Charging cement logistics

Electric vehicle (EV) cars have taken the fast lane on the road to net zero. Commercial vehicles lag behind, but it is no secret that the adoption of battery-powered, heavy-duty trucks will accelerate in the years ahead. This article looks at the "current" trends in heavy-duty electric trucking and outlines what impact these will have on logistics planning processes in the cement industry.

■ *by **Thomas Bergmans** and **Dirk Schlemper**, INFORM, Germany*

Ready to rumble down the road to net zero: electric heavy-duty trucks

Diesel is still king on the road – there is no doubt about it. However, efforts to reduce CO_2 and GHG emissions by truck manufacturers have made strong gains over the past two decades. Today's heavy-duty diesel-powered trucks are cleaner than ever. And this is not yet the end of the line for internal combustion engines. In 2019, for example, the EU's first-ever CO_2 standards for heavy-duty vehicles were approved. New trucks sold from 2025 will be required to emit 15 per cent less CO_2 compared to 2019 levels, and starting in 2030 new trucks must emit a third less CO_2.

This is good news for the environment, but investments in new technologies required to fulfil these emission levels will make new trucks more expensive. As a consequence, fleet owners may decide to hold on to their older, less environmentally clean and less fuel efficient trucks for longer periods of time. Moreover, if we look at the overall transport volume of the building materials industry,[1] tailpipes of diesel-powered tucks will still produce significant GHG emissions in 2030.

Electric heavy-duty trucks could be a way out of this dilemma as they promise zero emissions and lower cost of ownership. Compared to the electric vehicle (EV) passenger car market, EV truck manufacturers still have a fair way to travel to accelerate the widespread adoption of battery-powered trucks. However, cement and ready-mix producers should start considering the impact this will have on their logistics planning processes now.

Sparking adoption

Recent advances in technology and changes in legislation are creating market conditions that are increasingly favourable for electrification. The boldest move has been in California where by 2045 every new truck sold will have to be zero emission. In effect, the California Air Resources Board has ordered manufacturers of medium- and heavy-duty commercial trucks to begin selling zero emission versions from 2024, resulting in 15 per cent of trucks on the road being electric by 2035. That will amount to roughly 300,000 of about 1.9m total trucks expected on California roads that year.

In addition, more and more cities are imposing access restrictions for diesel trucks. Thus, it will not only be a question of economics but also a question of "still being able" to serve customers. Also, noise levels are considerably lower compared to diesel trucks, making EV trucks the ideal vehicle for congested areas and city centres. They also provide greater flexibility to operate after hours in residential areas where stricter noise restrictions apply. In 2020 Swedish ready-mix concrete products manufacturer Swerock began trialling two fully electric construction trucks in Gothenburg. In 2021 Holcim Switzerland used three electric concrete mixer trucks in cities including Zurich and Basel. Moreover, Cemex recently announced earlier this year that it is the first building materials company to complete a large-scale, multi-country pilot using fully electric ready-mix concrete trucks. An initial, successful trial was carried out in Germany, followed by a further trial in France.

An increasing number of producers expect to gradually introduce zero emission trucks to their fleets. The authors are confident that truck manufacturers and conversion companies are capable of engineering reliably working trucks – hence pilot use will almost certainly be a success. The real challenges will arise from putting larger fleets of EV trucks to work.

Concrete mixer trucks are suitable for electrification, as the distances from batching plants to construction sites are relatively short compared to cement shipments. However, with continuing advancements in battery range, long-haul cement bulk trucks are set to hit the road soon. Strictly speaking, when discussing electric concrete mixers, it is important to differentiate between "fully electric" and "hybrid" models. Fully electric means the truck and the drum are electric-powered. Hybrid means that only the drum drive is electric. Both options are good for the environment, but a mixed fleet of diesel and electric trucks – be it in cement, ready-mix or aggregates logistics – will bring new challenges to daily dispatch planning.

Formula EV

Being a dispatcher brings a tremendous amount of pressure and stress. Each day is a challenge and each decision has multiple flow-on decisions that, in turn, complicate future decisions. This is true for tactical scheduling, where dispatchers determine the delivery schedule and fleet configuration for the following shift but also for real-time operations. Disruptions like traffic hold-ups, adhoc orders or cancellations affect the efficiency of operations. If no counter-measures are taken, the entire plan can collapse like a house of cards – with shipments running late and costs way out of line. What is worse, decisions taken at this stage often ignore the environmental impact of the order/truck assignment. Order fulfillment is more important than carbon considerations. If electric trucks are added to this equation, dispatch planning will become even more complicated. This is because it will add more variables to the scheduling maths. A few examples include:

- Range: this is, and will, remain an issue with all electric vehicles. Monitoring the remaining range and incorporating accurate estimates into real-time planning is crucial.
- Pre-booking: reaching a charging station, be it a private or a public one, only to find that it is already in use, with no indication of when it will be free, is a serious waste of time. Slot booking and real-time planning need to go hand-in-hand.
- Charging times: actual charging times depend on a range of factors, including the type of charging station, the truck's battery size and on-board charger capacity, outside temperatures and the required capacity to fulfil all follow-up deliveries. Aligning charging times with drivers' breaks is also needed.
- Electrical capacity: charging one truck with 150kW will most likely be feasible in every plant or depot. However, what if six trucks need to be recharged after their third delivery round – almost all at the same time? Has the plant a spare 900kW of capacity in its connection to the grid or will load regulation tune the power down to a fraction of the maximum charging capacity of the truck? Either way, slot booking aligned with truck scheduling will be a must.
- Energy costs: with ever-rising energy costs, off-peak charging allows for significant savings compared to peak-hour charging.
- Temperature: dispatchers need to keep a weather eye on the horizon, since battery performance drops in cold temperatures. This will seriously impact order fulfillment if not taken care of.
- Elevation profile: on the way to customer sites, steep climbs will drain batteries quickly. Thus, the elevation profile becomes a new element in your route planning.

Adding EV trucks to a fleet will also bring new challenges to the strategic planning phase. While many personal EV owners can use a domestic wall outlet in their garage to charge their vehicle, heavy-duty trucks require much higher power levels. It can be quite expensive to generate and deliver this amount of power. The number of charging stations at each plant or depot will be limited. This raises the questions of where to invest in infrastructure and where to position EV trucks to get the most from this investment?

Adding EV trucks to the dispatch formula will add even more variables to the scheduling maths for operators

AI-powered transport planning

Procuring EV trucks is the easy part of electrification. However, when investing in transport planning software, many decision-makers feel a bit like they are buying a shiny car with its hood welded shut. The logistics software market is very crowded and it is easy to get dazzled by bright and shiny features that increase costs but do not necessarily add value.

A look under the hood reveals that logistics software vendors typically use three different types of engines to drive their calculations: spreadsheet-based calculations, pre-defined business rules, and engines powered by algorithms. While spreadsheets are a tool of the late 1980s, legacy systems that use pre-defined business rules lack traction when it comes to cornering unexpected disruptions and ad-hoc changes.

"Attempting to manage a mixed fleet of diesel and electric trucks without algorithms will be a major obstacle on the road to net zero."

Today, algorithms outperform legacy systems and human planners in both speed and quality. They allow transport planners to do incredibly complex, time-critical calculations with ease. What is more, algorithms can take a larger range of variables into account and process far more data much quicker than the human mind, thus effectively removing human error from the dispatch formula. Producers who have implemented a smart transport planning system powered by algorithms typically achieved an increase in loads per truck per day of 7-21 per cent (cement), 9-29 per cent (aggregates) and 10-37 per cent (ready-mix concrete). This may lead to a cut in logistics unit costs of 7-20 per cent.

With the rise in truck productivity, less trucks are eventually needed to fulfil the same order volume, be it diesel- or battery-powered vehicles. Best practices in the cement industry have shown that fleets can be downsized from 100 to 86 vehicles. That is not only 14 less trucks on the road, but also 14 less trucks that have to be manufactured, maintained, repaired and scrapped at the end of their lifecycle.

EV-ready dispatching

On the road to net zero, building materials producers and truck manufactures still have a fair way to go and new technology to develop. It will be exciting to see what can be achieved in the coming decade. Of course, a carbon reduction strategy must take all areas and stakeholders along the supply chain into account. This allows a company to prioritise areas where further reductions in emissions can be achieved – be it through new technology or optimised processes.

However, electric trucks will add more variables to dispatch planning. Attempting to manage a mixed fleet of diesel and electric trucks without algorithms will be a major obstacle on the road to net zero. Planning should start now. ■

REFERENCES

[1] BERGMANS, T, SCHLEMPER, D (2020) 'Lowering logistics CO_2' in: *ICR, (*6), p82-83