5-Min Monthly Read

September 2022

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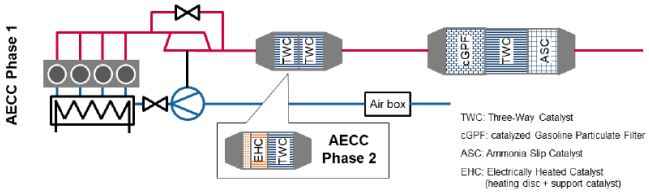
Regulations / Reports

Research finds new mechanism causing lung cancer amongst non-smokers with air pollution

Scientists at the Francis Crick Institute and University College London (UCL) have uncovered a new mechanism which links lung cancer with air pollution, especially amongst non-smokers. Cancer is often linked to damage of DNA due to environmental factors but there has been no evidence of that route for lung cancer amongst non-smokers. Scientists examined data for over 400,000 people in the UK and Asia and found that exposure to fine particulates promotes the growth of cells in the lungs which carry cancer-causing mutations.

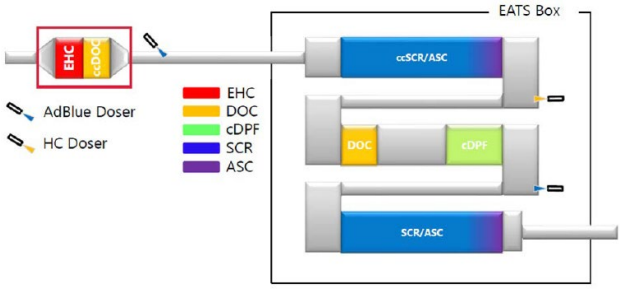
Ultra-low emitting vehicle demonstration done ahead of Euro 7/VII

The Association for Emission Control by Catalysts (AECC) and the International Platinum Group Metals Association (IPA) hosted a technical seminar to discuss the latest technologies available to address upcoming Euro 7 standards. Vehicle demonstrations showed the reductions in tailpipe criteria pollutants possible under aggressive real-world driving conditions and at low ambient temperatures (down to - 10 C).



For gasoline cars, pre-heating with an electrically heated catalyst, secondary air injection, high filtration GPF and ammonia slip catalysts were some advanced technologies shown to reduce NOx, particulate and ammonia emissions to well below the current Euro 6 standards.

On the heavy-duty truck, a combination of light-off DOC and SCR catalysts along with an EHC were shown to greatly reduce cold start and urban emissions. The detailed presentations are available on the website.



US EPA to tighten GHG standards for HD trucks

The US EPA is considering a supplemental notice of proposed rulemaking to reopen and tighten the current greenhouse gas standards for heavy-duty trucks. Previously, the agency had indicated this will be done in conjunction with the upcoming criteria pollutant low NOx regulation, but the passage of the Inflation Reduction Act and the incentives included for electrification is being seen as an enabler for more rapid electrification in some vocational segments.

NY governor calls for state to follow California's EV rule

New York Governor Kathy Hochul has called on the state environmental agency to propose and adopt California's electrification mandate which requires all new vehicle sales to be electric by 2035 (up to 20% can be plug-in). The state agency will have to hold a public hearing before such a rule is finalized. To promote electrification, the state will offer an additional $2,000 off the price of an electric vehicle, above and beyond the federal $7,500 tax rebate.

IEA report on clean energy progress

The IEA has published several reports tracking the progress made towards net-zero emissions. The report shows that emissions are increasing back to pre-pandemic levels.

- Transport emissions increased by 8% in 2021 relative to 2020.
- Also in 2021, CO_2 emissions from the power sector (electricity + heat) rose by ~ 5% to an all-time high. The global electricity demand increased by 1200 TWh, half of which was met by coal-fired generation. Renewable electricity generation also reached an all-time high, increasing by 500 TWh vs. 2020. The global electricity carbon intensity is at 455 gCO_2/kWh.
- A trend to watch is the rapid increase in grid storage capacity using batteries. In 2021 alone, ~6.5 GW of storage was added using batteries (mostly Li-ion), which is 40% of the total 16 GW installed capacity today. This is still only 10% compared to the total pumped-storage hydropower of 160 GW in 2021. And it is small compared to the growth of 80 GW per year required to meet net zero targets.

Study suggests a 3.5 times higher social cost of carbon compared to US government value

A new study published in Nature by researchers from various universities concludes the social cost of carbon at 185 $/ton-$CO_2$, 3.6X the current value used by the US government of 51 $/ton-$CO_2$. The four main components adding up to the cost include temperature mortality impact ($90 $/t), agricultural impact ($84 $/t), sea-level rise (2$/t) and energy costs for cooling buildings ($9/t). The study offers a range of costs based on various scenarios and highlights the sensitivity to the near-term discount rate used (2% in this study).

Electrification / Batteries / Charging

Bloomberg raises EV forecast in US

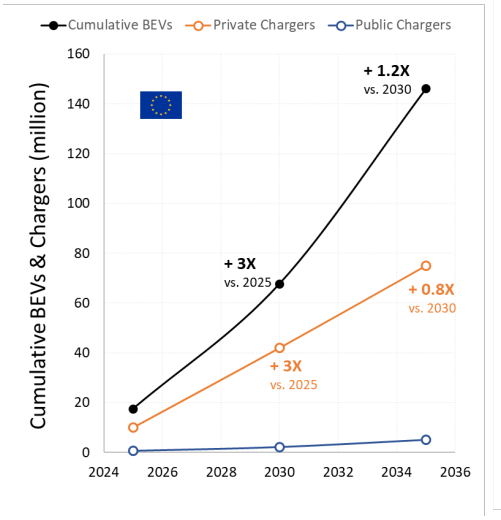
Studies are beginning to analyze the impact of the Inflation Reduction Act (IRA) on electrification. Some predict that the added requirements for "made in US" will limit the number of vehicles eligible for incentives in the near term, while ultimately boosting the rate of electrification in the longer term. BloombergNEF has increased its forecast of new EV sales in the US from 43% to 52% by 2030. Note that EV here include both pure battery electrics and plug-in hybrids. Since 2020, the share of plug-in hybrids has been ~ 20% of the total EV sales in the US. If that remains, it suggests a ~ 40% share of BEVs in the US by 2030.

By 2030, 90% of cathode production will happen in China

A graphic from Benchmark Mineral Intelligence provides a nice summary: In 2022, China has near dominance on anode production and produces more than 3/4th of cathodes. By 2030, Benchmark predicts that the share of cathode production in China will increase to 90%. Majority of minerals are mined in other regions, but refining is again heavily concentrated in China. Its leadership in the EV space is hardly news, and to state the obvious, the reason to emphasize this is the strategic implications and raw material constraints that could occur in EU and US to fulfil current policies. Electric vehicle sales are surging in China ahead of potential removal of subsidies next year. The share of new energy vehicles (BEVs plus plug-in hybrids) has exceeded 25% in August.

Charging infrastructure required to 2035

A new report from the ICCT projects the charging infrastructure buildout required in the "Zero Emission Vehicles Transition Council (ZEVTC)" members (European countries, US, India, others) to meet a Paris-aligned scenario of vehicle electrification in the coming years. The figure here is an example for light-duty vehicles in Europe, and is based on further analysis of the report. The number of chargers needs to increase significantly in the coming years. Current installed capacity is at ~13% of chargers and 10% of the total power output (240 GW) of that required by 2030, assuming ~ 80% EV share in Europe of new sales.



Battery swapping in Europe – better luck this time?

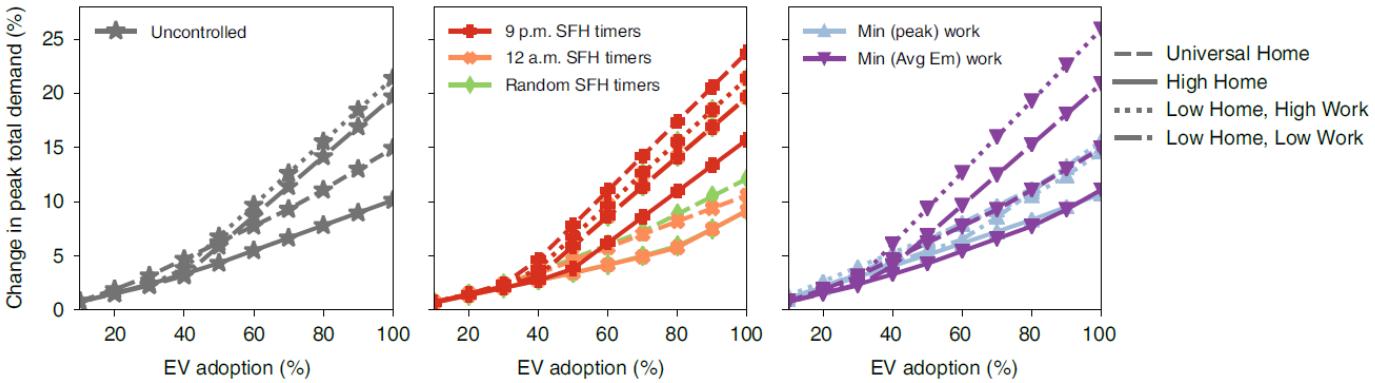
The idea of battery swapping to eliminate long charging time has been tried before but failed partly due to high costs, lack of standardization across OEMs and the increasing charging network. Still, Nio is planning to build 1000 swapping stations in Europe by 2025, following its early success in China and two stations in Norway.

When's the best time to charge EVs?

A new study from Stanford University concludes that at-work charging during the daytime, without controls that prescribe charging at a certain time of the day would reduce net demand on fossil-fuel powered base load, peak power demand, storage capacity, cost and ultimately emissions. While majority of EV owners today are single family homeowners who typically charge at night with a prescribed time (e.g. start at 9 p.m.), for high EV adoption scenarios (> 50%), the increased demand at night will be unsustainable – it will best to use the additional renewable power most available during the day. The authors also point to increased grid resilience as an added benefit.

The study was done for the Western Interconnection (WECC) grid of the US covering 11 states and 75 million people and projecting EV adoption to 2035. Another important takeaway was that energy storage will be critical

to reduce dependence on fossil fuel power. 10 GW of storage was found to be sufficient to meet the added load due to electrification (includes beyond EVs). The picture included here shows an example of the range of the increase in peak demand based on various modes of charging (at home vs work, and with and without timers).



On HD Electrification: Summary from SAE COMVEC

This is not a summary of the SAE COMVEC conference, but a snapshot of the views expressed on electrification of heavy-duty trucks. Based on early experience with electric trucks, here were some learnings discussed:

- Fleets are looking to electrify for reasons of sustainability and customer demand, not necessarily for total cost of ownership benefit. Today, the need for adequate infrastructure trumps any TCO considerations.
- Lots of models are now available and range is increasing with battery improvements. Range is already sufficient for many of the vocational segments (Class 3 – 6)
- Drivers are very happy with electric trucks, and are very reluctant to go back to ICE trucks !
- Smart charging methods are being developed. For example, a single 150 kW charger is used to charge 3 buses overnight in series (sequentially), cutting down on charging costs.
- Megawatt charging is making good progress (level 3 can charge up to 3.75 MW). But charging at such high power is not an easy process - don't try touching a MW charging cable. Catenary and wireless charging is also being developed

Despite the positive trends, reaching 50% ZEV penetration (for trucks) by 2030 is expected to be very challenging. Some issues discussed:

- Charging infrastructure is the key bottleneck, including lack of sufficient chargers and standardization of high-power charging. There are issues with charging equipment failure which is very disruptive. Getting permits for installing high voltage charging stations can take years, and utilities will need to upgrade the upstream infrastructure
- Cost of electricity is a concern. Recent price increase has translated to double operating cost on a per mile basis for electrics compared to diesel.
- Accelerated tire wear for electric trucks was found to negate some of the TCO benefits.
- For long-haul application, range is a key limitation. Current max range is ~ 250 miles, and increasing range will require larger batteries which reduces load carrying capacity.
- Incentives such as the $40K are included in Inflation Reduction Act for purchasing electric trucks might not be effective: the incentives are given to small fleet owners, whereas only the big fleets can take the risk of adding new technologies.

Hydrogen

H_2-ICE concept truck on display at IAA

Cummins showcased its hydrogen ICE on a concept Mercedes-Benz 4x2 truck at the IAA Transportation exhibition in Germany. The 6.7L engine features direct injection lean-burn combustion and delivers equivalent performance to a similar sized diesel engine. It is rated at 290 hp and 40 kg of on-board H_2 stored at 700-bar enables up to 500-km range. Refilling the tank is estimated to take ~ 10 mins.

Fuel cell trucks: Cost of green H_2 is the key bottleneck

The ICCT has published a study on the total cost of ownership of hydrogen fuel cell trucks, concluding that cost parity with diesels will require the price of green H_2 to drop from the current 6 – 9 €/kg level in major European countries to 4 €/kg by 2030.

CONFERENCES

Aachen Colloquium on Sustainable Mobility, Aachen and online, October 10th – 12th
https://www.aachener-kolloquium.de/en/

ASME The ICE Forward Conference, October 16th - 19th, Indianapolis
https://event.asme.org/ICEF