test equipment
- Arrange collection

Where to find information:
IDIS

- The **International Dismantling Information System (IDIS)** was developed by the automotive industry to meet the legal obligations of the EU End-of-Life Vehicle (ELV) directive.
- It **compiles vehicle manufacturer information** for **treatment operators** to promote the environmental treatment of End-of-Life-Vehicles, safely and economically.
- It is available for 39 countries and 30 different languages.



The vehicle data is organized into different areas. These areas are:

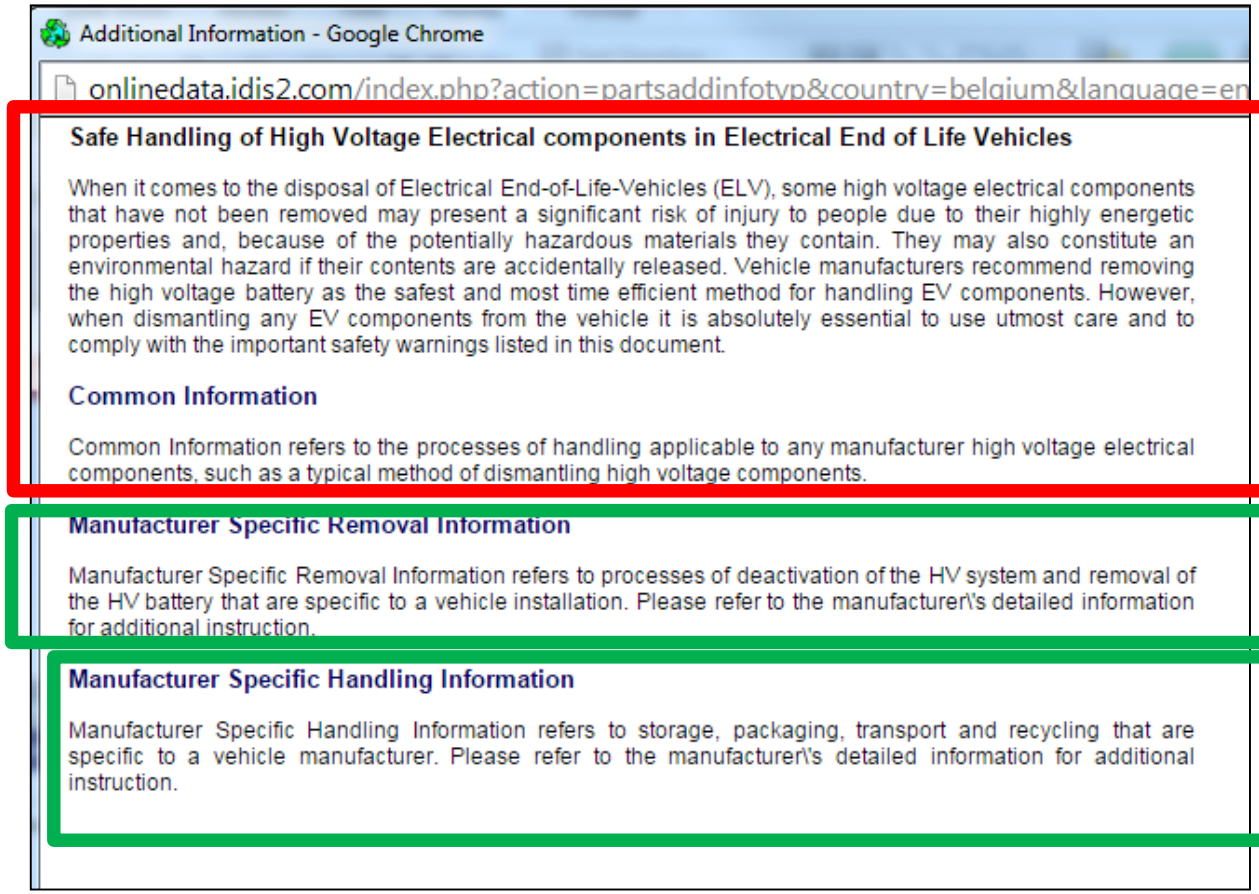
Batteries
Fuels
Draining
Controlled Parts to be removed
Other Pre-treatment
Pyrotechnics
AC
Catalysts
Tyres
Dismantling

- Manufacturer's specific information for airbags and **hybrid batteries**

- Website: www.idis2.com

IDIS – Improvement of Hybrid Battery Handling Information

Toyota has enhanced the Hybrid Battery Handling Information



Common Information

Manufacturer Specific Information

Additional Manufacturer Specific Information

HEV – Conclusions (1)

Future Mobility Global Vision

"Toyota will **lead the way to the future of mobility**,

enriching lives around the world

with the safest and most responsible ways of moving people."

HEV – Conclusions (2)

- **21 models** → further expansion of model range (incl. BEV and FCEV)
- **Hybrid electric technology requires IPM motor**, allowing EV-drive
- **Continuous improvements (Kaizen) leading to size and volume reductions** (eg. number of magnets)
- **Reduction and substitution of critical rare earth elements**

TOYOTA ENVIRONMENTAL CHALLENGE 2050

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Customer Benefits

- **Better fuel economy**

30-40% lower than equivalent petrol engines

- **More fun to drive and allowed city access**

quiet, smooth and easy to drive thanks to automatic transmission

- **Strong residual values and affordable**

Toyota HEVs are affordable and consistently awarded high residual values; ahead of conventional vehicles and up to 30% higher than EV's

- **Lower maintenance costs**

there are fewer components to replace and brakes wear less because most of the braking is done by the electric motor

Benefits for the Society

- **Reduced greenhouse gas emissions**

- Improved fuel economy 30-40% lower than equivalent petrol engines
- EV-mode = zero emissions
- Continuous improvement through the entire product life cycle, reducing overall life cycle CO_2

- **Better air quality**

91.6% reduction of HEV versus Euro 5-6 petrol standards

- **Improved resource conservation**

establishment of a recycling based society

ATF'S

Toyota:

- **Is fully prepared for Electrified Vehicles at the ELV**
- **Is providing practical safety materials for ATF's**

Thank you