futurefuel strategies

Prospects for Fossil Fuels in the Transportation Sector

January 2020

Rough Evolution of Global Fuels Regulation

Evolution from gasoline & diesel fuel quality and emissions improvement to other & totally new fuels, vehicles, technologies

Most of Africa, parts of Latin America & Asia now here

1980s

- Lead phase out
- Volatility
- Emission standards
- First fuel economy standards

1990s

- First stage sulfur reduction
- Reformulated gasoline
- Alternative fuels
- First WWFC

2000s

- Second stage sulfur reduction
- Benzene controls
- Biofuels mandates
- More stringent fuel economy/ GHG & emissions standards
- Non-road emissions

2010-2020s

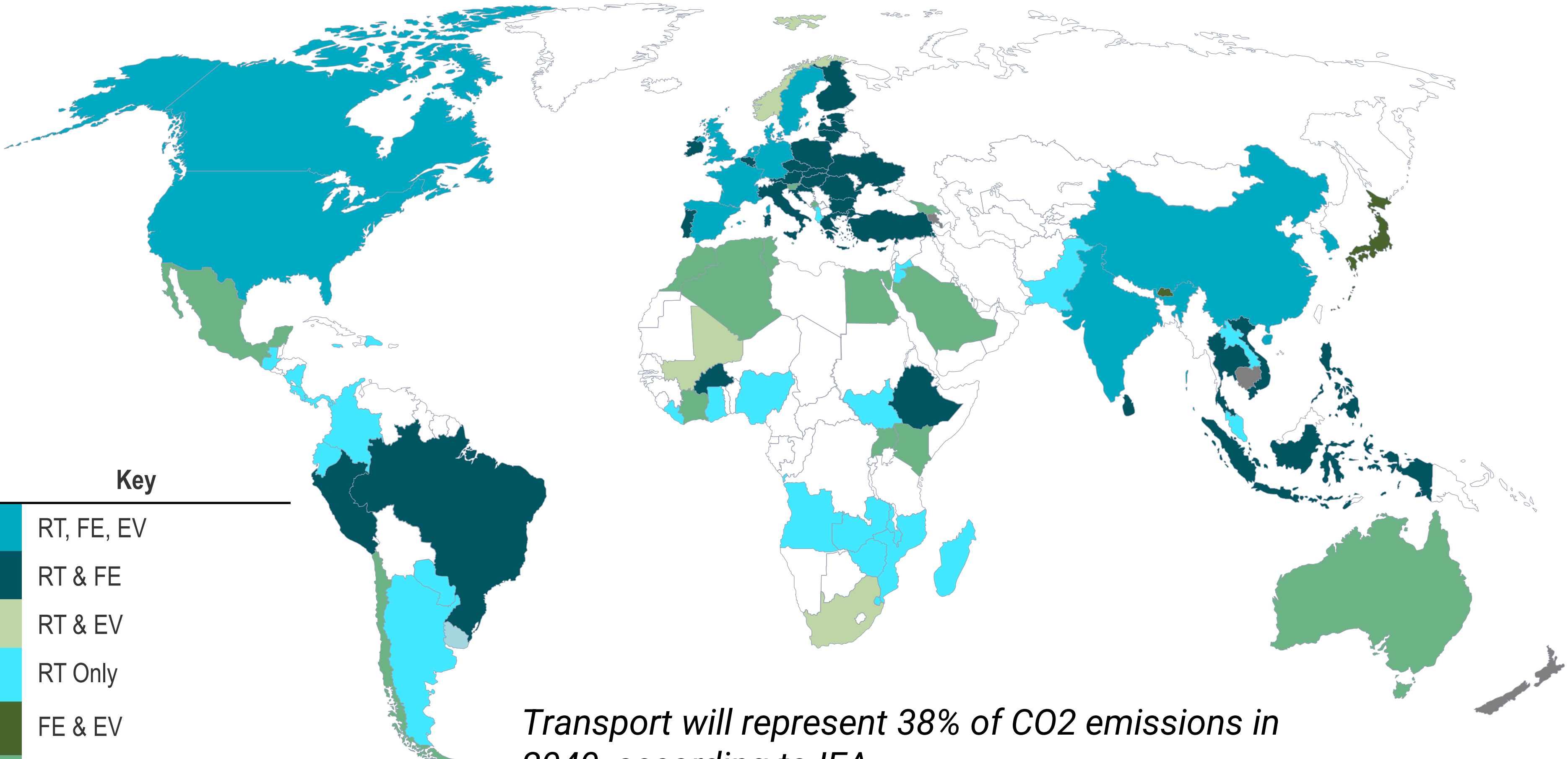
- Low carbon fuels standards
- Novel advanced biofuels
- Biojet
- ZEV technology
- ZEV mandates
- IMO sulfur requirements
- ICAO requirements
- HDV fuel economy
- Ride hailing/sharing
- Rise of EVs
- Rise of FCEV/Hydrogen
- Autonomous mobility
- Novel fuels: Power to X, etc.

EU, North America, Japan, South Korea, China now here

Sources: Compiled by Future Fuel Strategies, November 2019.

Paris Agreement Transport Aspirations

Biofuels, fuel efficiency & ZEV policies top low carbon initiatives for transport, but implementing them all will not be enough to reach 2°C



Key

- RT, FE, EV
- RT & FE
- RT & EV
- RT Only
- FE & EV
- FE Only
- EV Only
- All 3 Measures

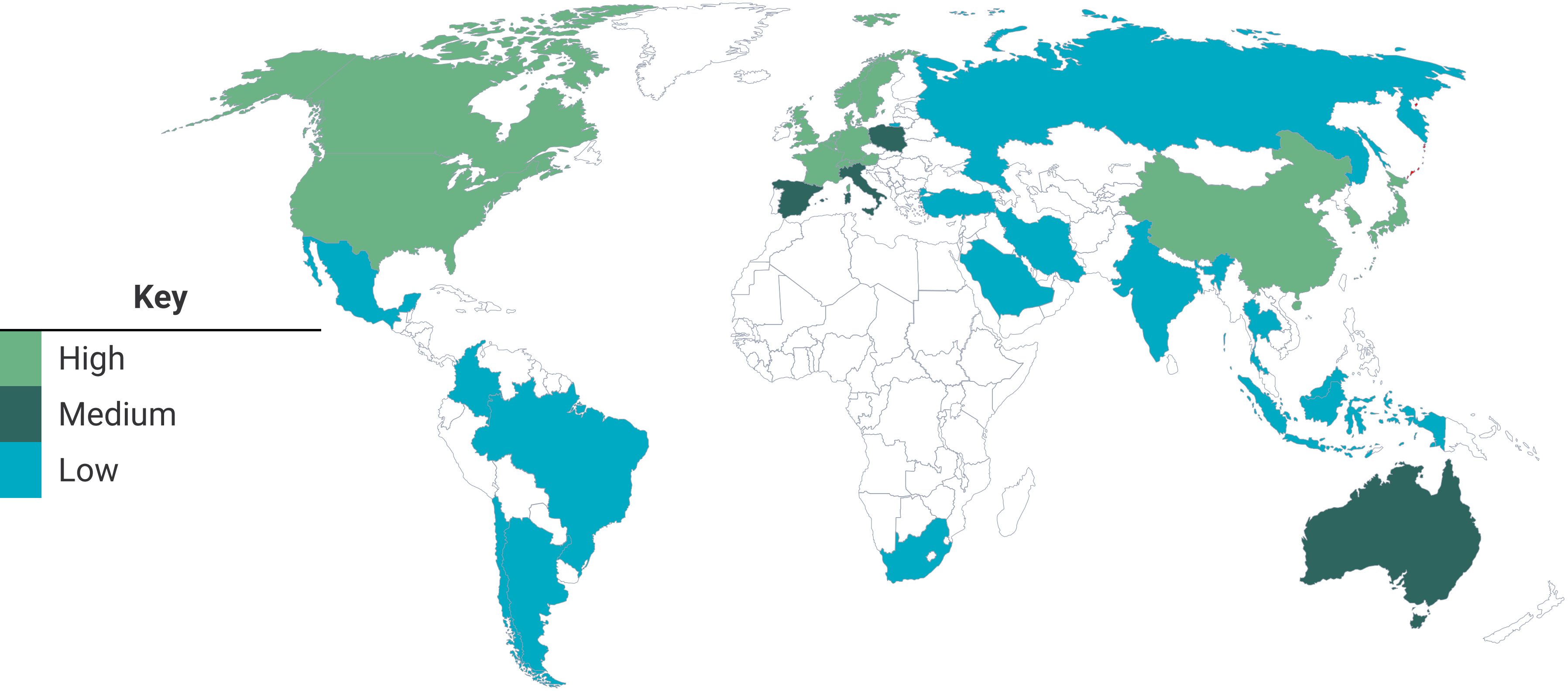
Transport will represent 38% of CO2 emissions in 2040, according to IEA

Sources: Compiled by Future Fuel Strategies citing data from REN21, "Renewables 2016 Global Status Report," "Intended Nationally-Determined Contributions (INDCs) Offer Opportunities for Ambitious Action on Transport and Climate Change," Partnership for Low Carbon Transport; Global Renewable Fuels Alliance

RT=Renewable Transport/Biofuel Mandates, FE=Fuel Efficiency, EV=Electric Vehicles (Battery & Plug-In)

High, Medium & Low Potential EV Markets

Except for China, the high potential markets are in the West; high potential markets=51% of current global oil demand

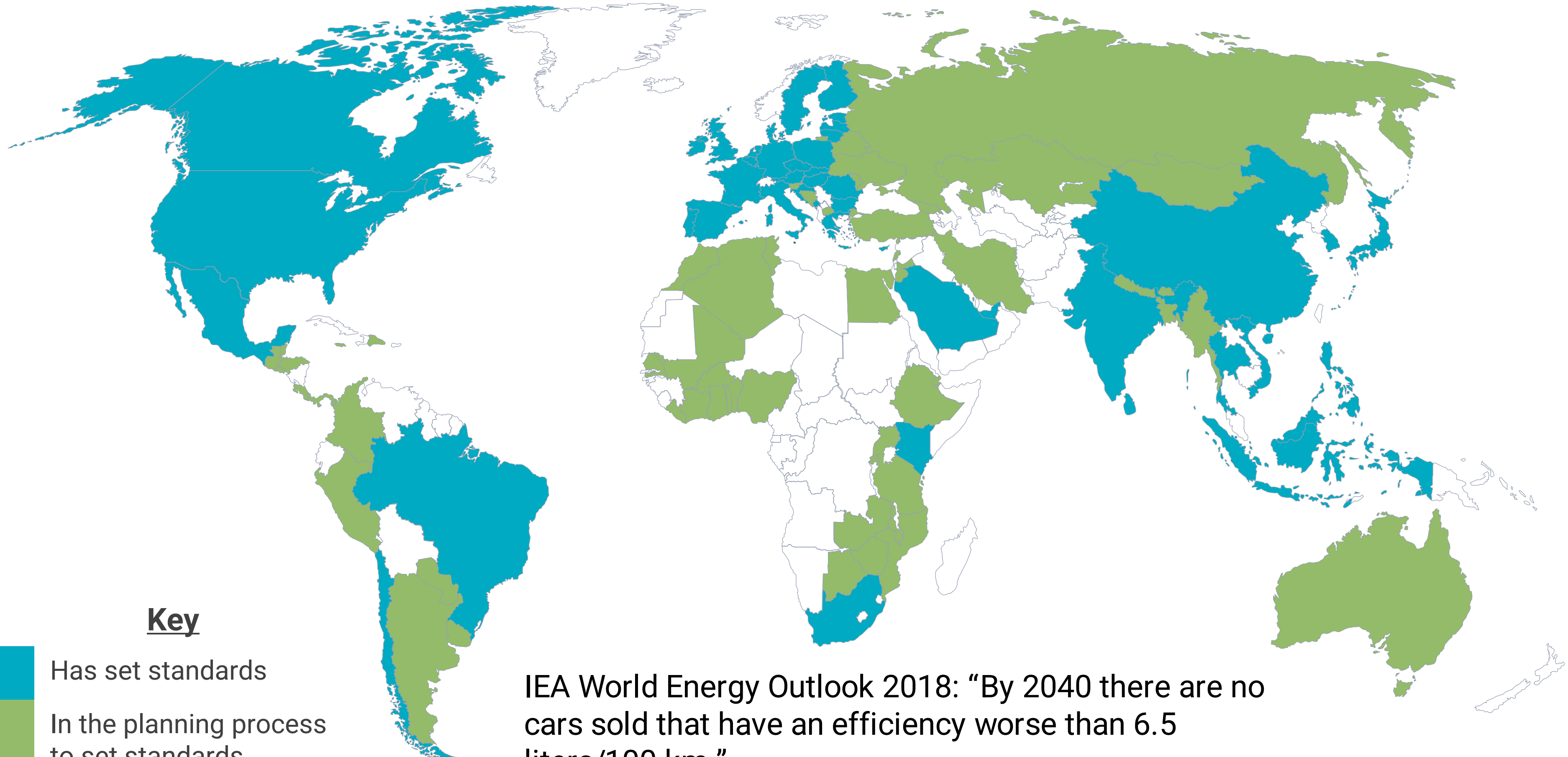


Why High Potential?	Why Low Potential?
• Richer • Political will • EVs the "last frontier" • Larger car fleets	• Poorer and financially dependent on NOCs • Net fossil fuel exporters • Not a big GHG emitter • Smaller car fleets

Source: Future Fuel Strategies, June 2018

Global LDV Fuel Efficiency Improvement

Over 80% of the vehicle market already covered, will be 90% when planned policies are implemented in the next five years



IEA World Energy Outlook 2018: "By 2040 there are no cars sold that have an efficiency worse than 6.5 liters/100 km."

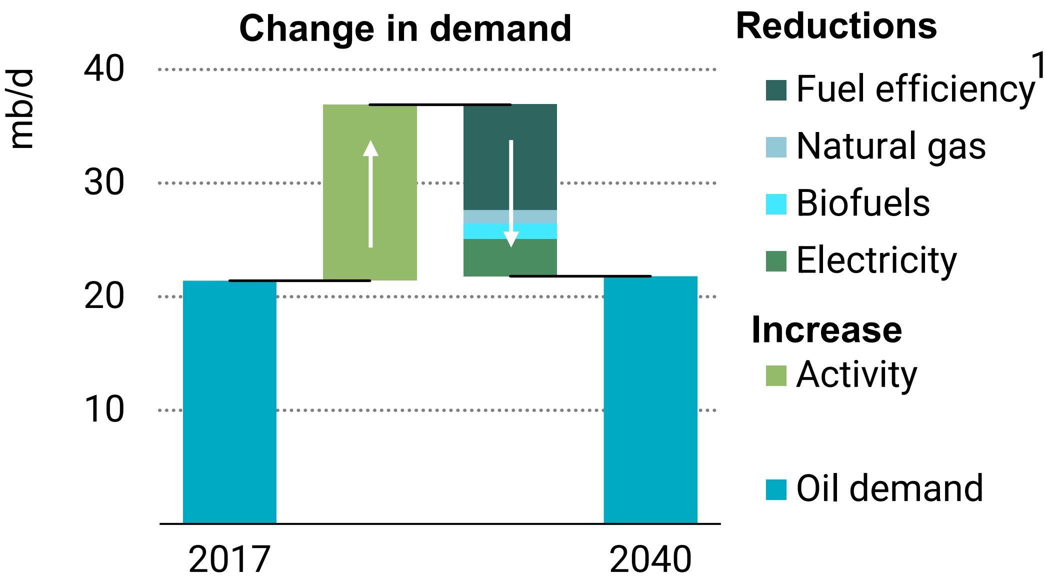
LDV=Passenger cars, light trucks and sport utility vehicles (SUVs)

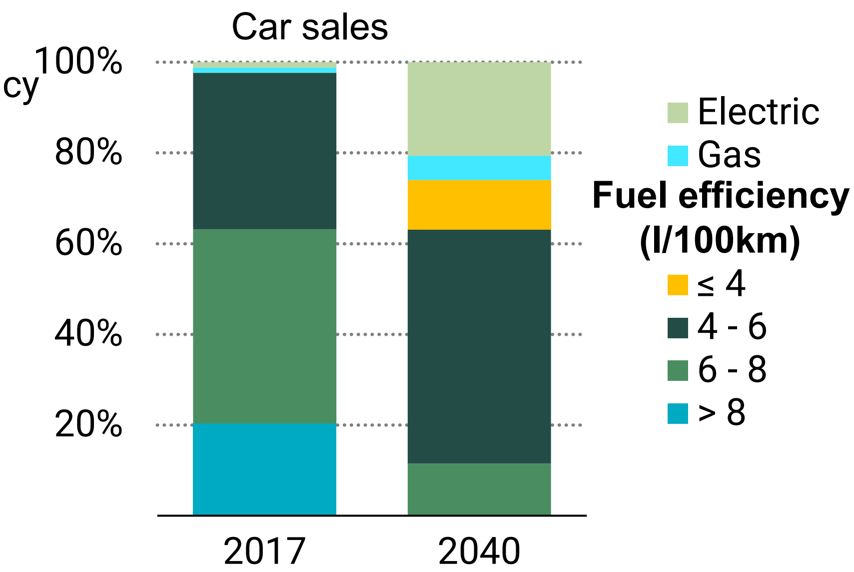
Source: Compiled by Future Fuel Strategies citing numerous sources including "Global Fuel Economy An update for COP23 ," Global Fuel Economy Initiative; September 2018

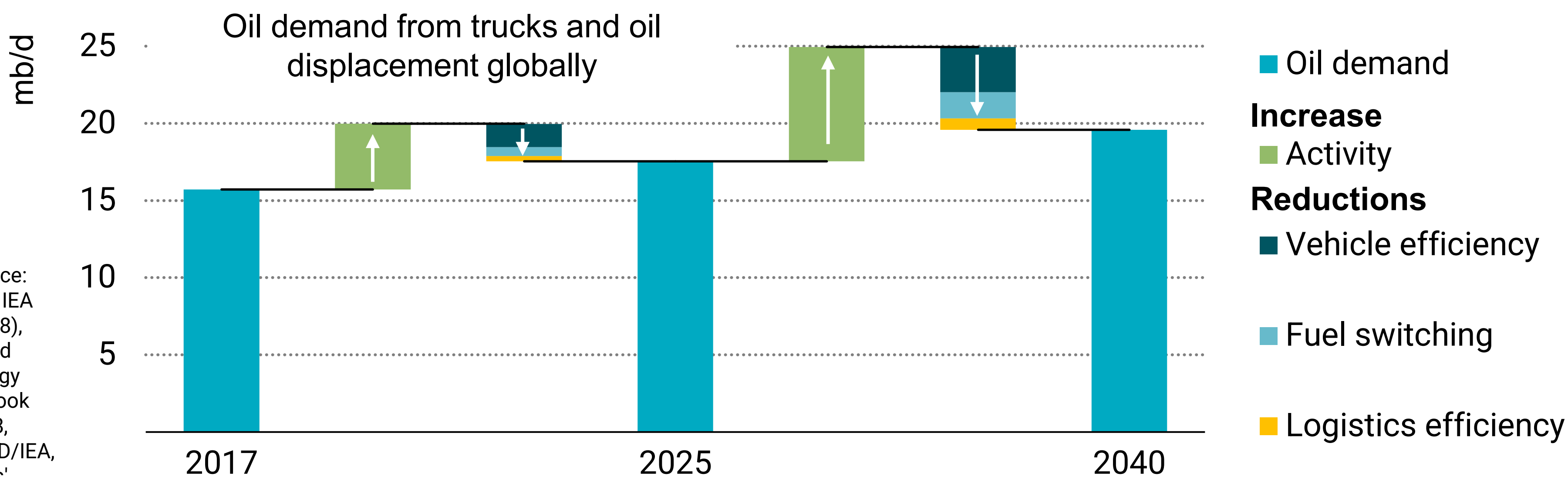
Impact of Policies on Fuel Demand

Growth is offset for cars, but grows for trucks; we still rely on the ICEV

Oil demand from cars, oil displacement and car sales globally







Source: FFS, IEA (2018), World Energy Outlook 2018, OECD/IEA, Paris' future fuel strategies

Questions?

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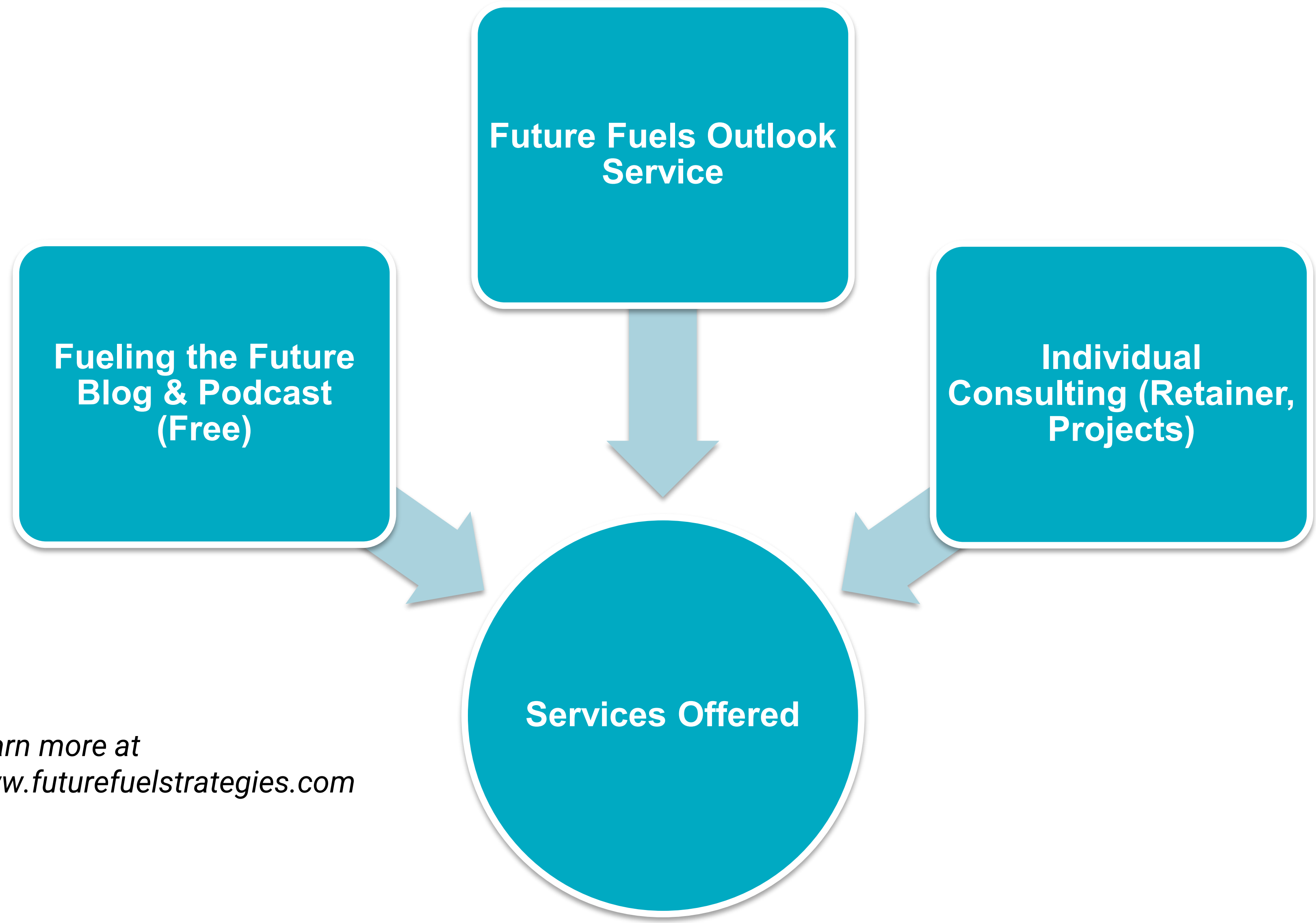
A consultancy that takes a 360° view of future fuels issues, trends and developments



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