Hi Callie,

Basis comprehensive literature review of academic research papers, industry reports, market-leading company publications and additional studies, I’m presenting my *findings and recommendations* for our client, Fast Cars.

Fast Cars, has conducted *a ‘cradle-to-grave’ emissions assessment* and have identified **21 key emission sources** along the value chain. These sources can be *categorized* as Scope 1, Scope 2, and Scope 3 emissions.

Basis analysis of emissions mix data provided by the client, the drivers of Scope 1 & 2 emissions are - **purchased electricity** and **onsite gas boilers**.

Methodology**:**

1. I have categorized the emission sources in the Value Chain into Scopes 1, 2 & 3.
2. I have then identified the abatement potential of levers, and mapped them to each emission source.
3. Approximated the abatement costs per t CO2, based on the data provided, and identified the best opportunities for abatement initiatives.

**1. Emissions Source: Scope 2 Electricity for Fast Cars Manufacturing:**

**1.1. Initiative: Renewable Power in Production (40-55% abatement lever):**

Nearly 50% emissions abated by this lever at only 9.1% of the allocated abatement budget. Renewable power is 100% carbon-free, and studies have shown that it is possible to completely abate emissions by implementing this lever. **Transitioning to** suppliers of solar, wind, hydel, geothermal power, etc., incurs minimal long-run averaged costs, and could have industry-wide benefits**.** I recommend a multi-sectoral intervention and an overhaul of T&D (Transmission & Distribution) systems to reduce losses.

Fast Cars can also benefit from **installing used batteries** asenergy storage systems, along with developing in-house renewable power generation strategies to reduce supplier dependencies. Nearshoring strategies and electrification of internal equipments with renewable power could effectively abate emissions.

**Case Study**

* **Factory 56**, Mercedes-Benz plant in Sindelfingen, Germany, has become fully CO₂-neutral and with significantly reduced energy requirements. A shift in energy-mix: photovoltaic system, a DC power grid and reused vehicle batteries for energy storage, innovation in assembly, providing the best support for the employees, are strategies that has made this feat possible. Mercedes-Benz has also required its suppliers to adopt its standards for decarbonisation.

**1.2. Initiative: Material and process efficiency (40-55% abatement lever)**

Less material usage, efficiency in energy consumption, cutting T&D losses abates 19% emissions at the source.

Fast Carscan invest in **developing a supplier network**, which incentivizes suppliers who self-align with Net-Zero targets. Decarbonized aluminium and steel procurement can also be made possible with this strategy. Engage suppliers so that **carbon-neutral parts** supply becomes a primary requirement. Procurement of **greener fixtures and upholstery** andusing leather-alternates instead of natural leather can abate GHGs emissions from the cattle industry.

Establish **cross-industry standards** for **supplier process-control**, to ensure and rate suppliers based on carbon-neutrality. This is a **multi-sectoral** intervention and can create industry-wide opportunities for all players. Some practical implications of this intervention would **increase robustness** and efficacy of **Predictive Maintenance** and **Condition Monitoring** of supplier plant systems, and improved processes such as Planned Maintenance activity.

**1.3. Initiative: Renewable Power and New Processes in Battery Production (40-55% abatement lever)**

We expect that Fast Cars will increase their production of electric vehicles, in line with global trends and regulations. However, *the energy intensity of making batteries* has the potential to increase Fast Cars emissions. For example, producing a *BEV can generate up to 60% more CO2 emissions* than producing a comparable ICE. We can recommend to Fast Cars that their investment in increased **battery production should be powered by renewable energy** and, where they use other facilities, Fast Cars should **prioritize factories that produce batteries with renewable energy**.

**2. Emissions Source: Scope 1 Fast Cars Manufacturing Onsite Gas Boilers:**

Onsite boilers are used to produce steam for generating mechanical power, Heat & Chemical treatment and for pressure-cleaning. Traditional boilers use gas or diesel as fuels and are 2nd largest emission sources in the value-chain for Fast Cars.

**2.1.** **Initiative: Renewable Heat and Power in Production (40-55% abatement lever)**

This initiative contributes to 75% abatement for this emission source, and is a highly cost-effective solution. **Deploy** **renewable** electric power for steam generation. Fast Cars currently use onsite gas boilers for heat production in their manufacturing processes. This makes up the greatest proportion of their Scope-1 emissions.

There are several options to reduce or eliminate these emissions that we could recommend to Fast Cars. These include using high-efficiency burners, heat exchangers and cogenerators that recover and use waste heat, as well as using biomass in place of gas. Fast Cars can also **replace traditional fuel with biogas-methane** for steam-generation. For mechanical power generation, Fast Cars can transition to renewable electric power.

**Case Study**

* One of Volkswagon’s production plants in the Czech Republic is working to replace the only fossil fuel still used at the plant: natural gas. From 2021 onwards, natural gas will be replaced by CO2-neutral methane from biogas plants. They are combining this with energy efficiency measures such as closing heating circuits to limit wasted heat.

**Next Steps:** I recommend that we present these interventions to our client, Fast Cars and work on an implementation strategy for these and other interventions that the team have come up with.

**Sources**:

* <https://www.cleanenergywire.org/news/battery-gigafactories-will-rapidly-make-e-cars-even-greener-battery-expert>
* BCG, Who Will Drive Electric Cars to the Tipping Point?
* BCG Report: Supply Chains as a Game-Changer in the Fight Against Climate Change
* WEF Report
* <https://www.bcg.com/publications/2020/green-factory-of-future>
* <https://www.volkswagen-newsroom.com/en/stories/pioneers-in-climate-friendly-vehicle-manufacturing-6428>
* <https://www.daimler.com/sustainability/corporate-environmental-protection/co2-neutral-production.html>

**Overall outcomes:**

1. **64.89% of Scope 1 & 2 emissions are abatable** by implementing a mix of levers.
2. Abatement levers for **90% of all abatable Scope 1 & 2 emissions** are priced at***less than* €*10 /t CO2 e*.**
3. Abatement levers for **58.66%** Scope 1 & 2 emissionscost **only 25% of allocated budget** and are **highly mature.**
4. Abatement levers of **6.23%** Scope 1 & 2 emissionsare **expensive (> €100/t CO2 e) and less mature.** They cost nearly 75% of the allocated budget. Effectivity and cost-efficiency of these levers can only be achieved with scale and multi-sectoral interventions.