Guardian Fire & Safety

Sustainable Transport Strategy

Author: Phil Walker, EcoMerit. 24 November 2023.

1. Summary

Guardian Fire & Safety are committed to play their full part in addressing the climate and bio-diversity crises. We implemented our Environmental Management System in 2013 when we achieved EcoMerit Environmental Certification. Since then, we have always had an active improvement plan in place, and we have been routinely measuring and monitoring our carbon footprint.

While we have made positive progress in implementing environmental improvements, the growth of our business and the increased need to visit clients' sites has recently resulted in our earlier trend of annual greenhouse gas emissions reductions being reversed. This is due to our continued dependence on diesel to fuel our fleet.

This strategy has been developed to address the issue and to plot a path to a 50% reduction in our greenhouse gas emissions by 2030. This is the result of an extensive review of the available and anticipated fuelling options. The preferred option is to progressively electrify the fleet, commencing with a pilot vehicle in 2024. The expected emergence of longer-range and more reasonably-priced electric vans in the

coming years will allow us to steadily reduce our carbon footprint year-on-year and to achieve our 2030 goal.

2. Setting The Scene

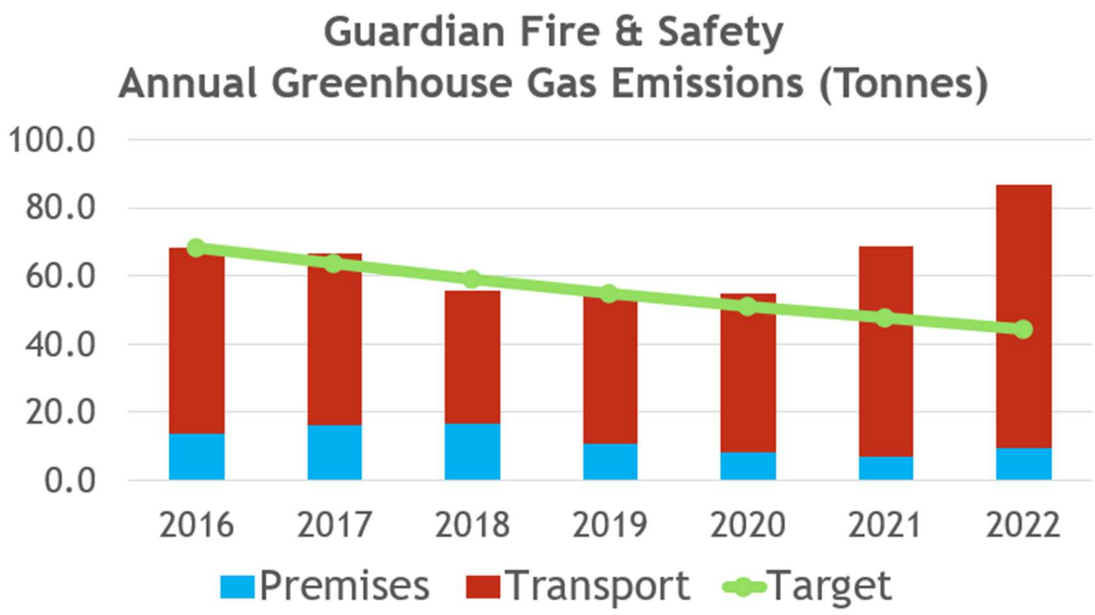
International Panel on Climate Change (IPCC) Report 2022

- **Urgent climate action needed to halve emissions by 2030**
- **We need to cut fossil fuel use, transition to renewable energy at scale and invest in carbon dioxide removal.**

The world is in a climate and bio-diversity crisis. If the worst effects of global warming are to be avoided, it is necessary to limit the increase to 1.5 ^{0}C above pre-industrial levels. This, in turn, implies a 50% reduction in greenhouse gas (GHG) emissions by 2030 and carbon neutrality by 2050.

These targets must be achieved at all levels – international, national, business and individual. To play our part, Guardian Fire & Safety must have in place a realistic plan to achieve a 50% reduction in our emissions by 2030.

The graph below shows our GHG emissions since 2016. It can be seen that the reductions achieved during the period 2016 to 2020 have recently been reversed.



While the emissions associated with our premises (electricity) are in good control, the emissions associated with our vehicle fleet (diesel) have increased significantly in the last two years. This is due to the growth of our business and the consequent need for our fleet to cover increased distances.

It is therefore essential that we achieve a major transformation of our fleet performance. This will require a change away from diesel to a sustainable low-emissions alternative.

3. Fuel Choices

In the early 1900s, three fuel choices were competing for ascendancy in the newly emerging automobile market.

Steam **Gasoline** **Electric**


Gasoline cars won through in the end. The fuel was cheap, plentiful & energy-intensive. Greenhouse gas emissions were not an issue at that time.

We are now at a similar crossroads, but with an even wider choice of possibilities. What are our requirements now? To achieve our objectives, the chosen fuel must be:

- Low emissions i.e. less than half that of diesel.
- Sustainably-sourced
- Safe and practical to use
- Available
- Cost-effective

The following is an exploration of the fleet fuelling options which are currently available or thought possible to be in place before 2030.

3.1. Outlier Fuels: Steam, Nitrogen, Compressed Air

For completeness, we should consider some of the more exotic alternatives which could become feasible in the coming years.

- A steam-powered ‘external combustion engine’ is technically feasible. Fuel could be biomass, for example.
- Liquid nitrogen stored in a pressurised tank can be heated to produce high-pressure gas. This can be used to drive a piston or rotary engine.
- Compressed air likewise.

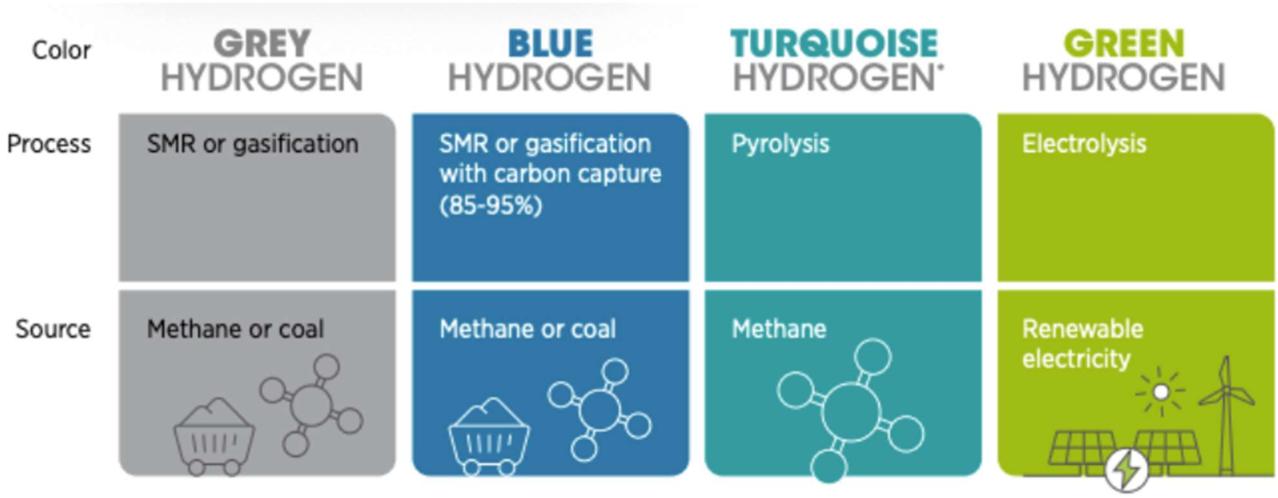
In all the above, nothing viable is currently on the market or under development as a mainstream automotive fuelling solution. It is highly unlikely any of these technologies will emerge as a viable alternative prior to 2030. No public infrastructure is in place or planned. We can safely discount these options.

3.2. Hydrogen

Hydrogen-fuelled vehicles already exist and some major manufacturers including Honda, BMW, Toyota, Hyundai/Kia and Jaguar Land Rover are developing new hydrogen fuel cell-powered vehicles which may soon appear on the market.

Hydrogen is attractive because it is energy-dense and the resulting tailpipe emissions are just water vapour. Theoretically, that can make hydrogen a zero-emissions fuel (although water vapour is itself a greenhouse gas).

A key factor is the production method used for the hydrogen. There are various options:



- ‘Green’ Hydrogen produced from water and (a lot of) renewable electricity is effectively net zero and sustainably-sourced.
- Other hydrogen sources (grey, blue, turquoise) are produced from fossil fuel sources and create greenhouse gas emissions in their production. They cannot therefore be regarded as fully sustainable or zero-emissions fuel sources although some options are more promising than others in both regards.

- The required infrastructure isn't in place in Ireland and is unlikely in the near future. There are currently only two hydrogen stations In Ireland, one in Dublin and one in Belfast.
- No hydrogen vans are currently available on the Irish market, or expected soon.
- If you have the electricity available, it is more efficient to just put it into a battery rather than create green hydrogen.

Hydrogen, in all probability, has a major future role to play for large trucks, marine shipping, aviation and electricity generation. This will particularly be the case when there is a surplus of renewable electricity generation available, and this can be used for the production of green hydrogen at scale.

Currently, the majority of hydrogen production is grey hydrogen, which is unsustainable and with high-emissions.

Even in the longer term, hydrogen is unlikely to become truly viable for small vehicles. Electric vehicles bypass the need to create hydrogen from electricity and are therefore more efficient overall.

3.3. Other Gases: LPG, LNG, CNG, Biogas

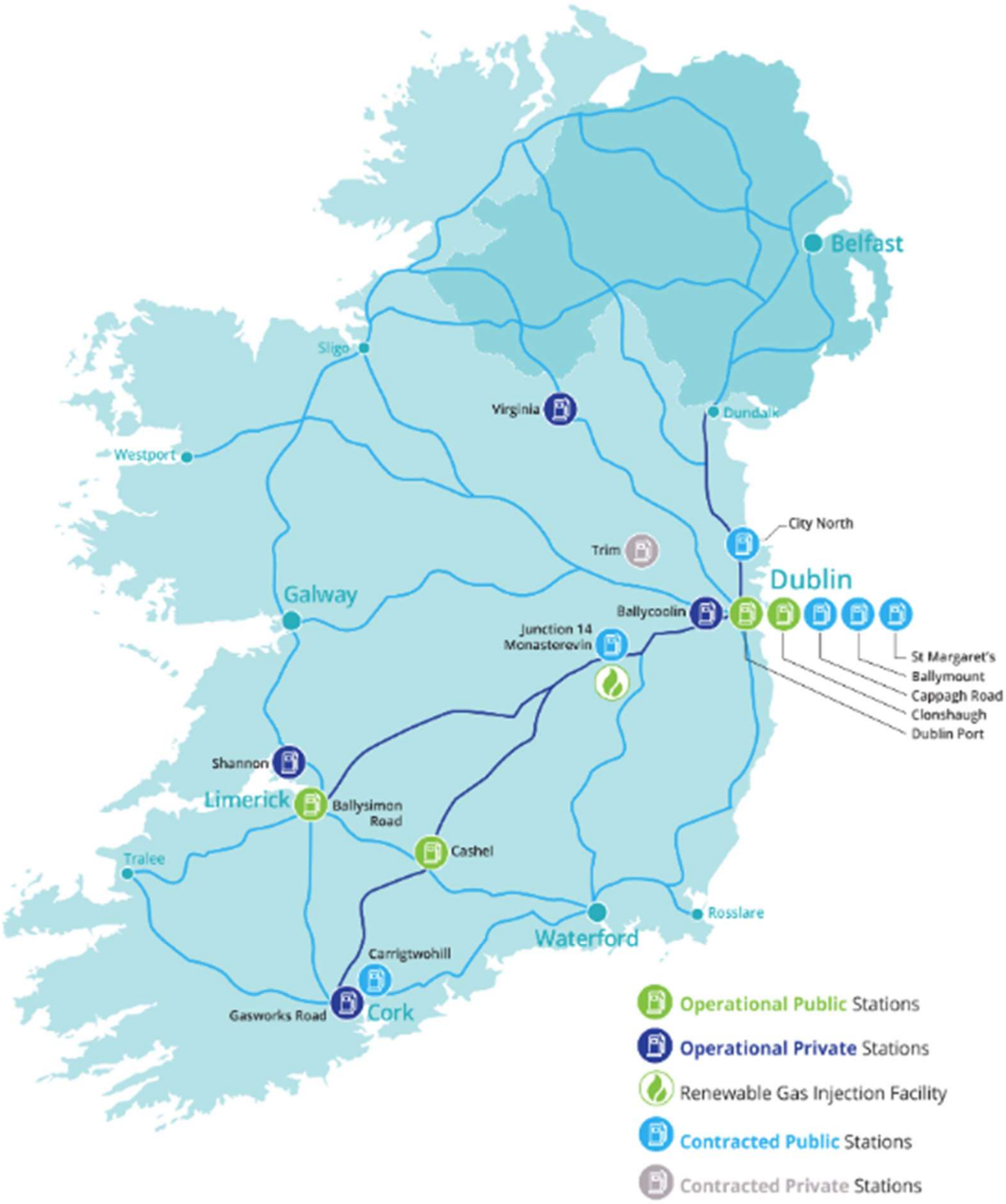
Other fuel gases are currently available for powering road vehicles.

Liquified Petroleum Gas (LPG), Liquified Natural Gas (LNG) and compressed Natural Gas (CNG) will have emissions around 30% lower that diesel. We require a reduction of more than 50%, so none of these are viable solutions. They are also fossil fuels, and not sustainable.

Biogas (e.g. bio-methane or bio-propane) can be sustainably produced from waste material. Depending on the feedstock used, biogas can be very low emissions.

- Vehicle price about 25% higher than a diesel.
- Maintenance costs 20 – 25% higher than a diesel.
- Fuel costs likely to be lower than diesel.
- Infrastructure and security of supply are an issue.
- Feedstock source is a concern. Bio-propane (Bio-LPG) can be produced from palm oil. For example, Calor has been selling palm oil-based biogas onto the Irish market. This will promote rainforest deforestation.

Gas Networks Ireland are building a network of CNG vehicle fuelling stations under their ‘Green Connect’ project. There are currently ten public stations in Ireland (six in Dublin and one each in Limerick, Cork, Shannon and Cashel). Locally produced renewable gas is also being injected into the gas network, so it could become possible to run biogas vans from this network in the future.



The Gas Networks Ireland 'Green Connect' Project. Map of current infrastructure.

Source: https://www.gasnetworks.ie/business/natural-gas-in-transport/green-connect-project/

Grant support is currently available for the purchase of CNG powered vans.

It is unlikely there will ever be sufficient supply of renewable biogas into the gas network to meet potential transport needs. This would imply higher costs on the basis of limited supply and increasing demand.

3.4. Biodiesel (FAME)

Fatty Acid Methyl Esters

This fuel is produced via the transesterification of vegetable oil or animal fats with methanol (which is a fossil fuel). It is available to blend with conventional diesel to produce a lower-emissions fuel.

Biodiesel is blended into all current retail road diesel. It is now a 10% blend.

- Higher blends are possible, at 20% or 30% but this would require the creation of, or access to, bespoke infrastructure.
- Biodiesel is not fully sustainable, and wouldn't reduce emissions sufficiently.
- There will never be sufficient waste to replace the existing use of fossil-diesel. This would imply energy crops competing for land with food crops (and rainforest).
- Not long-term sustainable.

Waste is not a scalable energy source: A study by the Sustainable Energy Authority of Ireland (SEAI) found that waste sourced from Ireland can meet only 4 per cent of our total energy demand.

Source: Irish Times 1 June 2023.

Hannah Daly. Professor of sustainable energy at University College Cork.

3.5. Renewable Diesel (HVO)

Hydrotreated Vegetable Oil.

This is a 'drop-in' fuel - a direct replacement for diesel which does not require any engine modification. It has the added advantage of a longer shelf life than diesel, up to ten years.

HVO provides an emissions reduction of 81% to 91% versus diesel. It can be produced from sustainable feedstock e.g. used cooking oil, tallow oil, palm oil mill effluent.

Major companies, and some Irish Local Authorities, are already adopting HVO as their means of meeting their emissions targets for their transport fleet, and for plant such as electrical generators.

All this would seem to make HVO a very attractive option. However, there are some serious downsides:

- Fuel cost is 20 – 30% higher than diesel.
- Much of the current supply uses palm oil mill effluent as the main feedstock. Although this is a waste product, it does serve to make palm oil production

more profitable. As a result, it could be construed at promoting further destruction of rainforest to make way for more palm oil plantations.

- Even more seriously, there are already real concerns that palm oil is being passed-off as used cooking oil (UCO) for HVO feedstock.

> **In 2020, Malaysia, the world's second-largest producer of palm oil, exported five litres of UCO per capita (about 150 million litres in total) to the UK and Ireland. This far exceeds the volume that was actually collected in the country.**
>
> **Source: Irish Times 1 June 2023.**
>
> *Hannah Daly. Professor of sustainable energy at University College Cork.*

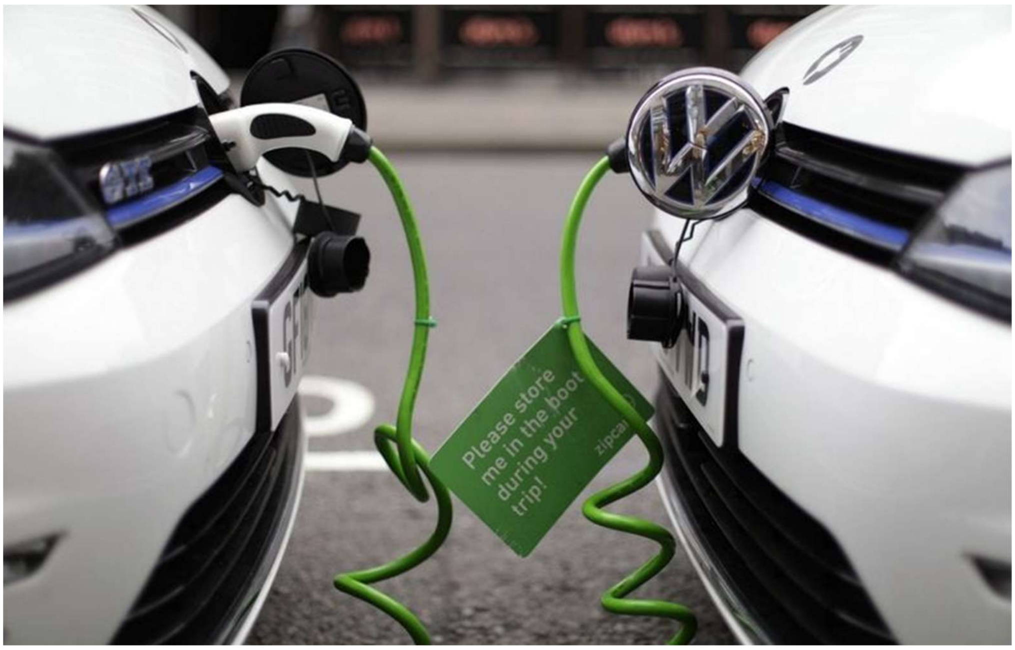
- There will never be sufficient waste to replace the existing use of fossil-diesel. Widespread adoption of HVO would therefore imply energy crops competing for land with food crops (and with rainforest).
- HVO, therefore, does not offer a long-term sustainable solution for transport fuel.

Given the above, and recognising there is a global bio-diversity crisis as well as a global climate crisis, it would be prudent to avoid adopting HVO either as our long-term transport fuel solution or as a short-term interim solution.

3.6. Electricity

Electric vehicles (EVs) are now well established on Ireland's roads and they are taking an increasing share of the new car market. In early 2023, for the first time, sales of new electric cars (albeit including plug-in hybrids) exceeded the sales of new diesel cars.

(Source: Society of the Irish Motor Industry as reported by RTE 14 April 2023)



Electric vehicles powered by Ireland's grid currently achieve 60% lower emissions than their diesel equivalents. As the grid gradually decarbonises, further emissions reductions can be expected.

Electric vehicles typically cost 60% less to run, both in fuel and servicing costs, than their diesel equivalents.

Overall, EVs can be regarded as providing a sustainable transport solution for the longer term. Their fuel source will be increasingly renewable. Batteries have a useful second life in static installations after they are no longer viable for powering vehicles. After that, they can be recycled, with the key materials being reused for the manufacture of new batteries.

They do however have some significant downsides in the short term:

- Electric vans have a high capital cost (50% more than a diesel van)
- The current van models available on the market have limited range, typically 200 to 300 km.
- The electric van market seems to be developing at a much slower pace than the electric car market.
- While charging infrastructure is in place, it is less than adequate. Insufficient chargers lead to regular queuing and this is unlikely to improve in the near future.

It is anticipated that the above issues will mostly resolve themselves in the next few years.

The price of EVs will come down as economies of scale take effect. This is already happening in the car market. Tesla recently took €10,000 off the price of their Model 3 cars and Nissan have just taken €5,000 off the price of the Leaf. It is likely that EV and diesel vehicle prices will approach parity by about 2027.

Longer range vans should also appear in the market. For example, the Nissan eNV200 is based on the same architecture at the Nissan Leaf. That would suggest they could readily produce an eNV200 with a range of 470 km, by installing the Leaf’s 63 kWh battery option.

There are other operational issues to be considered:

- Guardian Fire & Safety need to provide emergency call-out support at any time. An electric van with a depleted battery at the end of a working day would not be available for a distant call-out.

- The vehicles are best charged overnight (on cheaper night-rate electricity and when they are not generally required for use). This implies off-road parking at the driver's home.

While EVs have their shortcomings, especially in the short term, they do represent a viable long-term solution for most, if not all, of the fleet.

4. Overview of Choices

The table below shows an evaluation of each option against the criteria set out at the start of this report. The smiley face on the left indicates the current situation and the smiley face on the right indicates the anticipated situation in 2030.

Option	<50% emissions	Sustainable	Practical	Cost Effective	Available	Overall
Outlier Fuels	😐 😐	😐 😐	🙁 🙁	🙁 🙁	🙁 🙁	🙁
Hydrogen	😐 🙂	😐 🙂	🙁 🙁	🙁 🙁	🙁 😐	🙁
LPG, LNG	🙁 🙁	🙁 🙁	🙁 😐	🙁 😐	🙁 😐	🙁
Biogas	🙂 🙂	😐 🙁	😐 🙂	😐 😐	🙁 😐	😐
Blended Biodiesel (FAME)	🙁 🙁	😐 🙁	🙂 🙂	🙂 🙂	🙂 😐	🙁
Renewable Diesel (HVO)	🙂 🙂	😐 🙁	🙂 🙂	😐 🙁	🙂 😐	😐
Electricity	🙂 🙂	🙂 🙂	😐 🙂	😐 🙂	🙂 🙂	🙂

5. Strategy to be Adopted

The overall plan should be to progressively electrify the fleet. This should commence with one pilot vehicle in 2024. This will allow early practical experience to be gained to inform future fleet decisions and iron out the practicalities of EV operation.

A gradual extension towards the full fleet by 2030 will be supported by the expected improvements in model choice, vehicle range, capital cost and (to a lesser extent) infrastructure.

We should remain open to other options if they emerge. Biogas is the most likely to consider, possibly for larger vans with longer range requirements and/or to provide for improved call-out availability for a limited number of vehicles.

6. Candidate Vehicle for 2024 Pilot

The candidate vehicle for the 2024 pilot is the Citreon Berlingo EV. The table below shows how it compares with its diesel equivalent (which is currently in service with the company).

Citroen Berlingo	**ICE**	**EV**
Capital Cost	€27,518	€43,192
Annual Lease Cost	€5,808	€8,148
Annual Fuel Cost	€2,953	€1,102
Total Annual Costs	€8,761	€9,254
Annual emissions (tonnes CO_2e)	4.12	1.52

Citroen Berlingo EV

Range: **275 km**

Payload: **800kg**

Overall, at current prices, it will cost €500 per year more to run than the diesel. This offers a very cost-effective way to gain experience with EV operation.

7. Candidate Vehicles / Drivers

Seven drivers took part in an exercise over several months to log their daily travel distances. The results are shown in the table below.

Driver	Reg	Average Daily km	Max Daily km	Days > 200 km	Rating
A	201WX5**	93	171	0	
B	201WX18**	103	365	7	🙂
C	222D101**	103	361	6	
D	231WX22**	140	626	5	😐
E	191D198**	132	372	10	
F	221WX5**	142	536	12	☹
G	221D183**	149	383	17	

In order to minimise the need for charging during the day, an average daily travel of around 100km and a maximum daily travel of 200 km would be ideal. The suggested best fit, all other considerations being equal, would be a vehicle which seldom breaches the 200km daily distance.

8. Conclusion

We now have a pathway in place to achieve our required GHG emissions reduction.

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