Electric mobility impact on downstream oil business

Threat or opportunity?

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Executive summary

Mobility has been dominated by combustion engines and fuelled by oil companies. Regulation, customer demand and technological development, are pushing electricity as a mobility power source, which will inevitably impact the downstream oil business. While the traditional business model is under threat, new opportunities arise.

There is still uncertainty over the potential of electric mobility and the impact it could have on certain businesses, but we have deep-dived and estimated the impact on the downstream oil business.

- Conditions are given for EV deployment to accelerate.
- EVs' impact on refining will be highly heterogeneous among regions.
  - Some refiners will face tighter economics since they will have to find markets further away.
  - More shutdowns will occur in low-scale and/or low-conversion refineries.
  - Less impacted regions will only see displacement of oil products' imports, with minor impact on capacity utilization
- There will be relative excess of gasoline due to further challenges in the demand mix.
  - Part of this will find a market as naphtha.
  - Gasoline will face lower spread versus diesel.
- New refining capacity additions will come in the form of "oil to chemicals", limiting production in the light vehicles segment.
- Oil companies will struggle to retain their share of the mobility market.

Arthur D. Little has previously conducted studies on EVs, and now analyzed and simulated the potential impact on downstream oil business. In this document we will discuss:

- Refining capacity impact;
- Refining demand mix impact;
- Petrochemical business impact;
- Fuel retail business impact.

1. EVs are coming to stay

It is no news that electric mobility has been growing and advancing. The first commercial electric cars appeared in 2008, and their adoption rate grew slowly until recent years, when it broke the million-units-on-the-road mile, particularly due to developments in China, the US and Europe.

Its increasing penetration has been encouraged by four main stakeholders: 1) government entities, which are increasingly recognizing the importance of reducing CO_2 emissions and air pollution; 2) OEMs[1] and equipment/service providers, which are creating/reshaping business opportunities; 3) consumers, which are witnessing their purchasing barriers eroding; and 4) infrastructure enablers, which are eyeing additional sources of revenues.

The EV market: Drivers and challenges

Let's analyze the EV market's drivers and challenges in more detail:

Governmental entities' commitments

As showcased by the Paris Agreement, most governments are making efforts to reduce their carbon emissions. In addition, eight major nations signed the Government Fleet Declaration in 2016, pledging to increase their shares of electric vehicles in government fleets and calling for other governments to join them. This effort goes hand-in-hand with the ambition of decarbonizing power generation by switching first coal, and then oil products, to natural gas, as well as increasing the share of alternative energy sources.

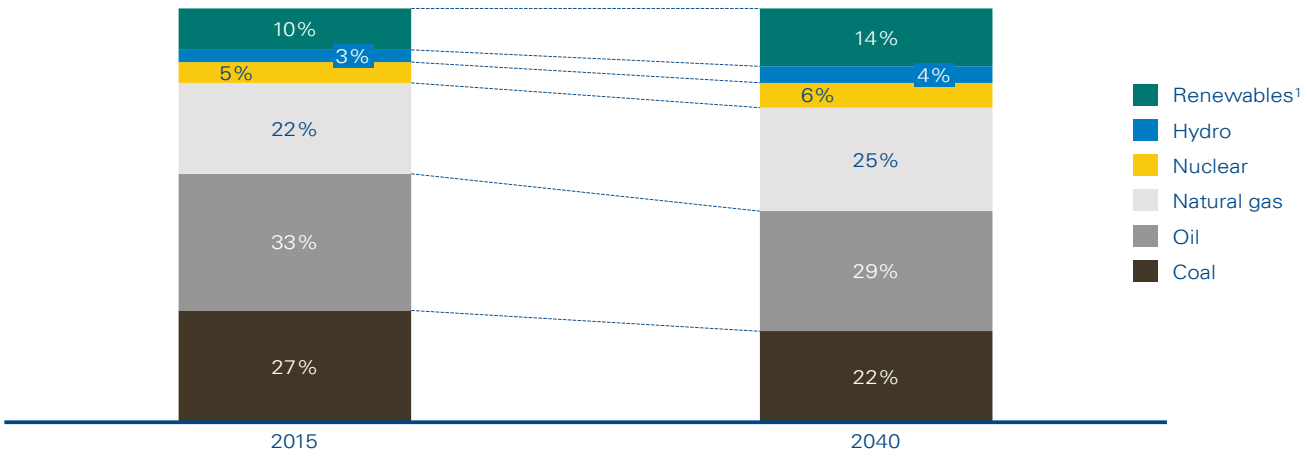
Similarly, metropolises and governments have started to address concerns arising from high levels of air pollution by applying policies to reduce fossil-fuel vehicles in cities, and even announcing bans on internal combustion engine (ICE) vehicles.

Overall, 14 countries have expressed intention to execute ICE bans. However, some of these bans are not pursuing a country-wide scope, and their commencements are dispersed from 2018 to 2040 so it will take some years after implementation to replace significant parts of running vehicle fleets.

OEMs' regulatory commitments and opportunities

Car manufacturers are in a peculiar situation – they need to balance their strategies between regulatory forces and business-model opportunities. Several large OEMs have announced plans to electrify large parts of their vehicle portfolios (Volkswagen, General Motors, Renault-Mitsubishi-Nissan, among several others). In this context, new players in the value chain constantly appear to compete and get shares of the new market, stimulating investments in technology and driving costs down.

Figure 1: Energy demand mix forecast



1 Non-traditional renewables, including biomass and biofuels
Source: Arthur D. Little analysis

1 OEM= Original equipment manufacturer

Eroding consumer purchase barriers

A few years ago, electric vehicles were perceived as naïve means of transportation for extremely wealthy people with deep environmental concerns, and far from attractive to mass customers. An Arthur D. Little study from 2016 that included thousands of consumers in automotive core markets confirmed that the main barriers to purchasing electric vehicles were their higher prices compared to those of traditional vehicles, the limited operating range, and insufficient charging solutions. However, these obstacles are constantly eroding, and will eventually disappear. Li-ion batteries are still relatively expensive and add up to 35–40% of a vehicle's cost. However, their cost has been decreasing exponentially. We expect the cost of EVs to reach parity with those of conventional vehicles between 2025 and 2027, and even outmatch them later on.

Autonomy range and charging time

Compared to that of oil-fueled vehicles, EVs' autonomy range is still limited. While top-notch cars surpassing 400 miles at full charge exist, "affordable" tier vehicles (<30k USD) are still between 100 and 200 miles.

Furthermore, EVs introduce a new variable to the customer experience: charging time. Even though there are fast-charging technologies available and increasing capillarity of charging infrastructure, the charging time-autonomy range equation is still poor against fossil-fueled vehicles. Besides current fast-charging technologies come at a cost in terms of battery lifetime. However, if more powerful energy storage technologies reach commercial feasibility it can be a game-changer.

Interest from infrastructure providers

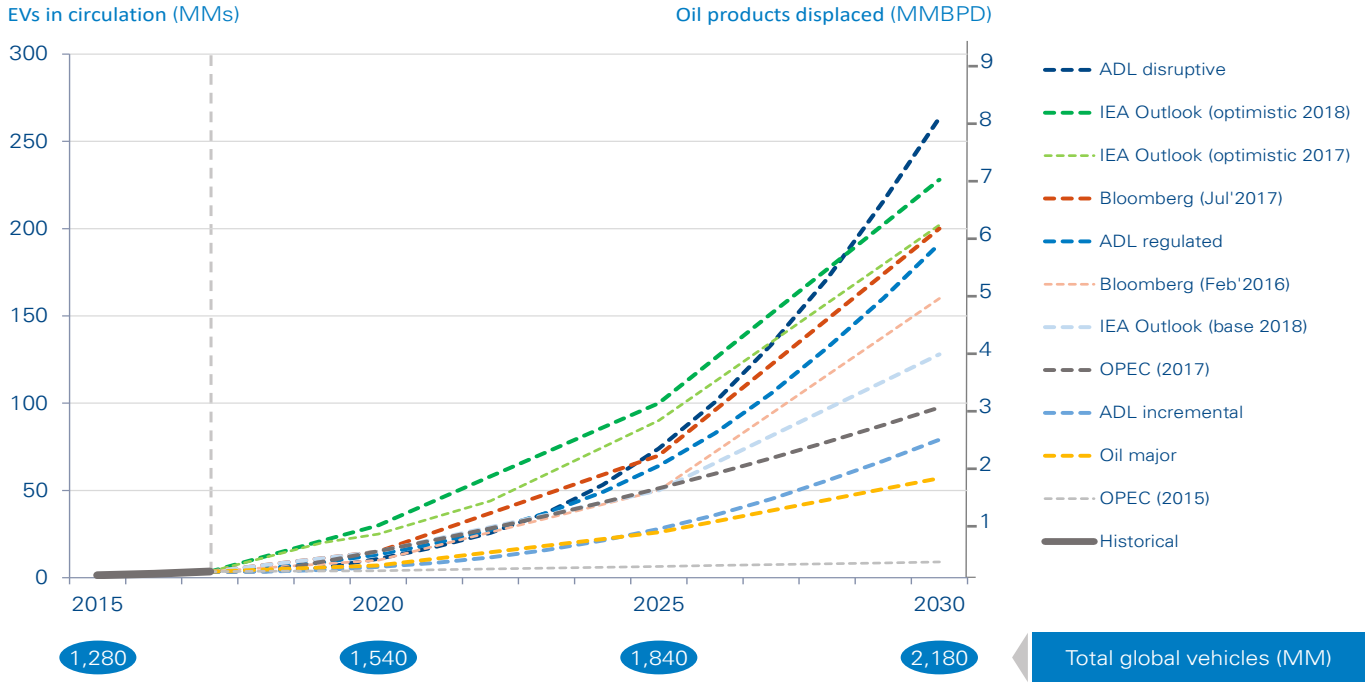
Infrastructure providers are increasingly looking into EVs as a source of additional revenues and embracing the cause. Utilities are increasing their sales through EVs, as well as using them to better manage their networks. Large retailers are using charging stations to attract new customers, parking operators are adding charging services to their offerings, and highway operators could add electric charging station rights to their benefits.

2. EV potential

When will EV deployment boom and how exponential will its growth be? There are multiple views on this issue, but even the more pessimistic and traditional predictions agree that EVs are coming. Market analysts update their forecasts more in favor of EVs every year, and some have even significantly underestimated their first forecasted years.

limited capacity of electricity grids. Less economically developed countries usually have lower carbon footprints per capita, which implies less pressure from international regulators. Moreover, these regions, on average, have the oldest car fleets; hence, their eventual replacement will be even slower unless there are serious incentives from local governments.

Figure 2: EV fleet (MMs) forecast to 2030 and oil products displaced (MM BPD)



Source: OICA, IEA EV Outlook 2017/2018, National Renewable Energy Laboratory, Bloomberg, OPEC, BP, Morgan Stanley, Arthur D. Little analysis

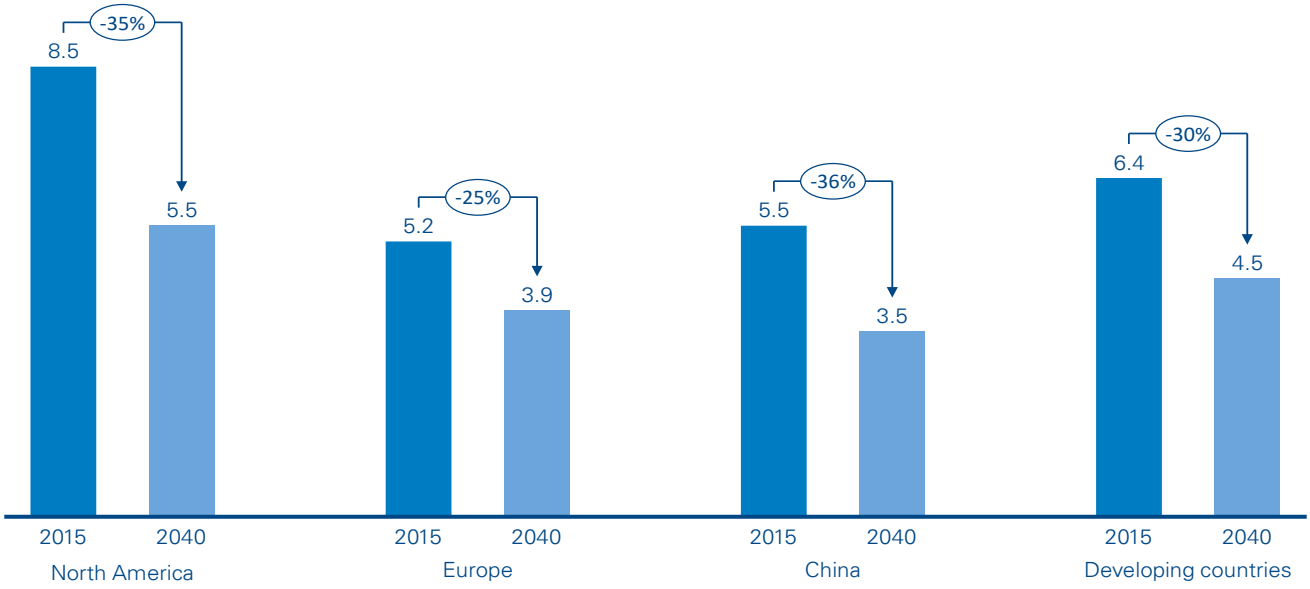
Nonetheless, it will take some time for EVs to have real impact on the global fleet since replacing parts of it will take years. Besides, the fleet is getting older every year.

Growth will be extremely uneven across regions. Europe and North America will lead the way, as they already have willingness from the demand side, government support sustaining growth through subsidies, and funds prepared to invest in charging-network infrastructure. Development in Asia, especially China and India, will be dependent on government policies due to poor air quality in major cities; purchasing power in these countries imposes limits on development of "natural" or organic demand.

The rest of the world (i.e., the rest of Asia-Pacific, the Middle East, Latam and Africa) will see much more moderated deployment, restricted by purchasing power and the already-

However, EVs are not the only trend affecting oil companies' business: vehicle efficiency and shared mobility are adding to the equation. Gasoline fuel efficiency is expected to reduce fuel consumption by at least 25 percent between 2015 and 2040.

Figure 3: Evolution of new light-duty cars' gasoline fuel efficiency by region (lt/100km)



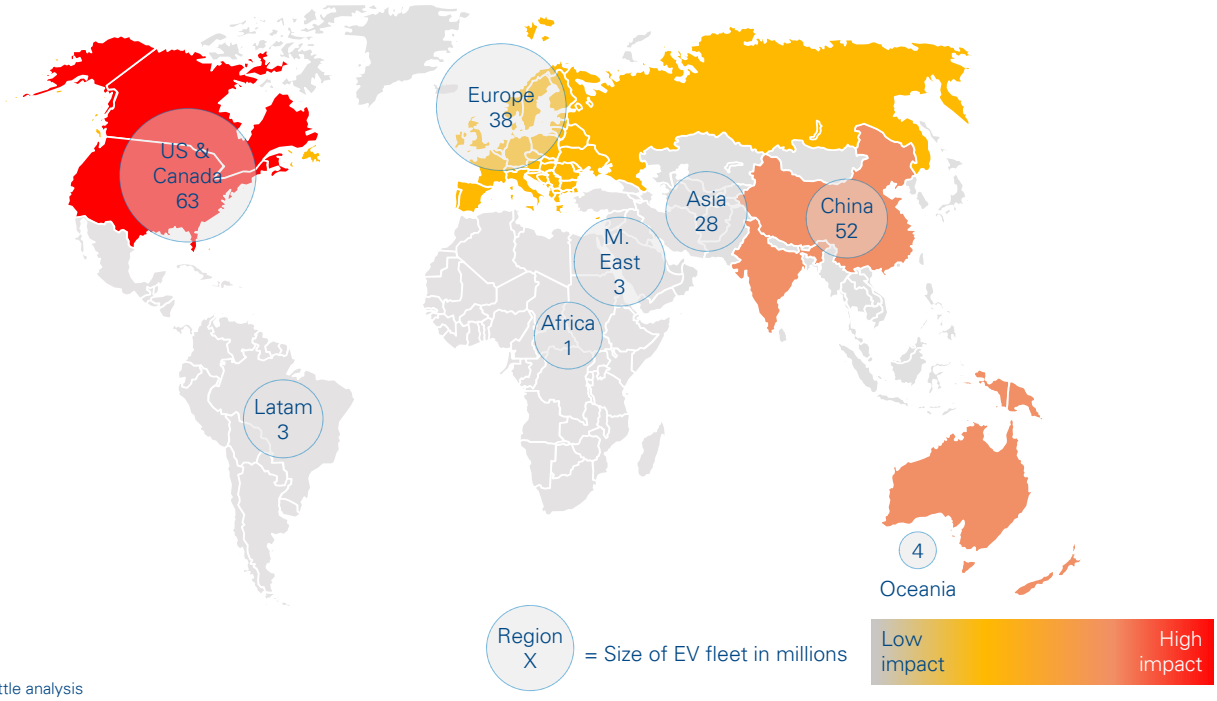
Source: OPEC, Arthur D. Little analysis

The increased adoption of shared mobility policies and solutions (inclusive of public transportation) in large metropolitan areas is drastically reducing the number of cars on the road, and hence energy demand for transportation.

Globally, we expect displacement of up to 5–6 MM BPD of oil products by 2030. In the "ADL regulated" scenario from the previous chart, we simulated that all countries' commitments were met in a timely fashion and non-explicitly committed countries experienced slightly optimistic deployment. As a result, there will be almost 200 MM EVs in circulation, representing 9 percent of the global fleet and 21 percent of global sales. However, deployment and its consequential displacement will be uneven across regions and split disproportionally among fuel types.

We will analyze the possible impact on refining capacity, refining demand mix, petrochemical business and fuel retail business

Figure 4: Number of EVs by region and impact on oil consumption 2030



Source: Arthur D. Little analysis

3. Impact on oil business

Oil consumption grows at about 1 percent every year and will keep growing globally, but unevenly. Its growth is mainly driven by in-land trade, international trade, increasing vehicle penetration and industrial growth in general (and petrochemicals in particular). So, said global growth will come largely from regions where these drives are to be further developed.

Refining capacity impact

Petroleum refining industry is going through a structural transformation. Regional capacity vs demand unbalances have deepened in recent years, Middle East and Asia projects are the new industry pacesetters in terms of scale and configuration, tightening fuel specs are eroding value of existing capacity and forcing refiners to invest with uncertain returns.

As mentioned before, shared mobility and vehicle fuel efficiency combined with displacement of fuel oil by natural gas already pose a challenge to the refining industry.

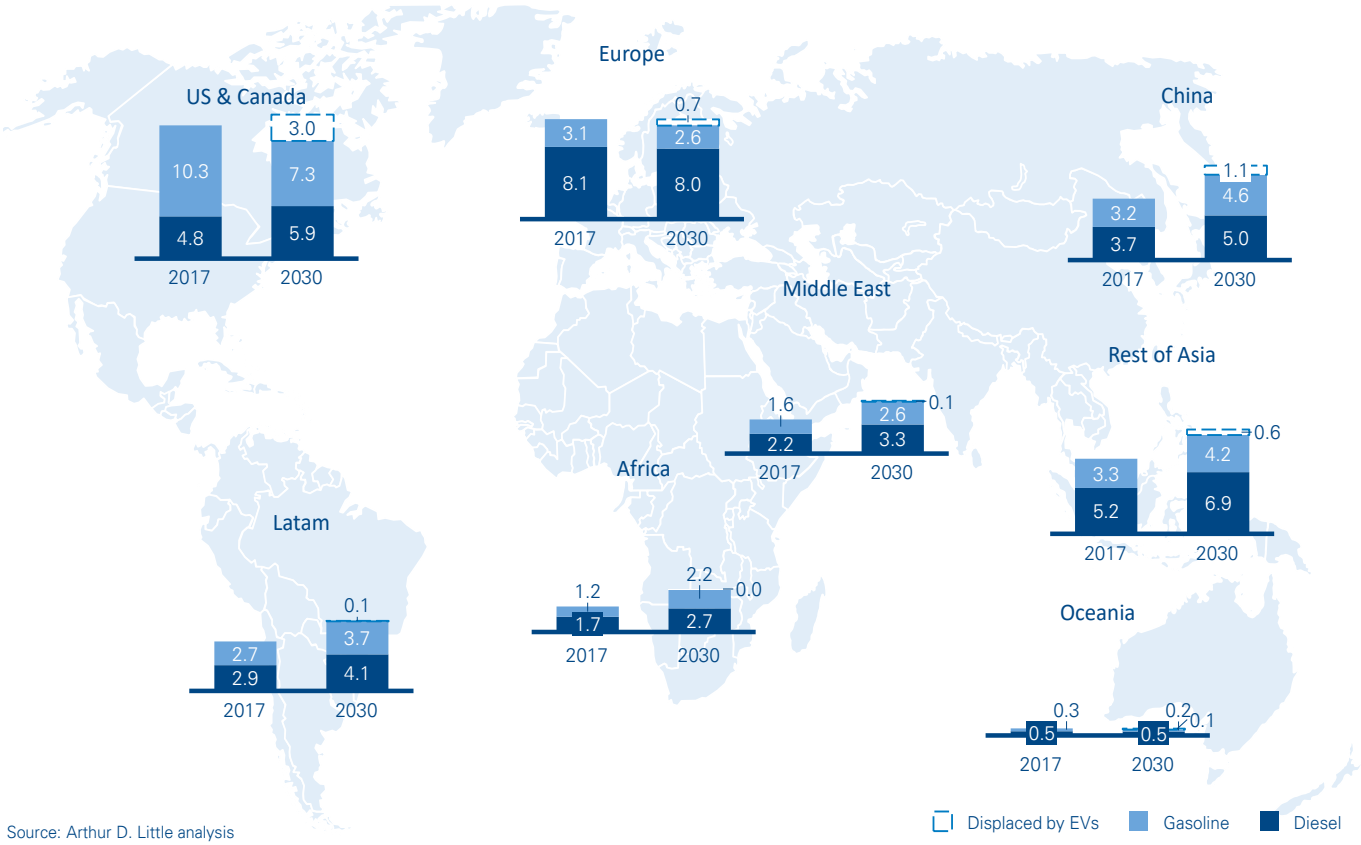
Since mobility will keep growing, so will energy to supply it, and we expect EVs to take a portion of that growth. Yet, it will drive down fossil-fuel consumption in specific regions

EV penetration will accelerate refining capacity crisis, especially in Europe, with more refineries running at low utilization rates and more candidates for closure, primarily short scale or limited conversion capacity ones.

Nevertheless, in fuel-importing regions, it is difficult that EVs will end up affecting refiners' price parities on their products. For instance, we estimate that Latam will be importing about 2 MM BPD of gasoline and diesel together by 2025, and to displace that demand there will need to be around 50 MM EVs on the road. There are almost 140 MM vehicles in the region, with average lifetime of over 20 years. Even if 100 percent of sold vehicles are electric, it will take five to six years to displace imports. And for most countries in the region, we don't foresee significant electric participation in vehicle sales before 2025.

In Asia, a fast growing demand and importing region, the impact on refining capacity will take time

Figure 5: Current and projected on-road demand for oil products (MM BPD)



Source: Arthur D. Little analysis

Refining demand mix impact

There is no doubt that the gasoline supply-demand balance will be affected, as well as that of diesel, albeit more moderately. For alternative markets, it is worth mentioning that:

- Part of the refinery streams going into the gasoline pool can and will be placed in the petrochemical market. Hence, refinery margins will be increasingly influenced by the petrochemical supply-demand balance. In any case, we expect that refinery naphtha used as petrochemical feedstock will see limited price differentiation against crude oil. Moreover, such balance is going to see greater supply of virgin naphtha coming from increasing condensate production from gas fields.
- Displaced diesel will find a market as marine fuel, especially since IMO regulation at 0.5 percent sulfur content will be established (if not entrenched by the time EVs represent a real threat) and some shippers will be willing to switch to middle distillates.

Such effects will challenge refining capacity and product mix, particularly where the current diesel-gasoline unbalance is to be deepened.

For the rest of refinery products, we do not expect major challenges due to greater electric mobility participation. Methane and ethane are usually used as self-consuming refinery fuel or fed to the petchem industry. LPG will continue to supply off-the-grid population as cooking fuel, and any surplus will continue to be a valuable petrochemical feedstock.

For heavier products, there will be no choice but to convert them, since their demand is shrinking every day, and this will happen mainly in scale-reasonable refineries (over 130–150 KBD).

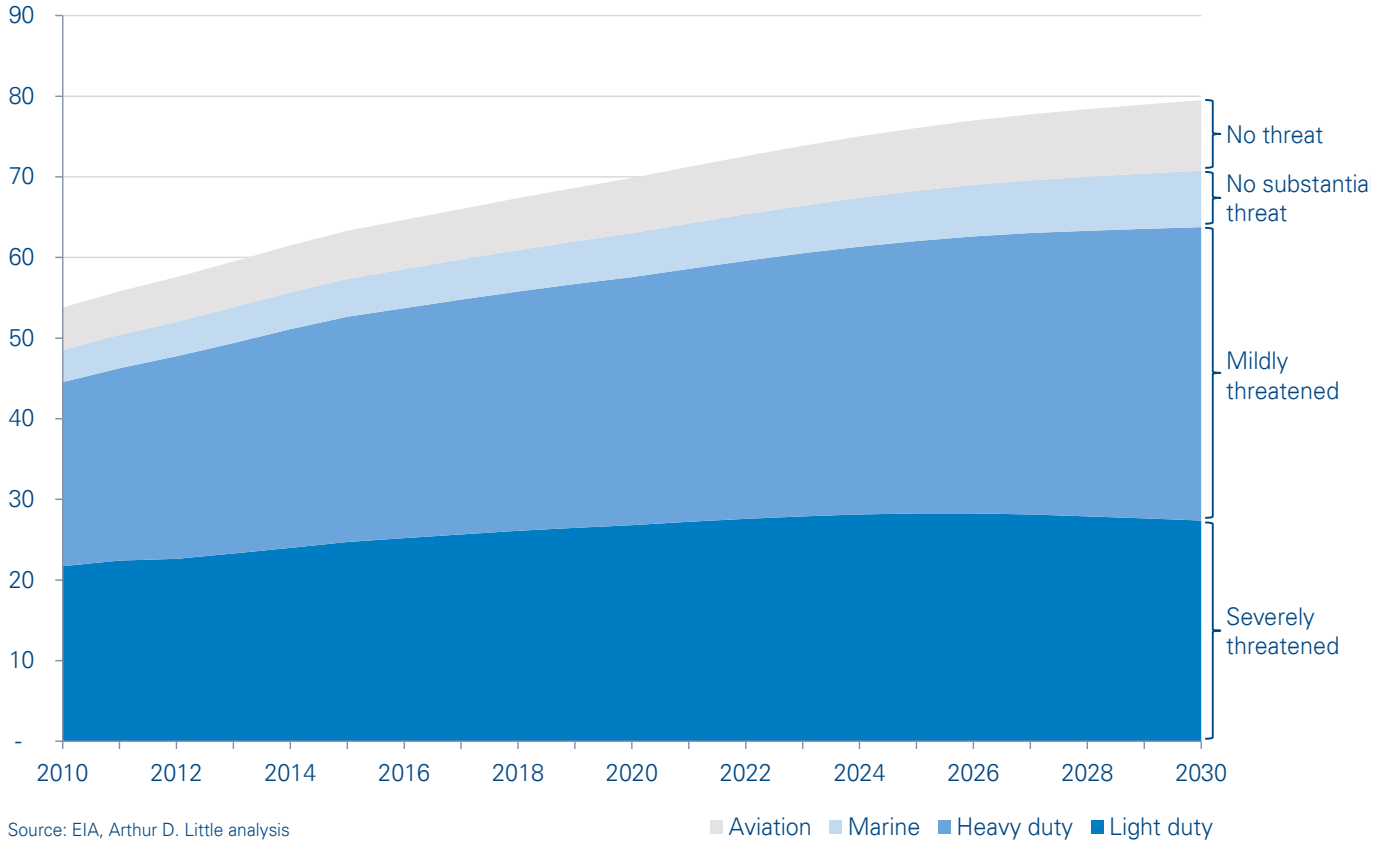
Electric mobility will surely have greater penetration in the light-vehicles segment, which is mostly gasoline fueled; thus, the impact on gasoline consumption will be greater.

This due to:

- Lower lifetime of light-duty fleets
- Lower weight of economics for individuals
- Higher fuel taxes for light-duty vehicles

However, we also foresee increasing electrification in heavy-duty mobility, especially urban buses and marine mobility – although marine mobility is less proportionate and still in its inception. Light-duty vehicles running on diesel will also have an impact.

Figure 6: Global oil-products demand for transportation (MM BPD)



Source: EIA, Arthur D. Little analysis

This brings up questions for each refining sector operator:

- Is there still a time window (i.e. 2025-2035) to get adequate returns on investing now in conversion upgrades for relatively small scale refineries?
- Which is the most cost efficient approach for adjusting production mix and getting fuels compliant with new specs?
- How to capture value from growing petrochemical business leveraging current refining facilities?

Petrochemical business impact

At some extent, EV penetration will increase the relative availability of naphtha from refineries as petchem feedstock. Geographies with structural low natural gas prices will experience a limited increase in penetration of naphtha as a feedstock, but in the end, it will depend on the Natural Gas-LPG-Naphtha volume equation. We expect relative lower prices for naphtha.

In any case, the most attractive economics currently come from integrated refinery and petrochemical complexes aiming to maximize petchem feed production at refineries. Hence, we expect most **new capacity additions to come in the form of "oil to chemicals".**

Fuel retail business impact

One factor challenging EV users is the availability of charging points other than at home. Consequently, we are seeing an increasing number of players investing in charging infrastructure. Many of these players are oil companies installing charging points at their gas stations, but others will include utilities and newcomers.

For oil (or energy) companies, the common business model is about lending a space to EV users for a limited time and charging cost plus tariff for the electricity, which is bought from the grid owner/operator.

Since the rest of the players are newcomers to the transportation business, it means we are already facing a paradigm shift. Oil companies are no longer the exclusive energy suppliers for on-road mobility.

We expect electricity distribution companies to make use of the capillarity from street lamp posts. Petrol stations at premium spots in cities will not be enough, and additional space for charging points will come from less costly and congested areas.

Fuel retail companies and independent dealers will push non-fuel business growth beyond its current share.

As a longer term challenge, fuel retailers will struggle to capture value from autonomous mobility.

This brings up questions related to the charging business:

- Will selling electricity make up for margin loss due to the decrease in fuel consumption?
- What is the best retail business model for oil companies regarding electricity penetration?
- Should oil companies partner with utilities or get their supply some other way, like producing their own?

How can Arthur D. Little support key players?

- Industrial reconfiguration design and feasibility
- Business model recommendations
- Segment and market-entry strategies
- Business and technology innovation
- Corporate venturing
- Fuel distribution and retail network strategy

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