






ASEAN Automotive Outlook and EVs Trend

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	LIGHT VEHICLES Up to 6 tons	MEDIUM/HEAVY VEHICLES Over 6 tons
	✓	✓
	✓	✓
	✓	✓



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Global Automotive Conferences

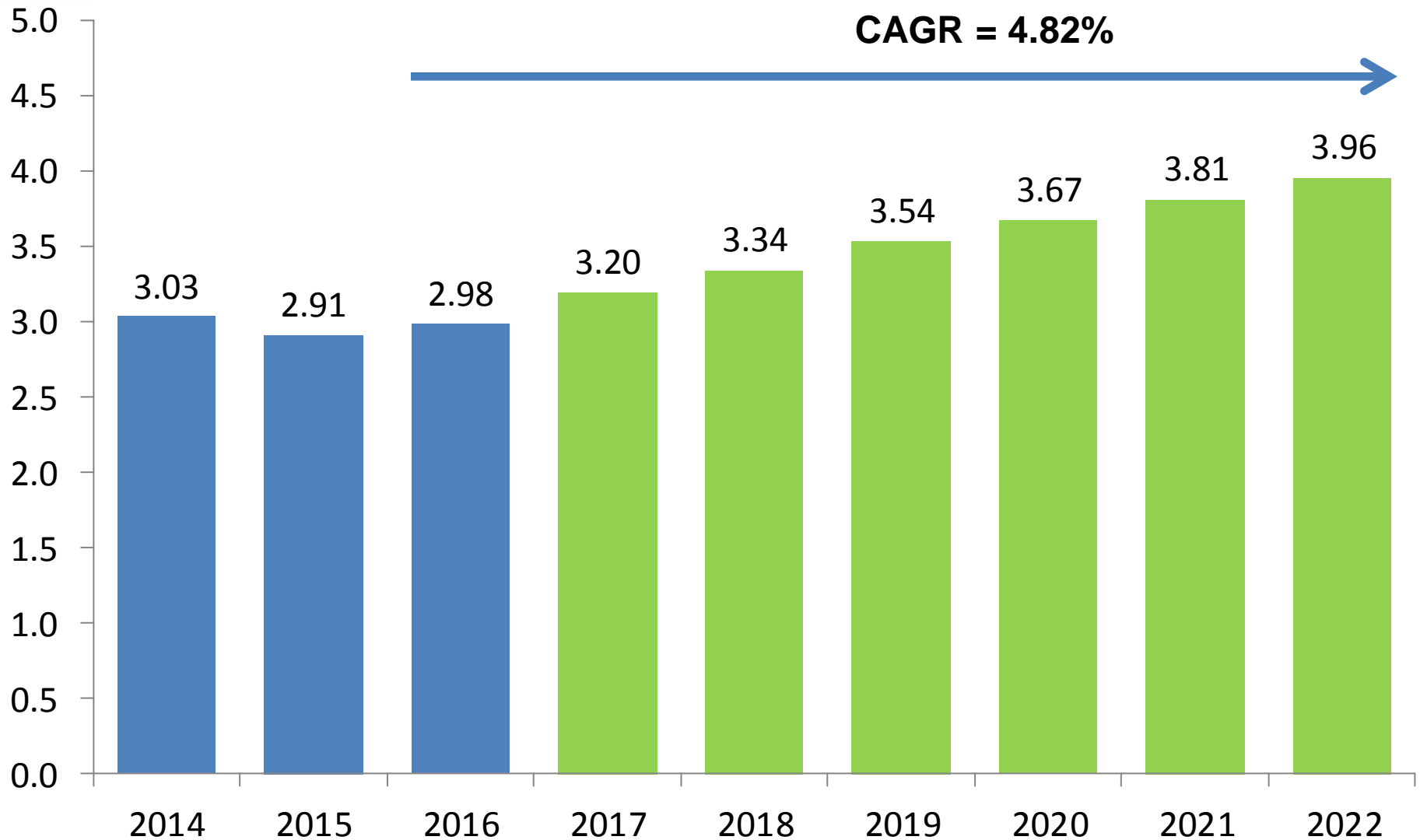
- *May - Light Vehicle Seminar – Frankfurt, London*
- *October – Automotive Industry Conference – Michigan, USA*
- *October – Asia Pacific Outlook Conference – China, Japan*
- *November – Global Industry Truck Seminar – London, UK*

Global Client Webinars

- **Free registration** - > www.lmc-auto.com

- Light vehicle sales and production outlook
 - ASEAN5
- Key Challenges for Thai automotive industry
- EVs trend and outlook:
 - Global
 - Thailand

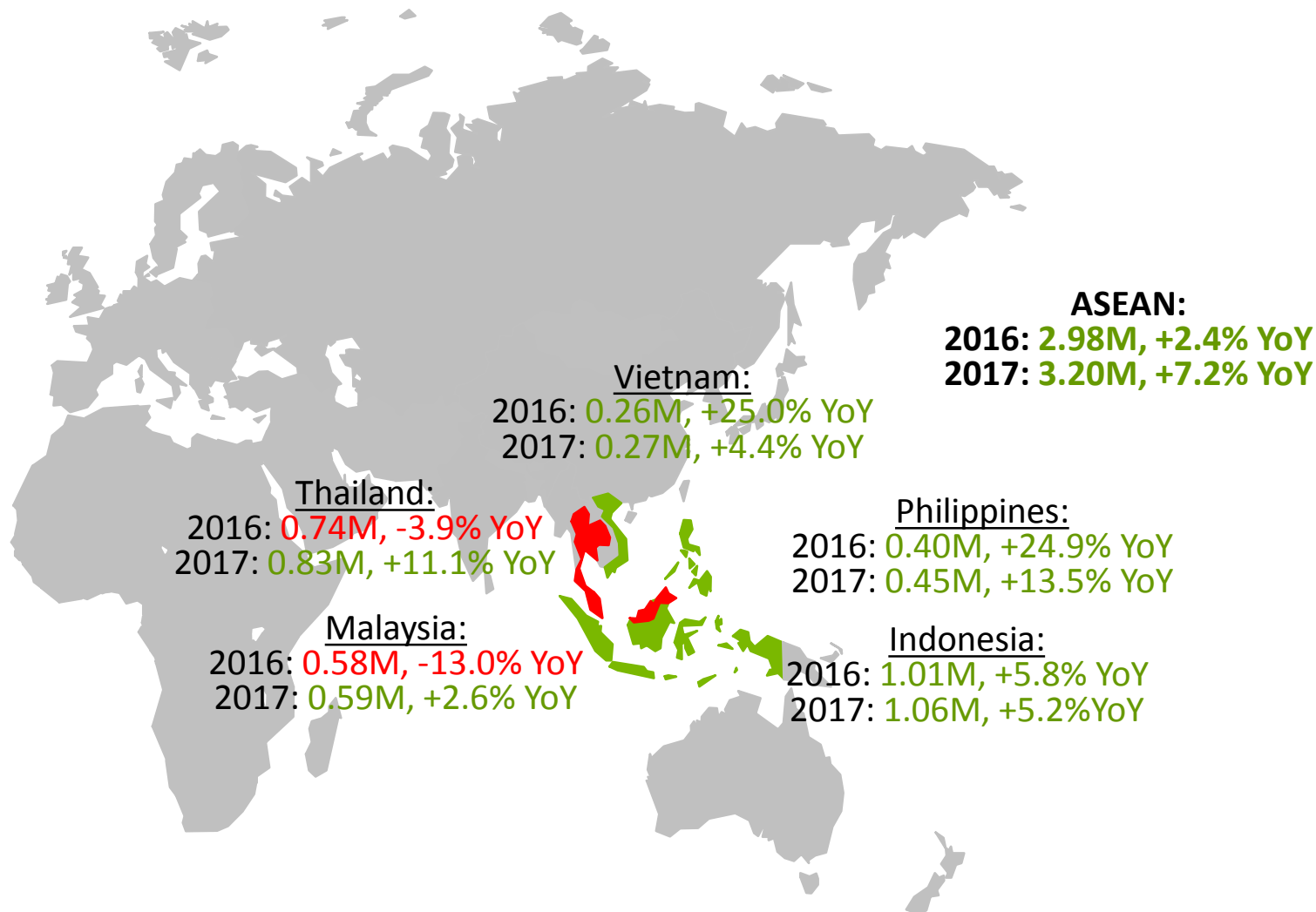
Regional LV sales: ASEAN 5



Source: LMC Automotive

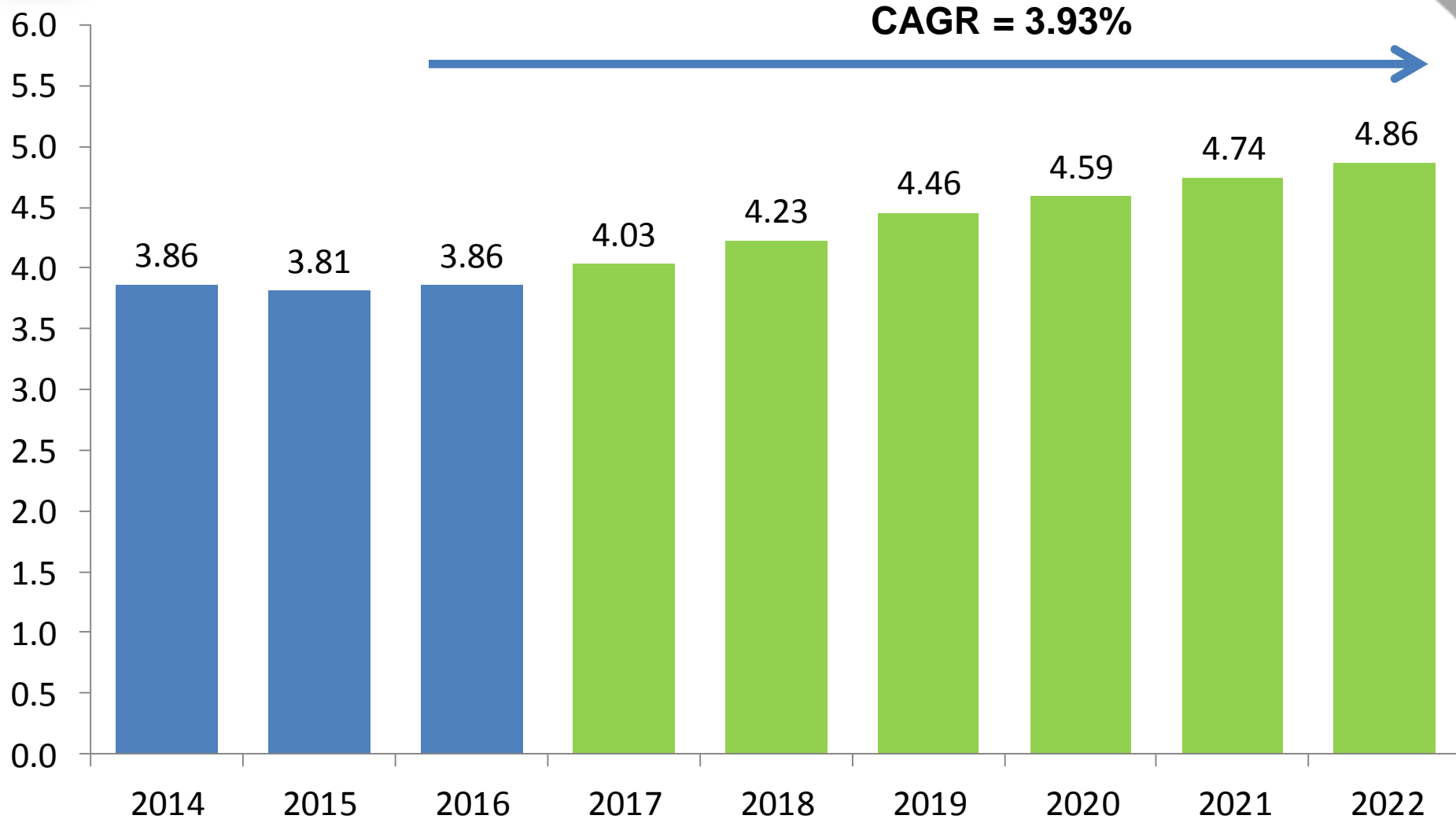
Updated: Jun-17

LV sales performances by country



Updated: Jun-17

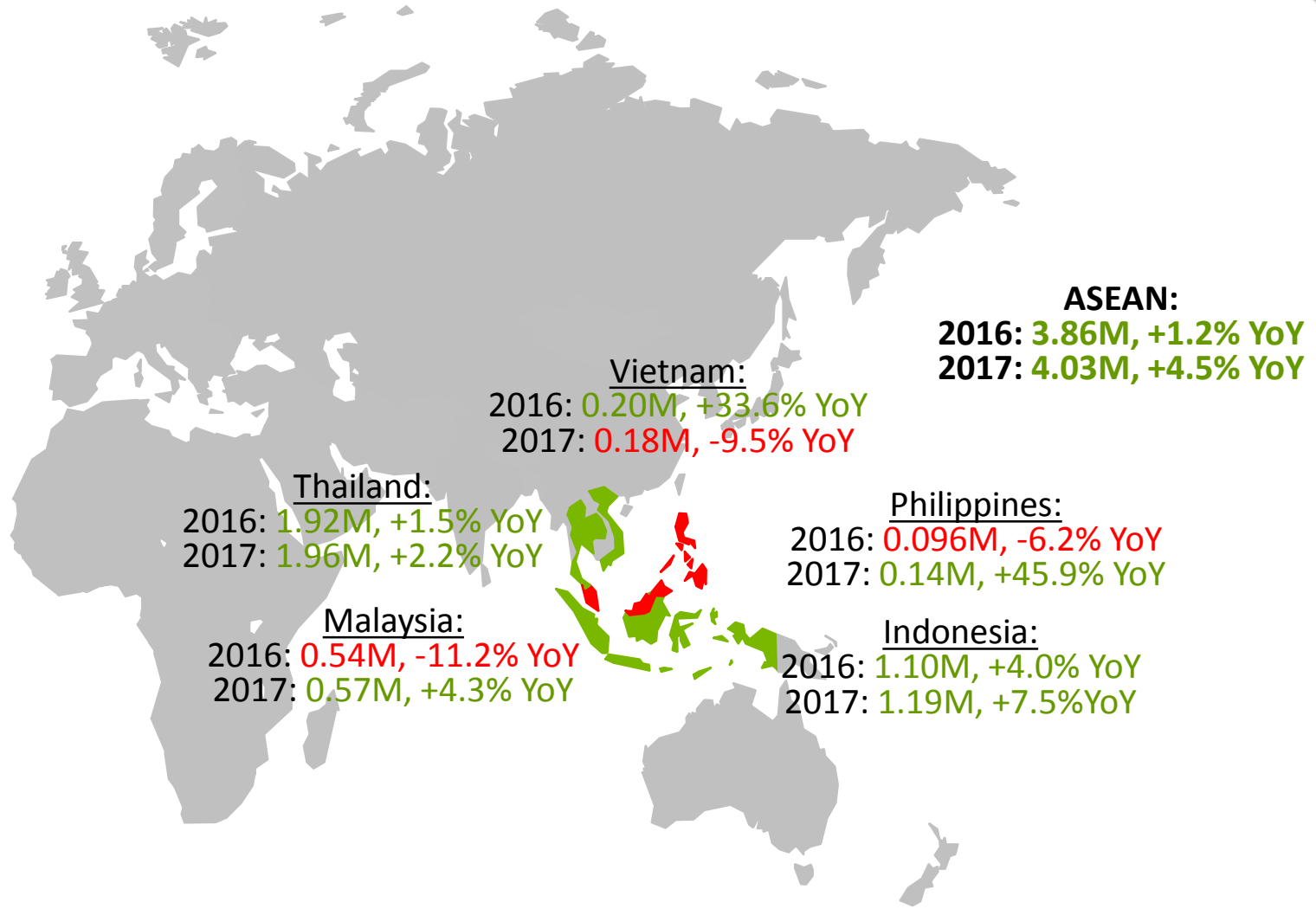
Regional production: ASEAN 5



Source: LMC Automotive

Updated: Jun-17

ASEAN production by country

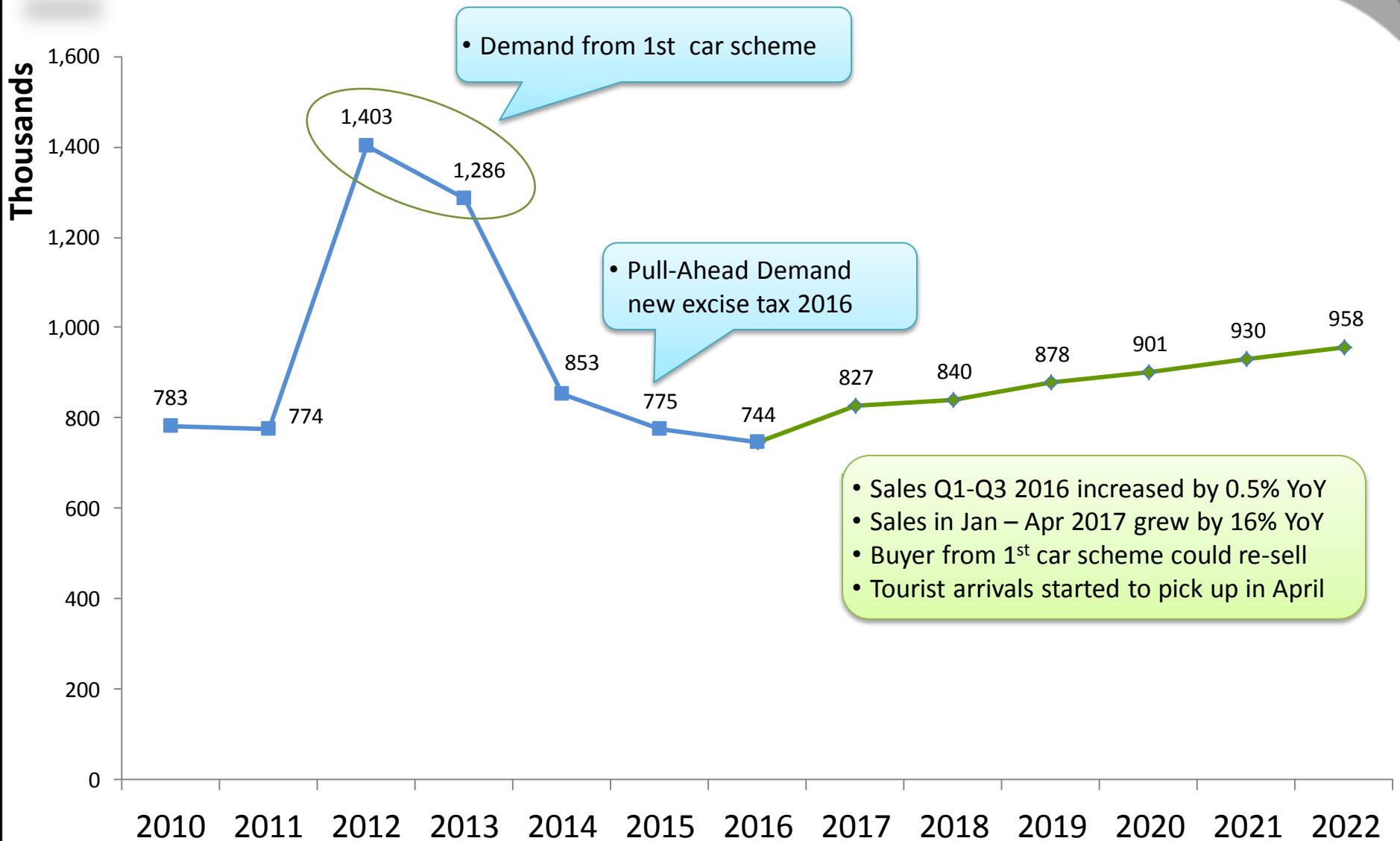


Remark:

Thailand and Indonesia production are nearly 80% of regional production.

Updated: Jun-17

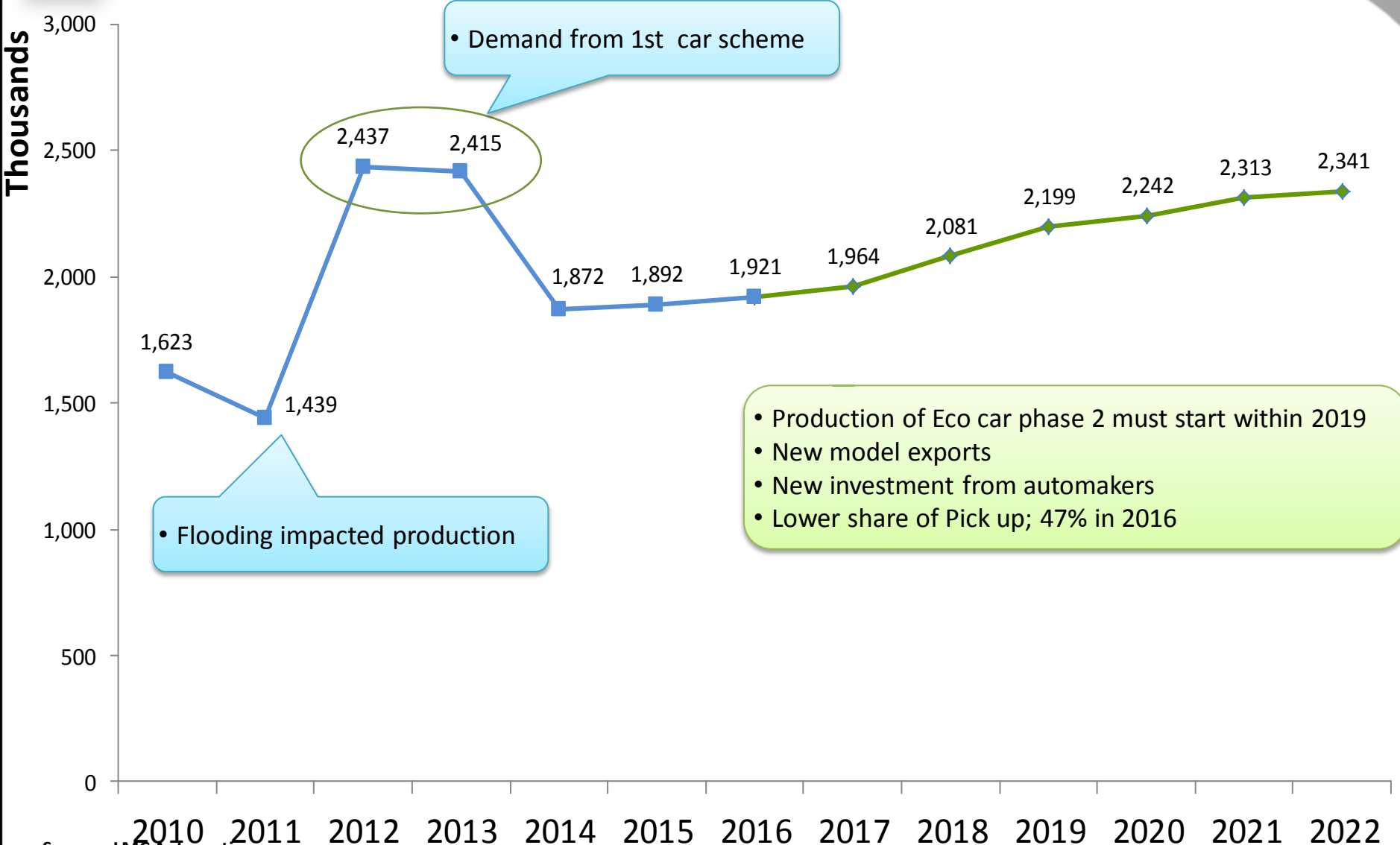
Thai sales outlook



Source: LMC Automotive

Updated: Jun-17

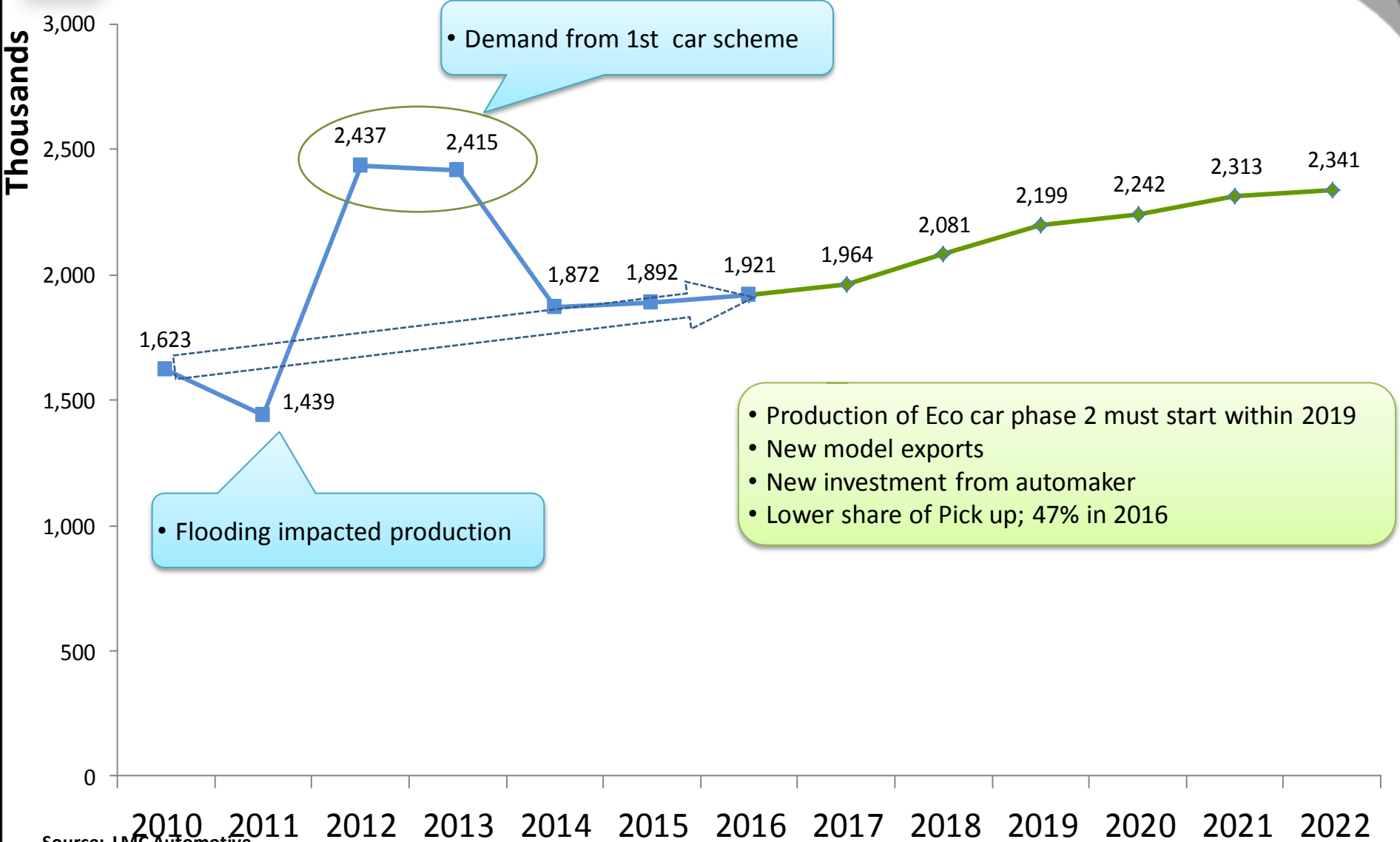
Thai production outlook



Source: LMC Automotive

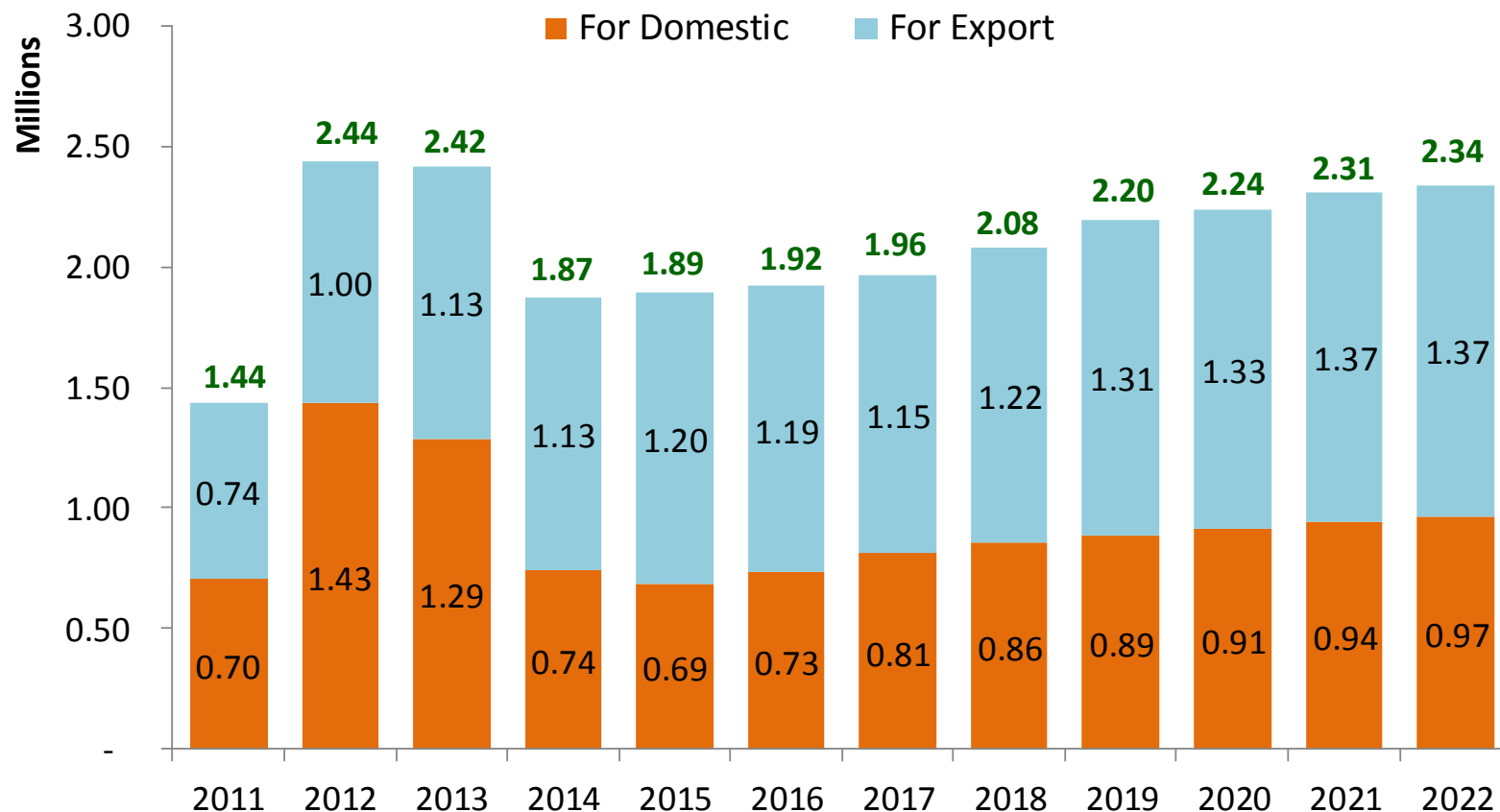
Updated: Jun-17

Thai production outlook:



Source: LMC Automotive
Updated: Jun-17

Thailand: Export base



- Export is the main growth driver of Thai Production
- Global uncertainty; Europe and Middle East in particular
- CBU export value was 593bn in 2015 and THB 632bn in 2016

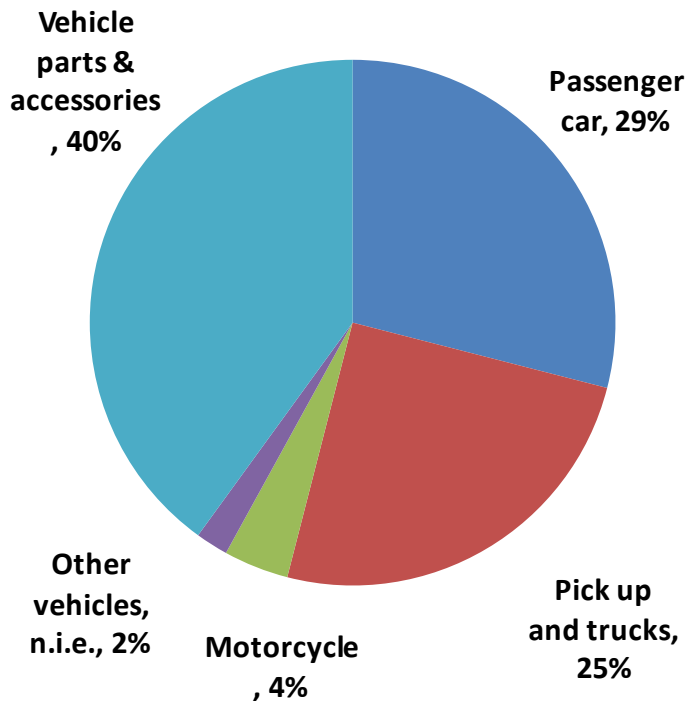
Source: LMC Automotive

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A drop in volume but increase in value

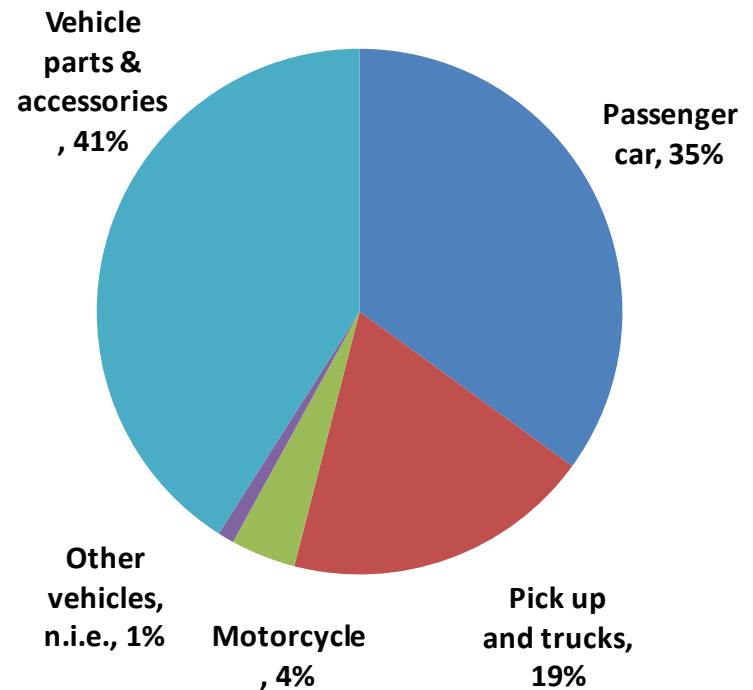
2015 Automotive Sector Exports

USD 32,407 mn



2016 Automotive Sector Exports

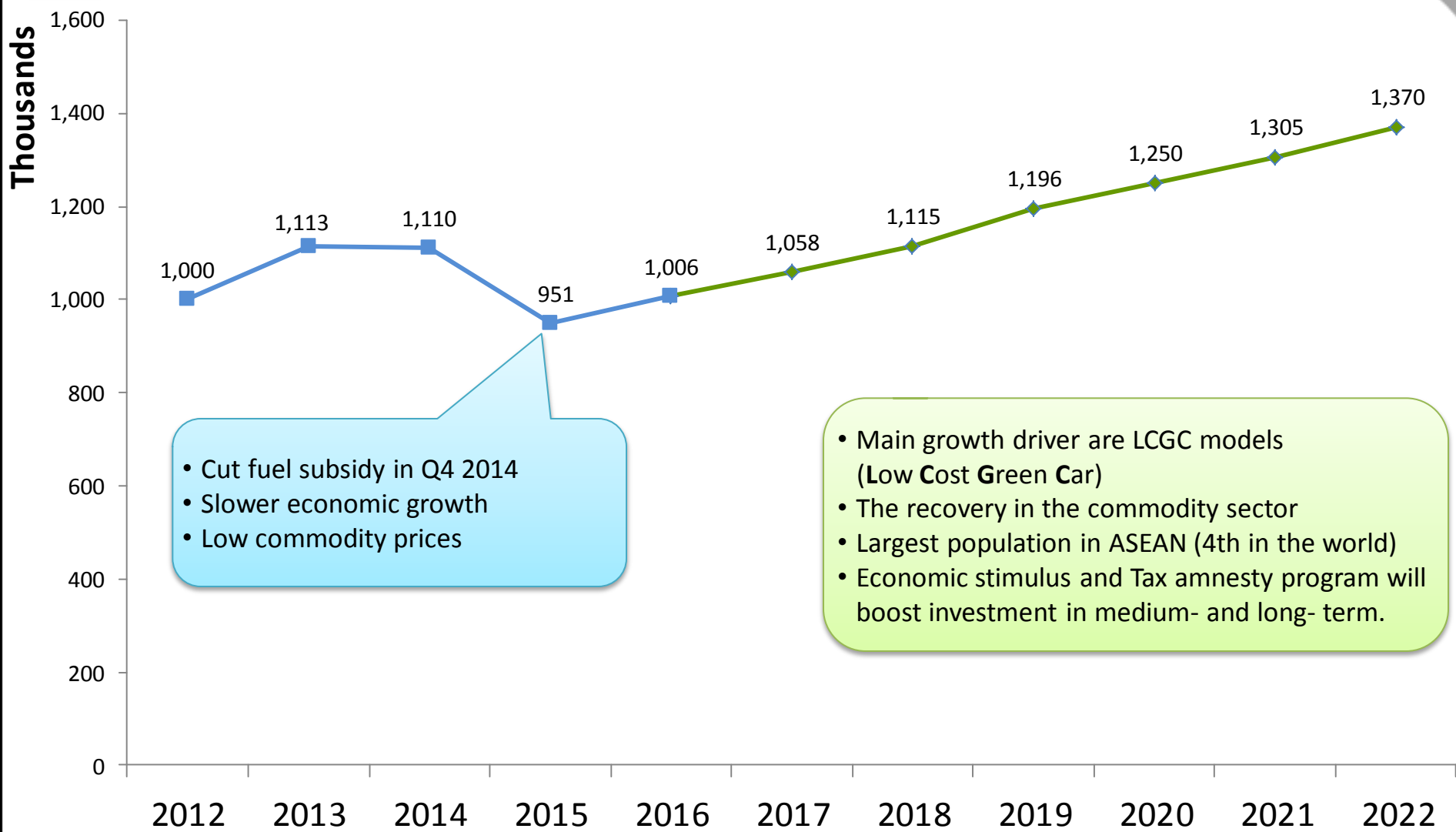
USD 33,383 mn



Source: Bank of Thailand

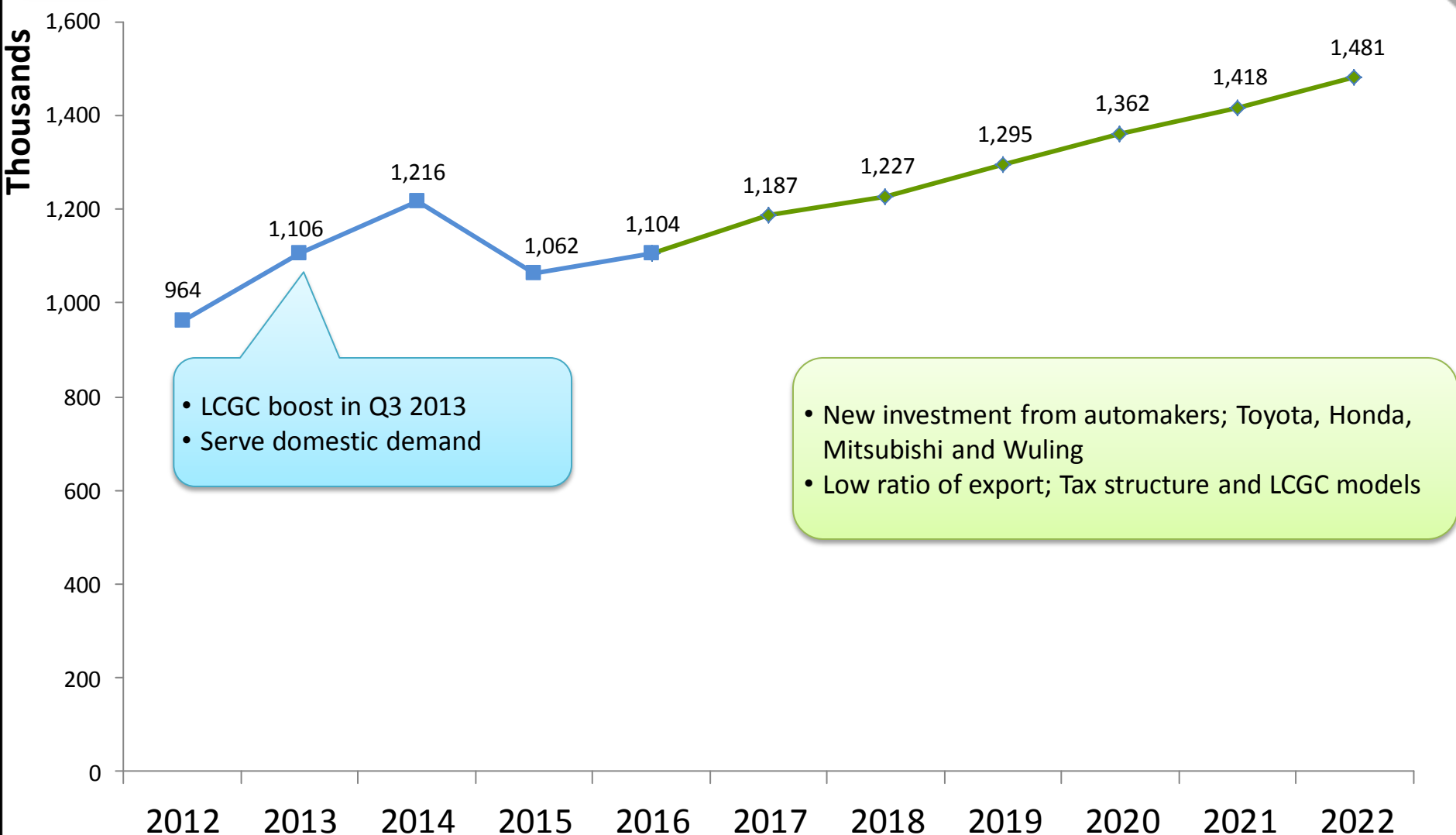
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Indonesia sales outlook



Source: LMC Automotive
Updated: Jun-17

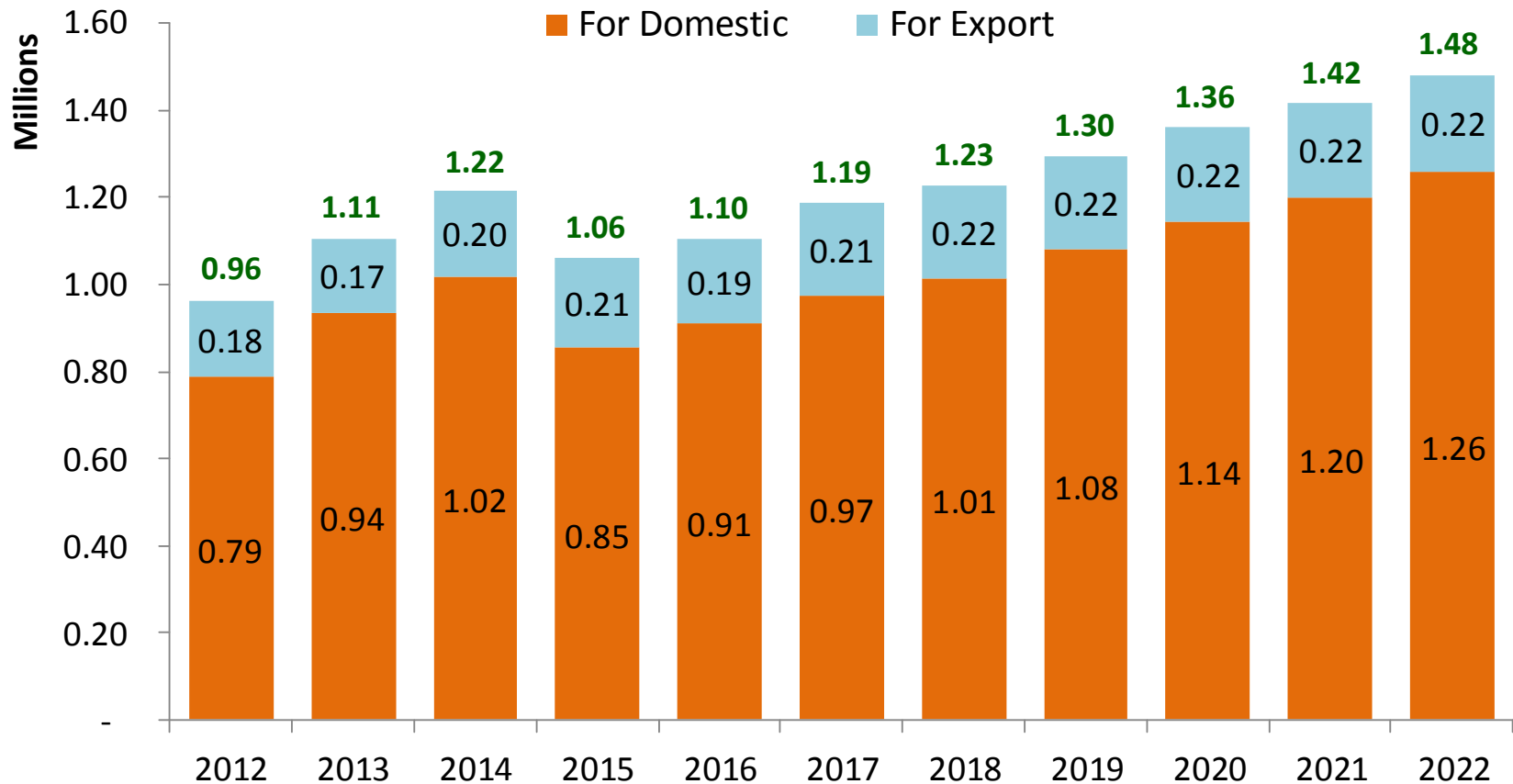
Indonesia production outlook



Source: LMC Automotive

Updated: Jun-17

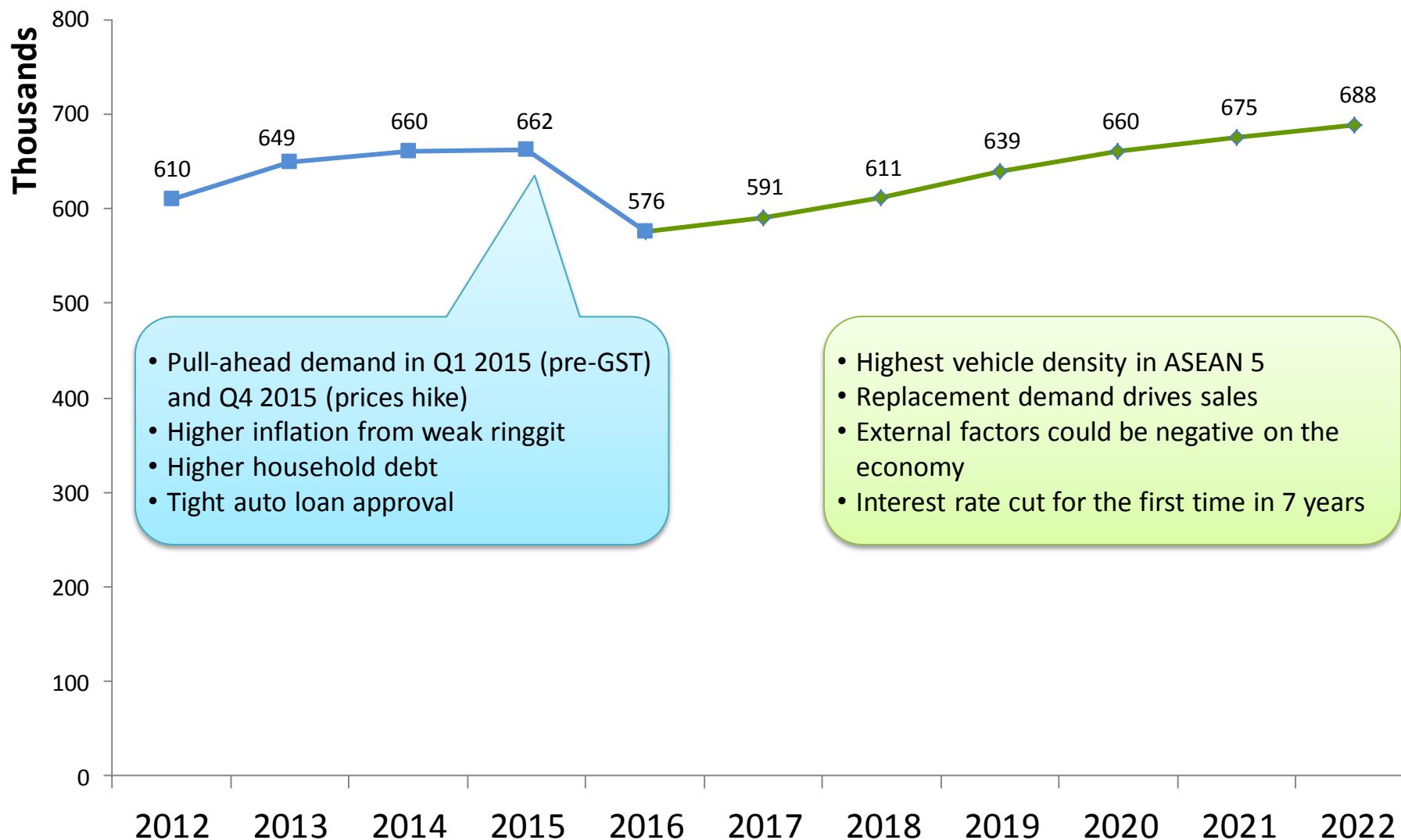
Indonesia: Limited export due to tax structure



- LCGC models create new demand but limited export destinations
- Reducing taxes for sedans aim to boost demand and production for export
- SUV could be increased and be the main growth driver

Source: LMC Automotive
Updated: Jun-17

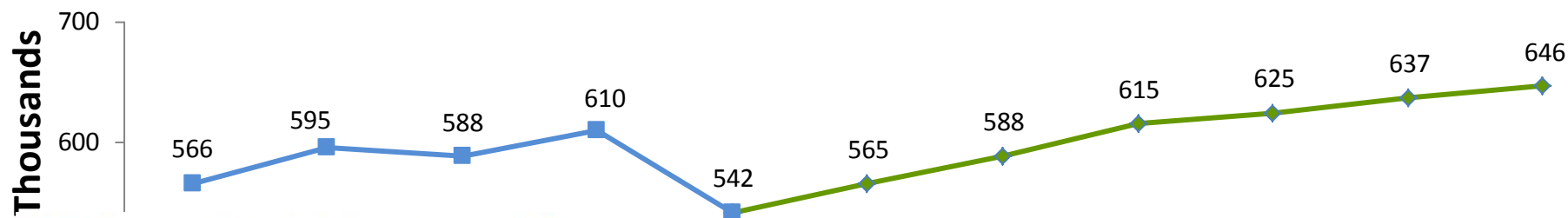
Malaysia sales outlook



Source: LMC Automotive

Updated: Jun-17

Malaysia production outlook



Home » Cars » Malaysia aims to be 'marketing hub' for EVs – targets 100k electric cars, 125k chargers on the road by 2030

Malaysia aims to be 'marketing hub' for EVs – targets 100k electric cars, 125k chargers on the road by 2030

In Cars, Local News / By Danny Tan / 12 April 2017 9:59 am / 52 comments

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Home » Local News » New ChargeEV station available at Petronas Serdang

New ChargeEV station available at Petronas Serdang

In Hybrids, EVs and Alternative Fuel, Local News / By Mick Chan / 9 March 2017 2:20 pm / 17 comments

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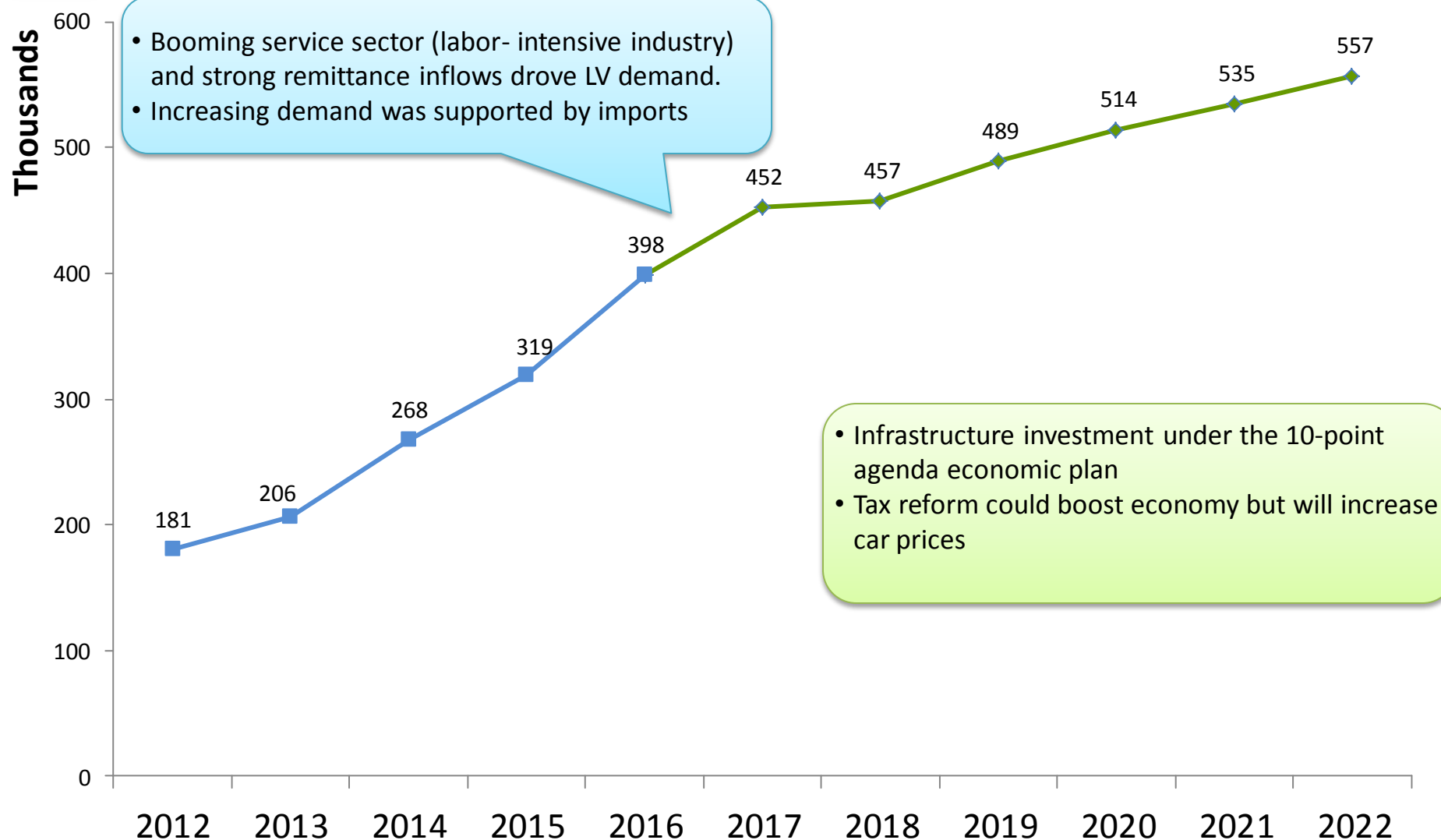
- Toyota to add 2nd plant in Malaysia
- Geely bought 49.9% of Proton shares
- **Customized EEV program and incentives**
- Partnership between GreenTech and BMW



Source: LMC Automotive

Updated: Jun-17

Philippines sales outlook



Source: LMC Automotive

Updated: Jun-17

Philippines: New excise tax

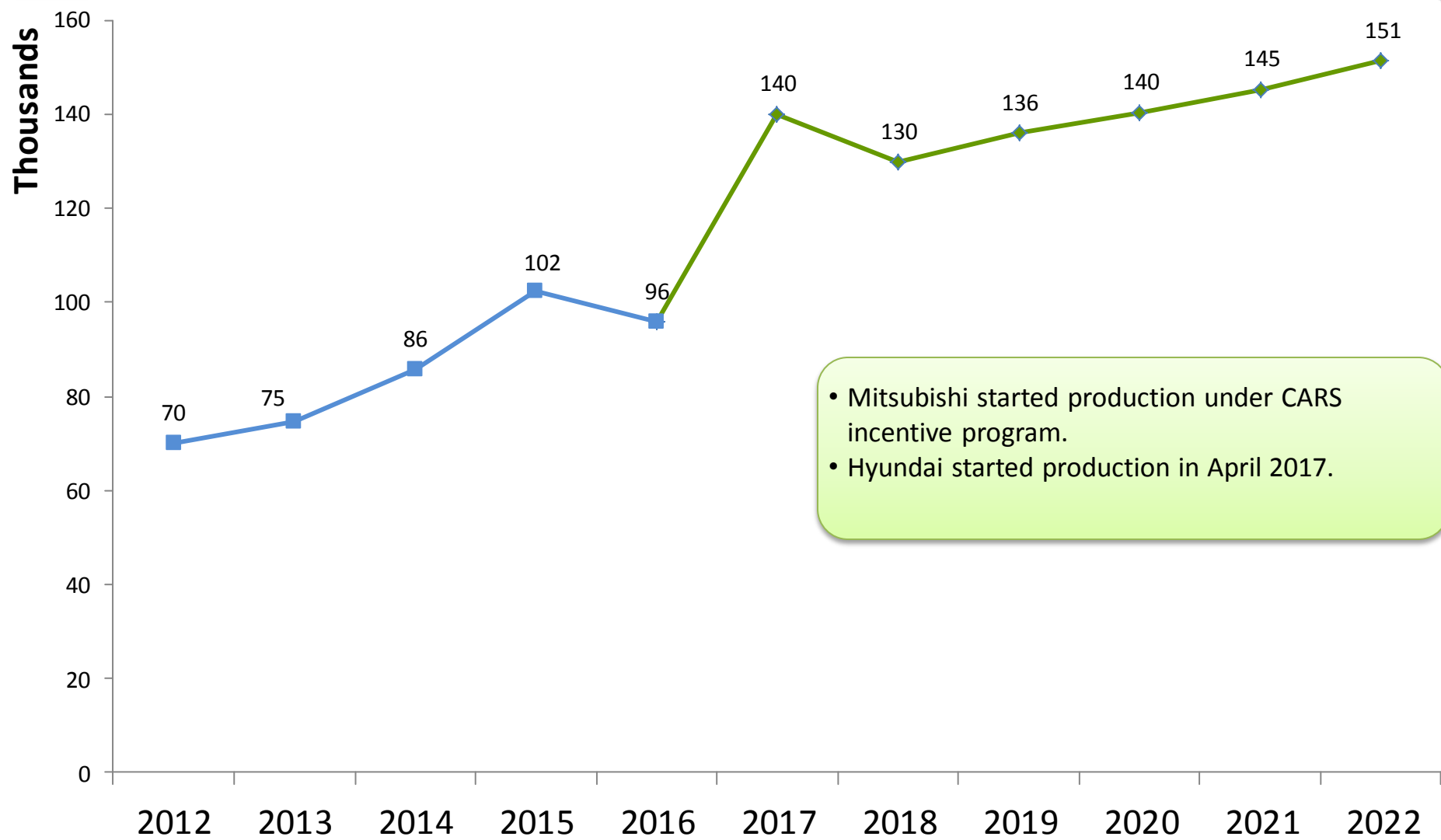
Vehicle prices: PHP	Current	1 st stage; Jan'18	2 nd stage; Jan'19
< 600k	2%	3%	4%
600k – 1.09 mn	a) PHP12,000 + b) 20% of value in excess of PHP600k	a) PHP 18,000 + b) 30% of value in excess of PHP600k	a) PHP 24,000 + b) 40% of value in excess of PHP600k
1.1 mn – 2.09 mn	a) PHP112,000 + b) 40% of value in excess of PHP1.1 mn	a) PHP 168,000 + b) 50% of value in excess of PHP1.1 mn	a) PHP 224,000 + b) 60% of value in excess of PHP1.1 mn
2.1 mn – 3.09 mn	a) PHP512,000 + b) 60% of value in excess of PHP2.1 mn	a) PHP 668,000 + b) 80% of value in excess of PHP2.1 mn	a) PHP 824,000 + b) 100% of value in excess of PHP2.1 mn
More than 3.1 mn		a) PHP 1,468,000 + b) 90% of value in excess of PHP3.1 mn	a) PHP 1,824,000 + b) 120% of value in excess of PHP2.1 mn

Vehicle prices: PHP	Increasing rate (est.)
550k	+1.0% - > +2.0%
800k	+3.0% - > +6.1%
1.5 mn	+5.7% - > +11.4%
2.5mn	+6.8% - > +13.6%
3.5mn	+7.2% - > 14.5%

Toyota	Prices range
Wigo	473 - 623k
Vios	559 – 976k
Corolla	850 – 1215k
Fortuner	1.39 – 2.13 mn
Camry	1.55 – 2.15 mn

Source: LMC Automotive

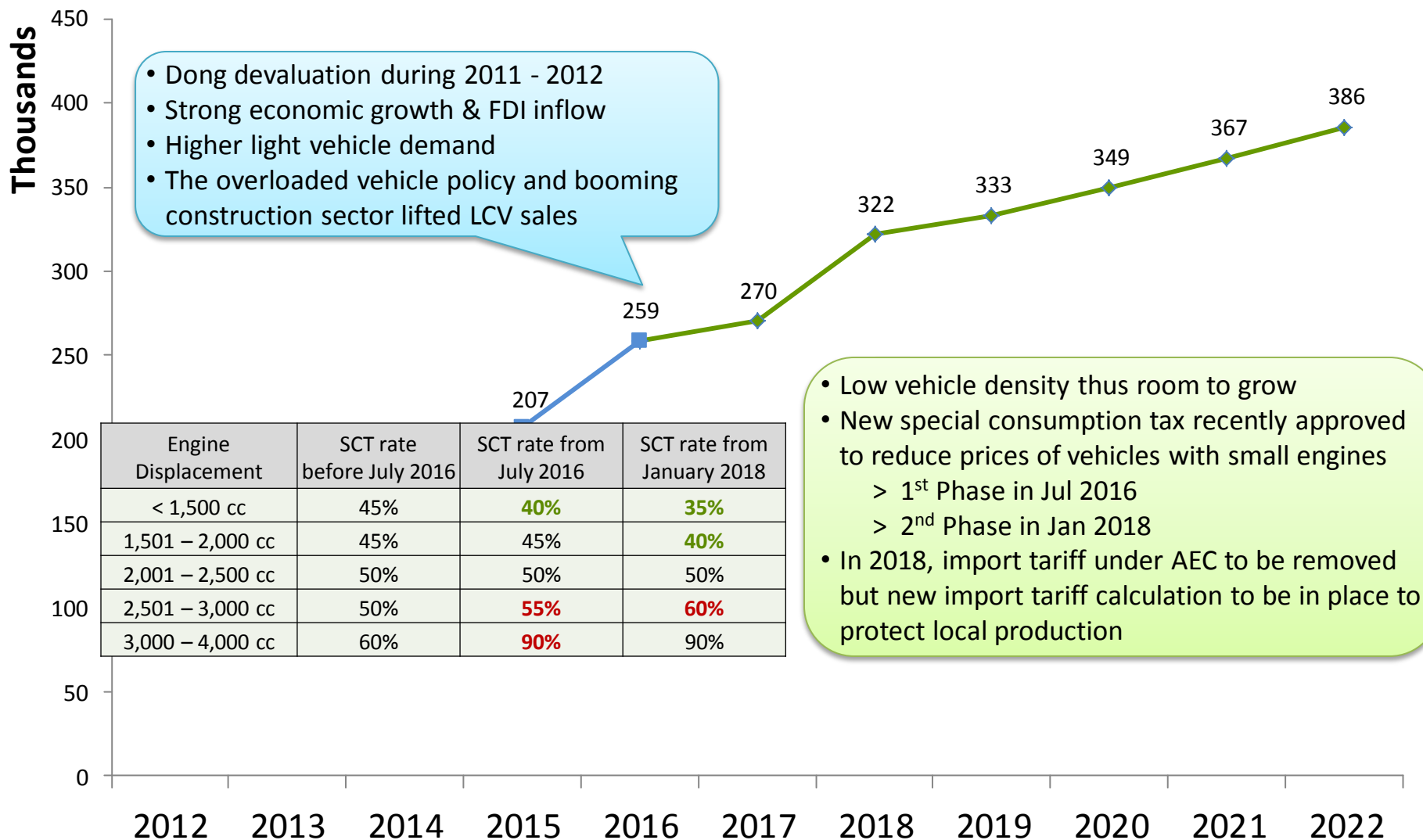
Philippines production outlook



- Mitsubishi started production under CARS incentive program.
- Hyundai started production in April 2017.

Source: LMC Automotive
Updated: Jun-17

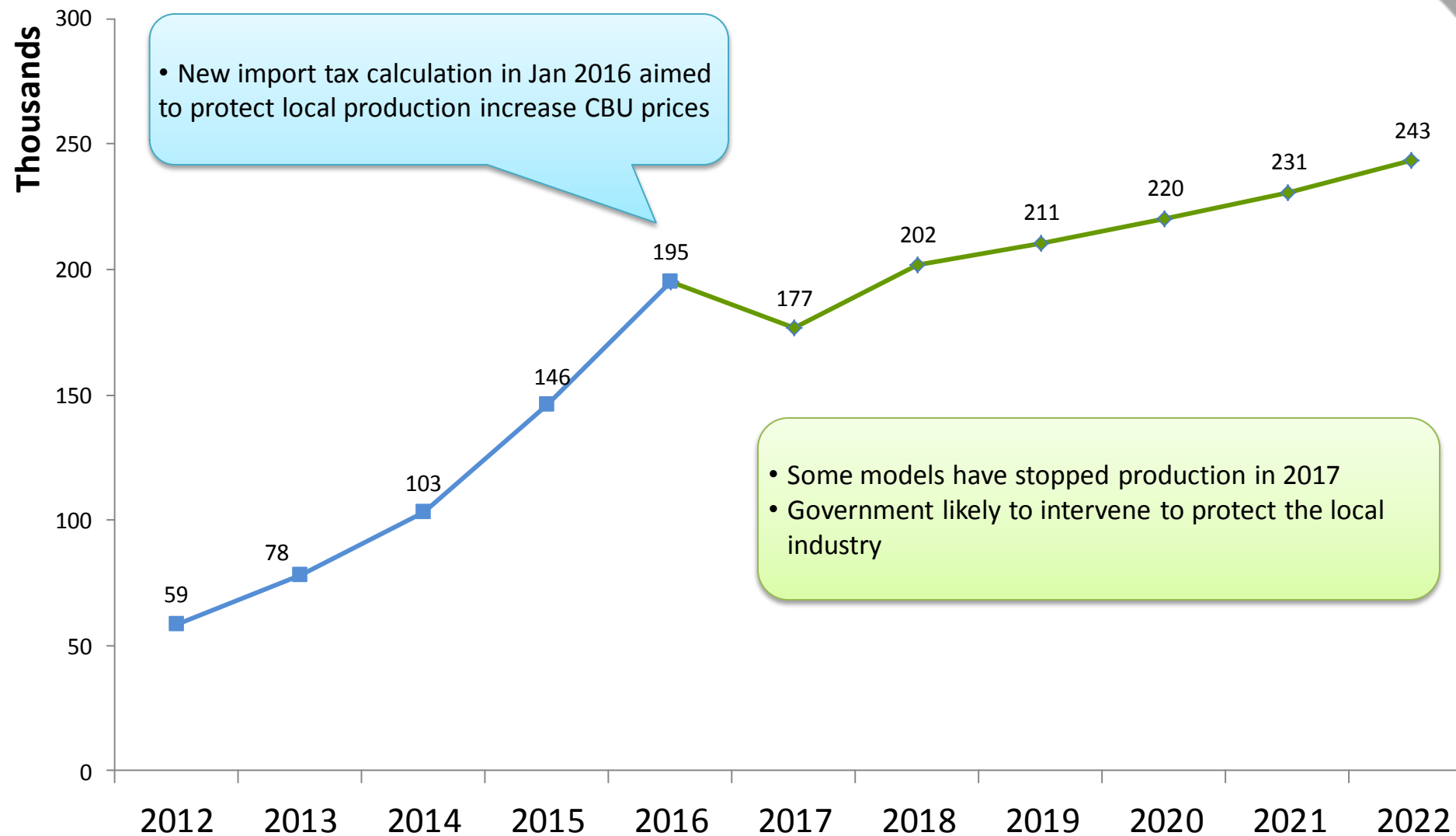
Vietnam sales outlook



Source: LMC Automotive

Updated: Jun-17

Vietnam production outlook



Source: LMC Automotive

Updated: Jun-17

Key challenges for Thai automotive industry

	Detail
Thailand	<ul style="list-style-type: none"> • The challenges from policy of neighboring countries • Rising labour costs and lack of skilled labour • Demographics: Declining working-age population • Government policies aim to increase automotive R&D and technologies e.g. super cluster policy and proving ground project • EVs policy; No incentives for buyers / uncertainty as to effectiveness in attracting investments
Indonesia	<ul style="list-style-type: none"> • LCGC program likely to be fore the domestic market with limited impact on export • Proposal to revise luxury tax for Sedans (30% - 70% vs. 10% for MPV/SUV/Hatchback) • Attractive destination for new investments in ASEAN given the scale due to large population and for SUVs (auto specific).
Malaysia	<ul style="list-style-type: none"> • The Energy Efficient Vehicles (EEV) program is flexible and can be customized based on automaker's proposal. • Government focuses on EVs technology; MOU between GreenTech and BMW

MHEV: Mild Hybrid Electric Vehicle

- IC and electric motor(s) working in parallel. Not usually able to drive with electric power alone. E-assistance typically 10-15 kW. 48V systems will be integrated into this category gradually.

FHEV: Full Hybrid Electric Vehicle

- IC and electric motor(s) working in parallel. Can be driven for short distances under electric power alone. Electric assistance greater than 30 kW. Typical electric assistance: 60 kW to 165 kW.

PHEV: Plug-in Hybrid Electric Vehicle

- Full hybrid electric vehicle with larger battery pack which can be recharged from the electricity grid thereby enabling a longer electric-only driving range of 50 km or more.

BEV: Battery Electric Vehicle

- No IC engine. Relies on energy stored in battery to provide propulsion via electric motor(s). Recharged from electricity grid or other source of electricity.

EREV: Extended Range Electric Vehicle

- A battery electric vehicle with an on-board charger (comprising IC engine + generator) for the battery pack to enable a longer range than BEV. The IC and electric motor(s) operate in series.

FCEV: Fuel Cell Electric Vehicle

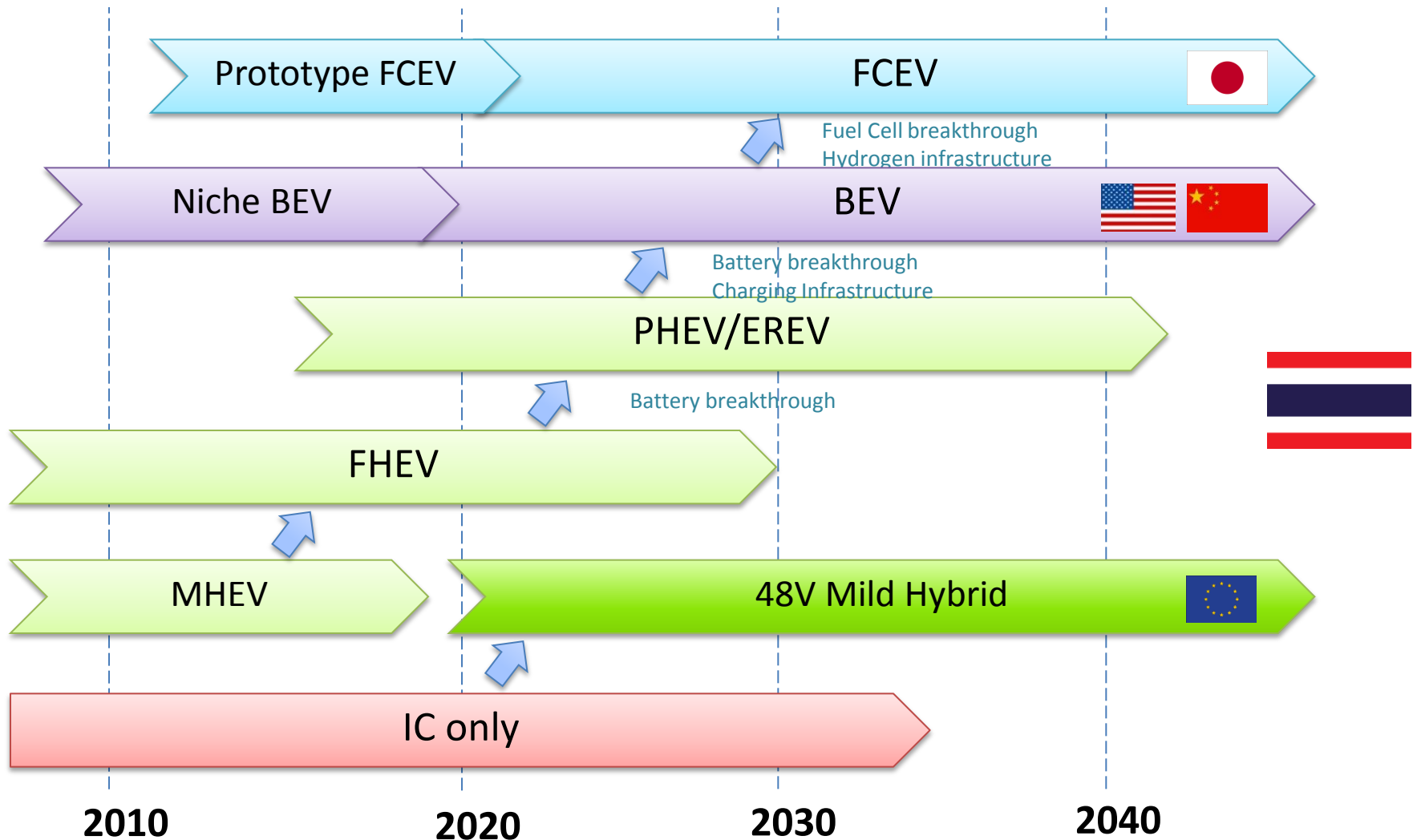
- Similar to a BEV but the battery is replaced by a fuel cell. The fuel (typically hydrogen) is processed on-board in a stack of fuel cells to generate electricity for powering electric motor(s).

Plug-ins

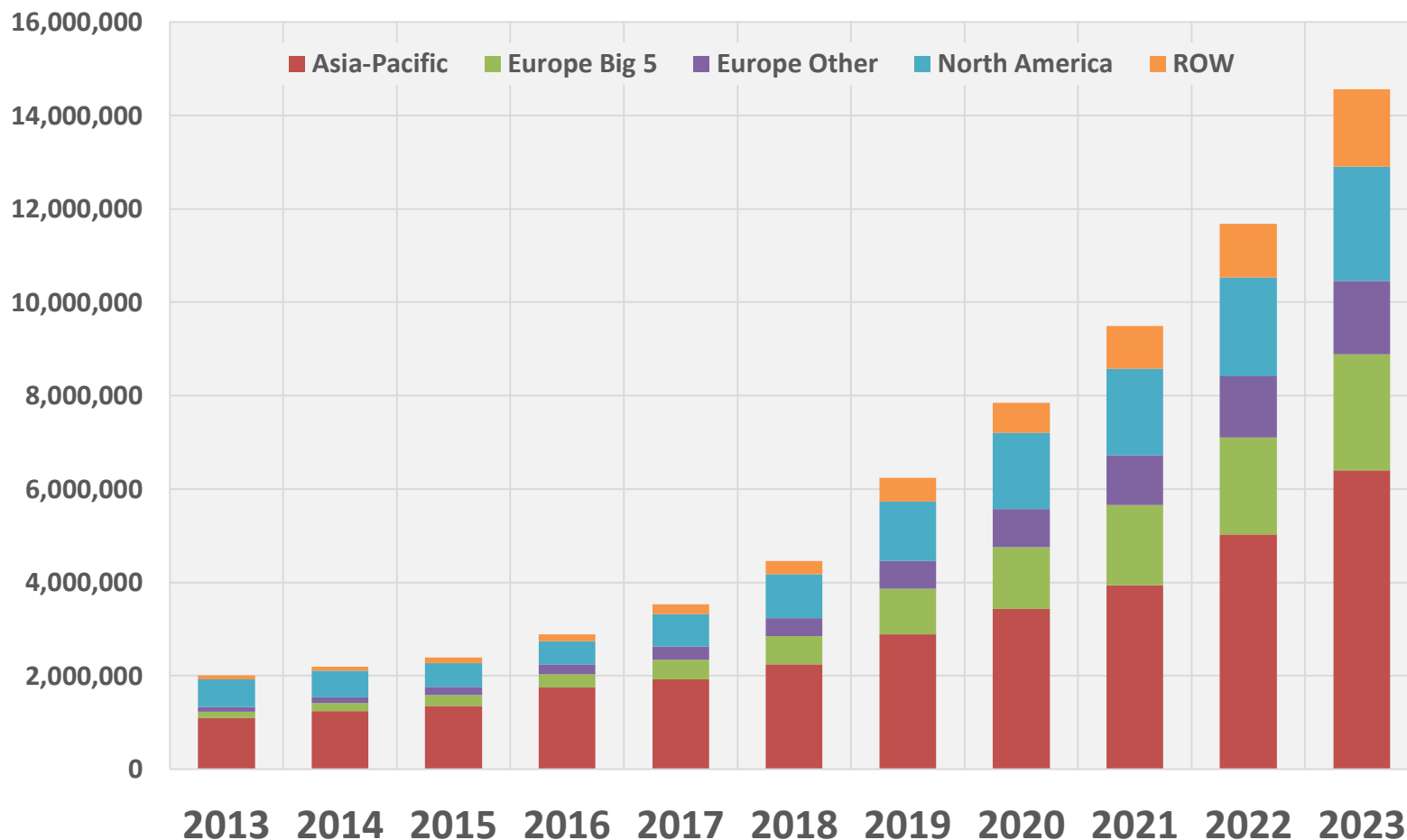
Hybrids

EVs

Technology Roadmap



Global Hybrid/EV Sales by Region



BEV

PHEV

FHEV

2016

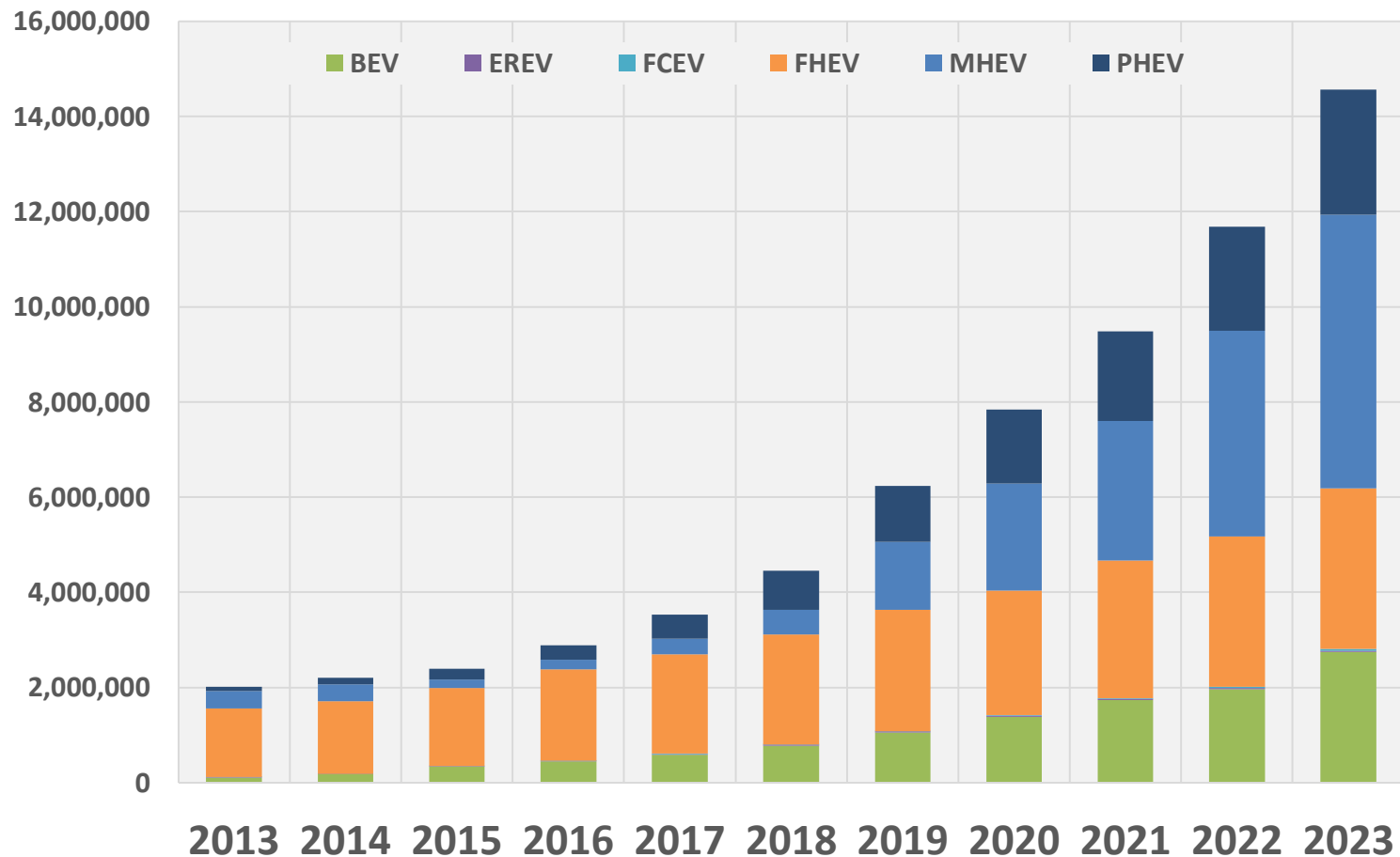


Updated: Jun-17 55% of global BEV sales

37% of global PHEV sales

53% of global FHEV sales

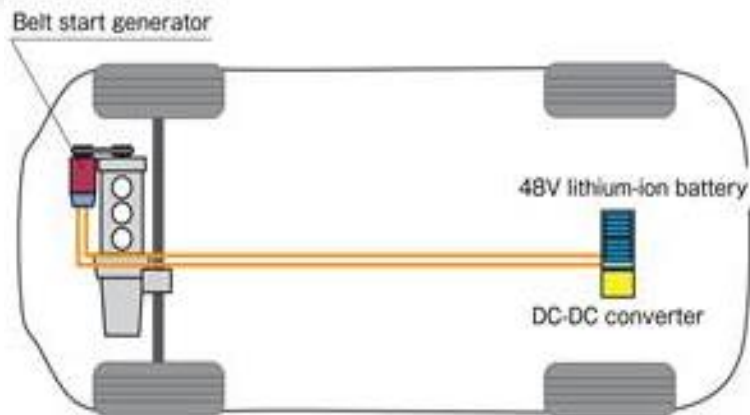
Global Hybrid/EV Sales by Type



- 48V MHEV will rapidly accelerate from 2019, becoming the highest volume technology by 2021
- BEV sales of 450,000 units in 2016, we'll see 1.1 mn in 2019 and reach 2.8 mn by 2023.
- Total electrified market will approach 30 mn units by 2026, account for 27% of all vehicle sales globally.

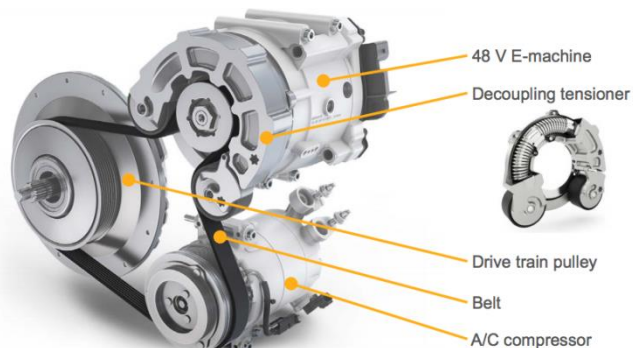
Updated: Jun-17

What is mild hybrid 48-volt ?



Core component parts

- E motor/generator
- 48-volt LIB
- DC-DC convertor



Source: Continental Automotive

MHEV (48V): *Mild Hybrid Electric Vehicle (48-volt)*

- It is a type of mild hybrid system that IC and electric motor(s) working in parallel. Not usually able to drive with electric power alone. E-assistance typically up to 12 kWh in generator mode and using start/stop and regenerative braking.

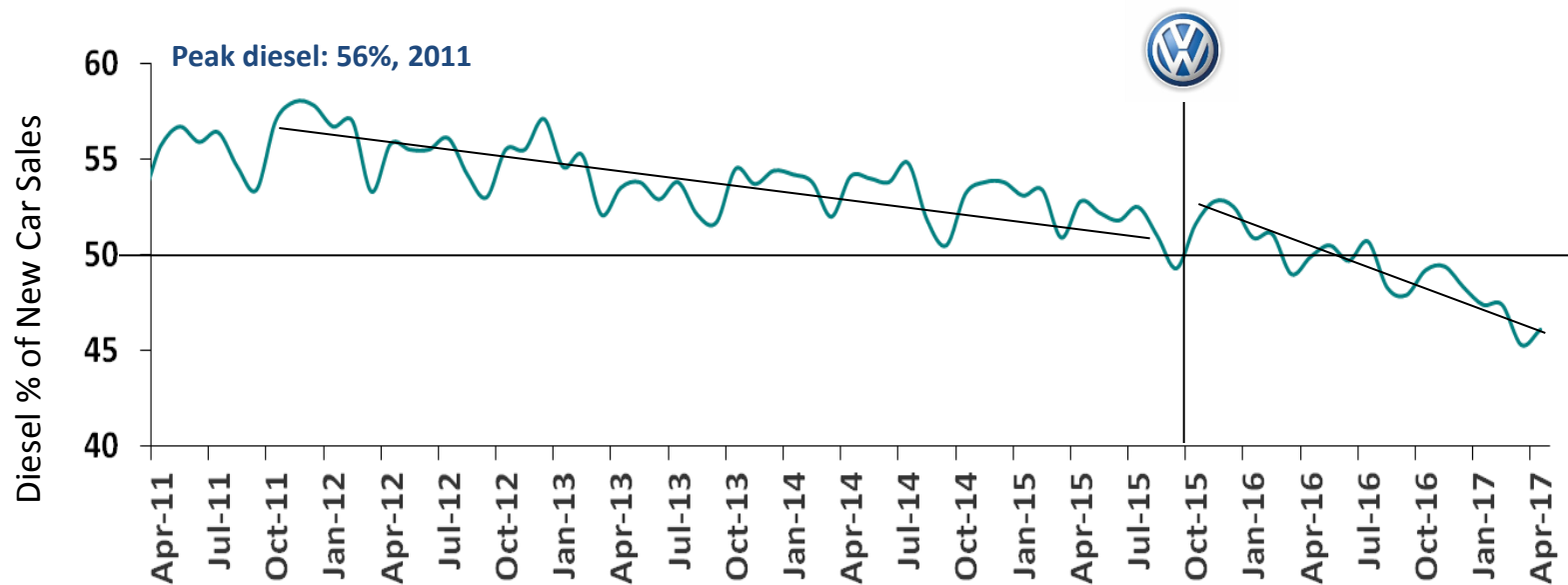
Popularity:



Pros :

- The foremost reason is helping cars to meet stricter emission regulations
- Low cost and lightweight
- 13-20% improve in FE
- Standard 12-volt electrical systems cannot supply all electrical accessories

Diesel Share Trend, Western Europe



Source: National Sources

- After 18 months of post-dieselgate results, we can now see the impact
- VW Dieselgate did Accelerate Decline in Diesel Share
- A new trend seems to be established, but will it continue?

The Pressure on Diesel Just Keeps Building

Stuttgart to begin selective banning of diesel cars 21/2/17

High court rules UK plans to tackle air pollution are illegal 2/11/16

Diesel vehicles will disappear sooner than expected says EU industry chief 4/4/17

Sadiq Khan warns diesel cars could be banned in London 20/2 17

Drivers of older diesel cars to be charged extra £10 to enter London 17/2 17

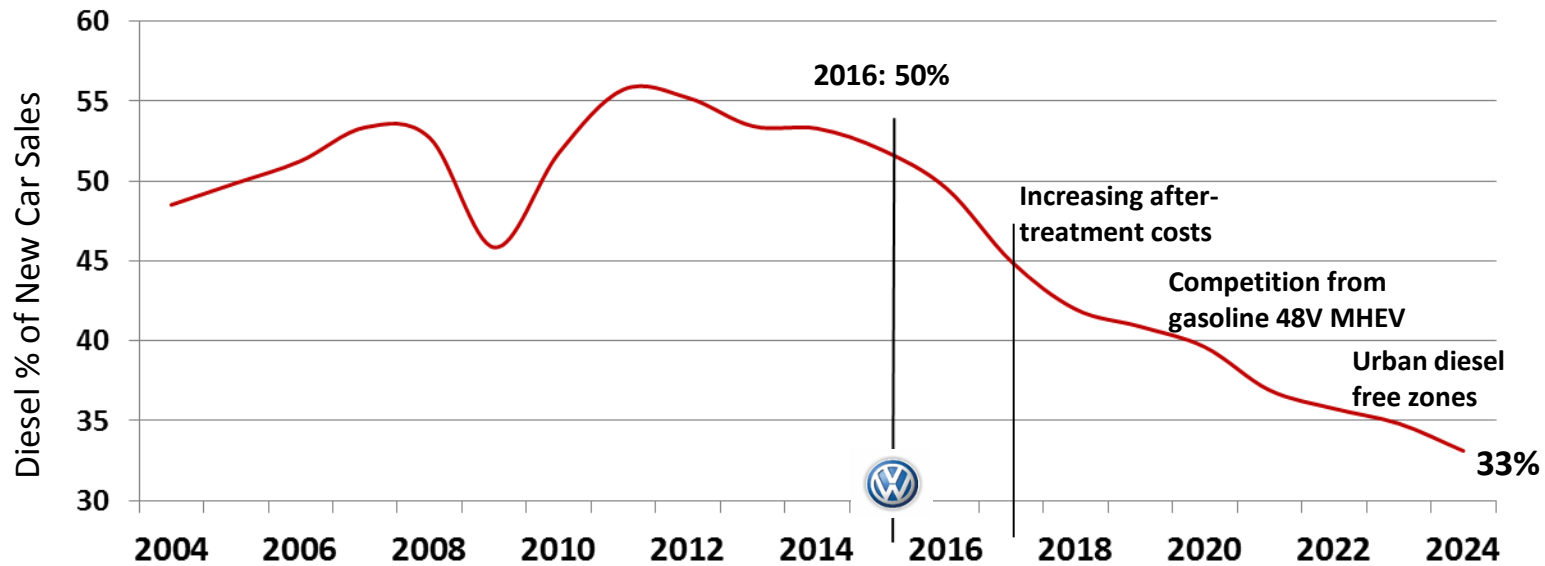
Diesel ban in Munich one step closer after court decision 1/3/17

VW, PSA, FCA & Renault to be referred to prosecutors in Europe over diesel

Madrid vows to ban diesel-fuelled cars by 2025 2/12/16

Paris bans old polluting diesel cars 24/1/17

Diesel Market Evolution: Western Europe

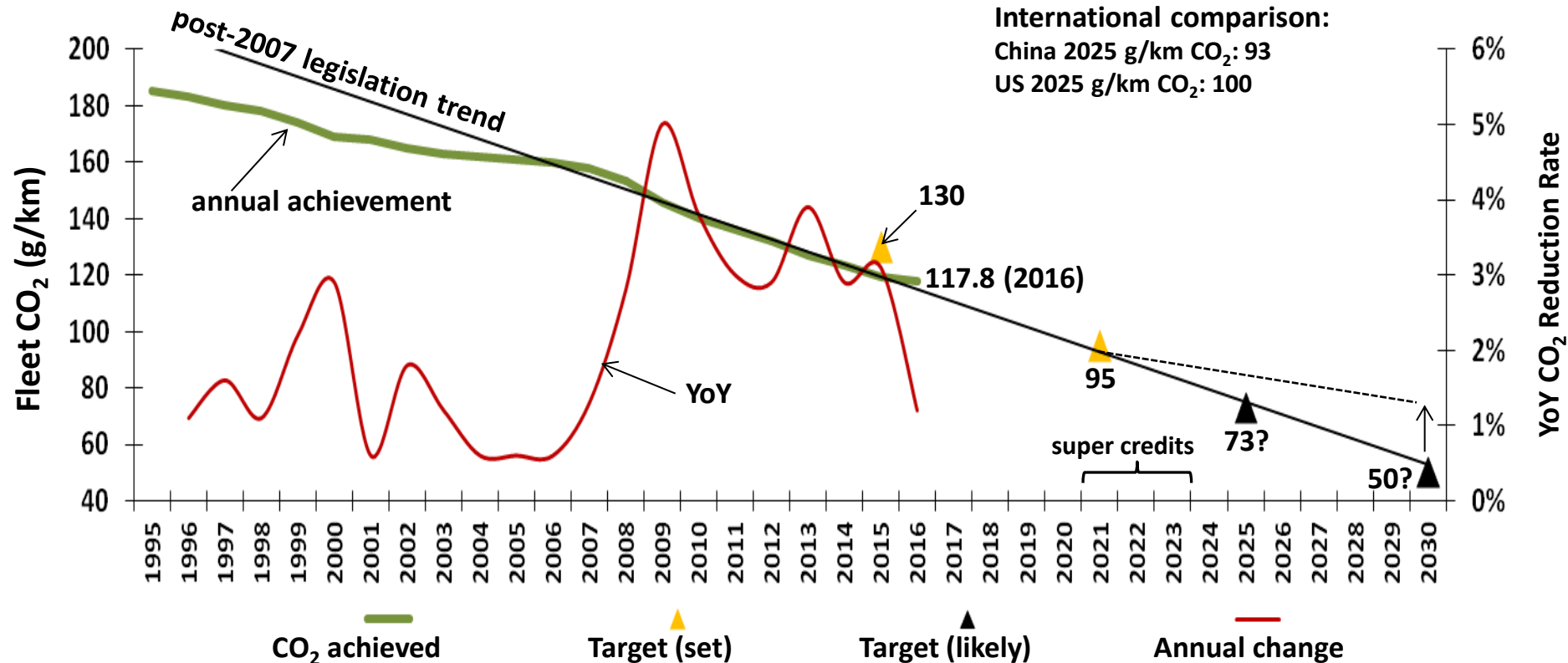


Source: LMC Automotive European LV Diesel Forecast

- Nervousness about investing in diesel is growing
- But core strengths of diesel mean it will endure at least in some segments
- Diesel remains a crucial tool for 2021 CO2 targets
- Beyond 2021, diesel will become less useful and that plug-in vehicles and gasoline hybrids will proliferate

Europe : CO₂ Achievements & Targets

EU Passenger Car CO₂ Emission Trend



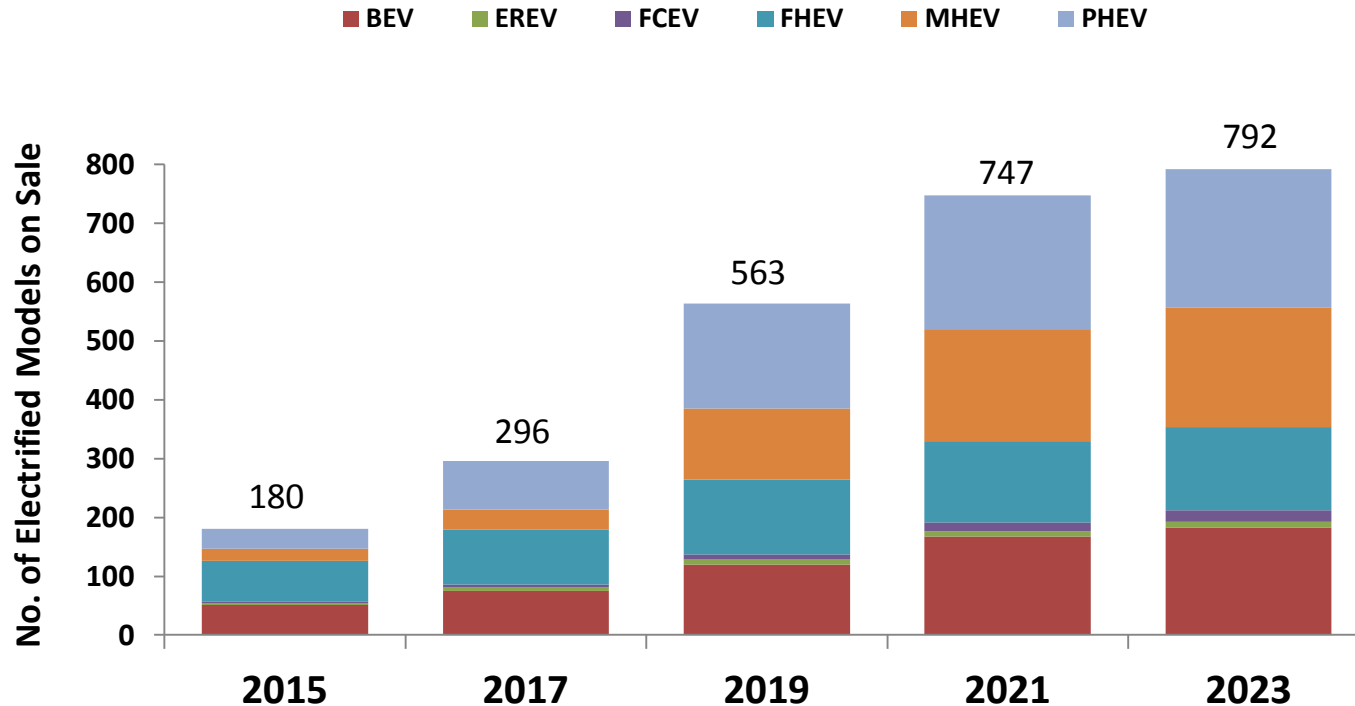
Source: European Environment Agency, CCFA, JATO

- CO₂ fell less sharply in 2016: SUV boom & falling diesel share?
- The industry is on track for 2021, but can't afford more years like 2016

- **Urban air quality:** potential to be a driver of plug-in demand as NOx is coming under the spotlight. Legal action may force more anti-ICE laws
- **Anti-diesel policy:** This looks certain to get more widespread either by direct or indirect measures, opening the door for more electrification
- **ICE-free zones:** some European cities have expressed a long-term plan to ban all ICE vehicles within a certain timeframe, allowing only ZEVs (Zero Emission Vehicles)
- **Infrastructure targets & mandates:** New building schemes will be required to offer charge points & local authorities will incentivise more
- **Alternative vehicle incentives:** These will increasingly be aimed at plug-ins, especially BEVs, and may be direct or indirect schemes
- **AVs (Autonomous Vehicles) schemes:** Likely to be city-based at first and to use EVs but we don't envisage high volume before 2030

Mainstream Electrified Car Models on Sale by Technology

Global, sales >100 units per annum, individual model lines split by technology type



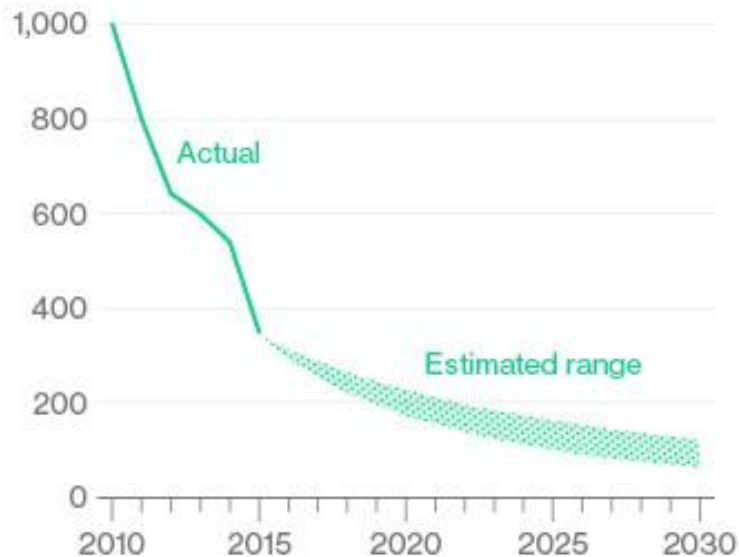
- Both BEV and PHEV pipeline increases significantly over the next 5 years
- By 2023, PHEV model count is still leading, BEV rising quite fast, MHEV has highest growth rate.
- Some MHEV could be classified as FHEV as boundaries become blurred

It's All About the Batteries

Batteries make up a third of the cost of an electric vehicle.
As battery costs continue to fall, demand for EVs will rise.

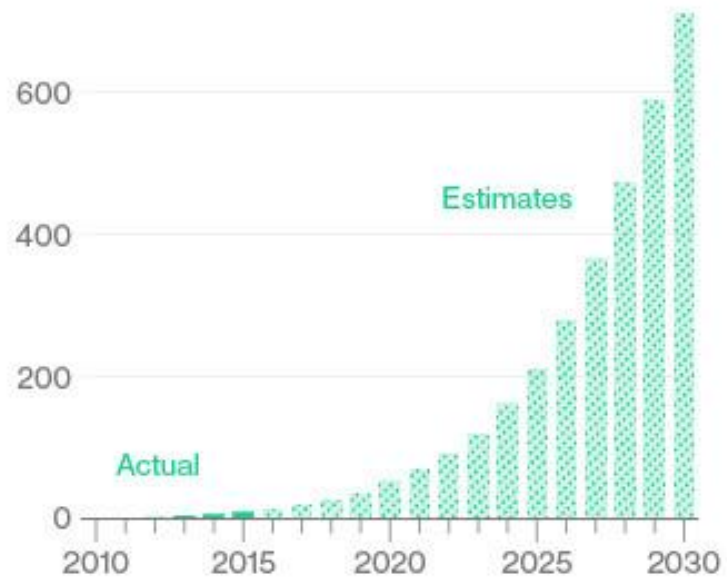
Cost for lithium-ion battery packs

\$1,200 per kilowatt hour



Yearly demand for EV battery power

800 gigawatt hours



Source: Data compiled by Bloomberg New Energy Finance

Bloomberg

BOI (Board of Investment)

- The electric vehicles covers; Hybrid vehicle (HEV), Plug-in hybrid vehicle (PHEV) and Battery electric vehicle (BEV).
- At least one of key components production;
 - Battery, Traction motors, Battery management systems (BSM) and Drive control units (DCU)
 - Corporate income tax exemption period
- Waste management for scrap batteries
- Plan for HEV and PHEV must be submitted within Dec-17
- Plan for BEV must be submitted within Dec-18
- Exempted import duty for CBUs for first two years (only 10% of annual production plan)

MOF (Ministry of Finance)

- Batteries must be produced or assembled in Thailand
 - Lower the excise tax duty for HEV and PHEV by 50%
 - Lower the excise tax duty from 5% to 2% for BEV

China

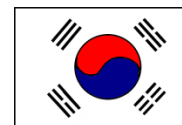


- Quotas for new car plates in Beijing:
 - 2016: 90k for normal cars vs. 60k for EVs.
 - 2015: 120k for normal cars vs. 30k for EVs.
- National subsidies for passenger cars

Vehicle Type	BD (Wh/kg)	ER (km)	RP (kW)	Subsidy level CNY 10,000/vehicle	
				2016	2017-2018
BEV	90≤BD<120	100≤ER<150	-	2.5	2.0
		150≤ER<250	-	4.5	3.6
		ER≥250	-	5.5	4.4
	BD>120	100≤ER<150	-	2.5	2.2
		150≤ER<250	-	4.5	4.0
		ER≥250	-	5.5	4.8
PHEV	-	ER≥50	-	3.0	2.4
FCV	-	-	10≤RP<30	20	0.6/kW
	-	-	RP≥30	20	20

*BD = battery energy density (Wh/kg), ER = electric range (km), and RP = rated power (kW).

Korea



■ Tax Break for buyer

> *Maximum KRW 3.1 mn for HEV and PHEV*

> *Maximum KRW 4.85 mn for BEV*

Qualification of BEV

a) *Fuel consumption: 5 km/kwh or higher*

b) *All electric range: 27 km or higher per charge*

c) *Time to full charge on slow charge (7 kwh): 10 hours or less*

■ Subsidy from central government

> *KRW 1.0 mn per vehicle for HEV*

> *KRW 5.0 mn per vehicle for PHEV*

> *KRW 14.0 mn per vehicle for BEV*

■ Subsidy from local government

USA



- **Federal Incentives**

- > *Tax credit of \$2,500 to \$7,500 for PHEV and BEV buyer, relying on the size of the battery. (The incentives are now phasing out.)*
 - > *Discounts on Insurance*

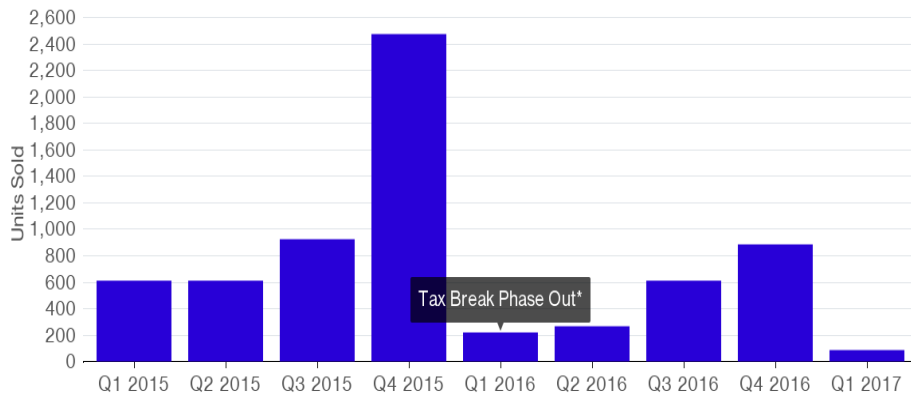
- **State Incentives**

- > *California: Maximum rebate of \$2,500, relying on EVs type*
 - > *New York: Rebate of \$2,000 for PHEV and zero-emission vehicle*
 - > *Arizona: Reduced license fees*
 - > *Florida: EVs are allowed to carpool lane and a rebate of \$500 - \$1000*

Source: The international council on clean transportation

Out of Favor

Sales of electrically chargeable vehicles have plummeted amid confusion over tax breaks



Source: ACEA

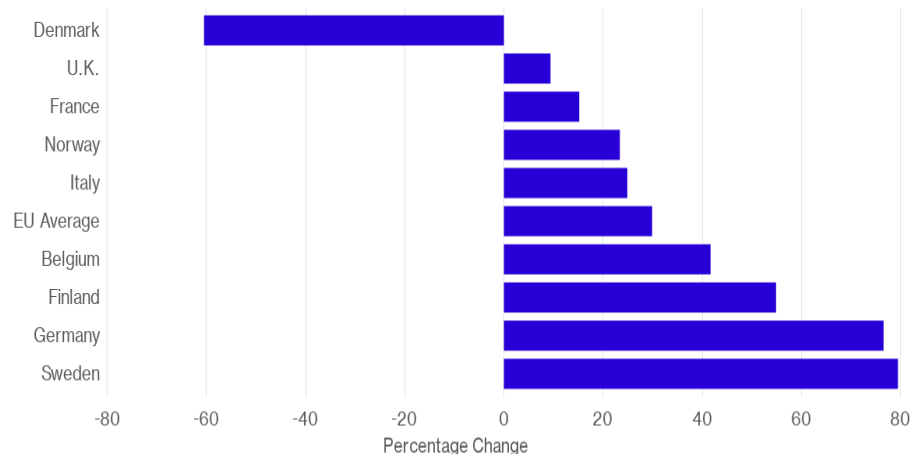
* Deadline has since been extended

Bloomberg

Reverse Gear

Denmark is the only major European market where sales of electric cars are slowing

■ ECV sales in 1Q 2017 vs 1Q 2016

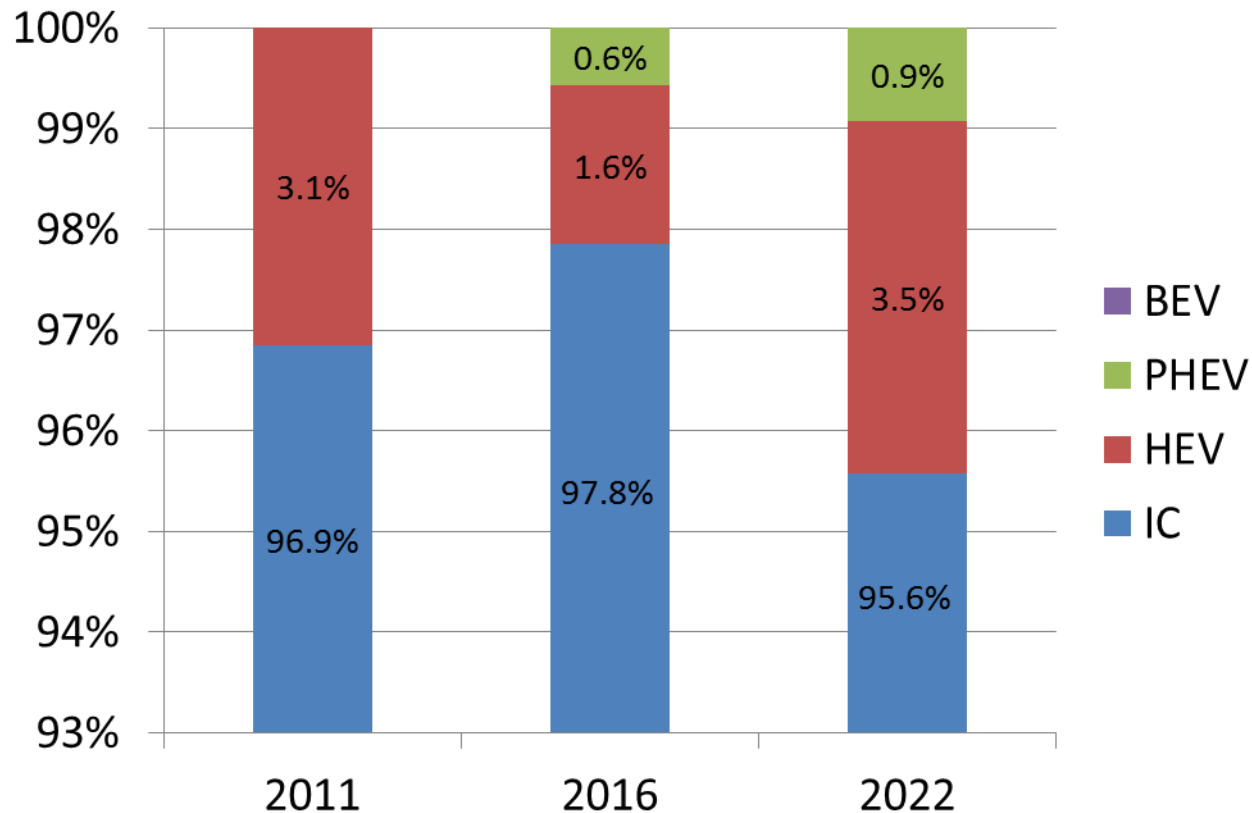


Source: ACEA

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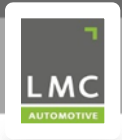
- “Price really matters” □ Without government subsidies, EV sales cannot sustain.
- Sales of Tesla in Denmark dropped from 2,738 units in 2015 to only 176 units in 2016
- EV sales in Denmark plunged -61% YoY in Q1 2017 compared to Q1 2016.

EVs sales share for passenger vehicle



- High fuel prices and new hybrid models boosted HEV demand in 2011
- HEV and PHEV are projected to increase based on incentives for buyers

Updated: Jun-17



Thank You

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