08.09.2020. The CIEL Ferney Trail carbon footprint

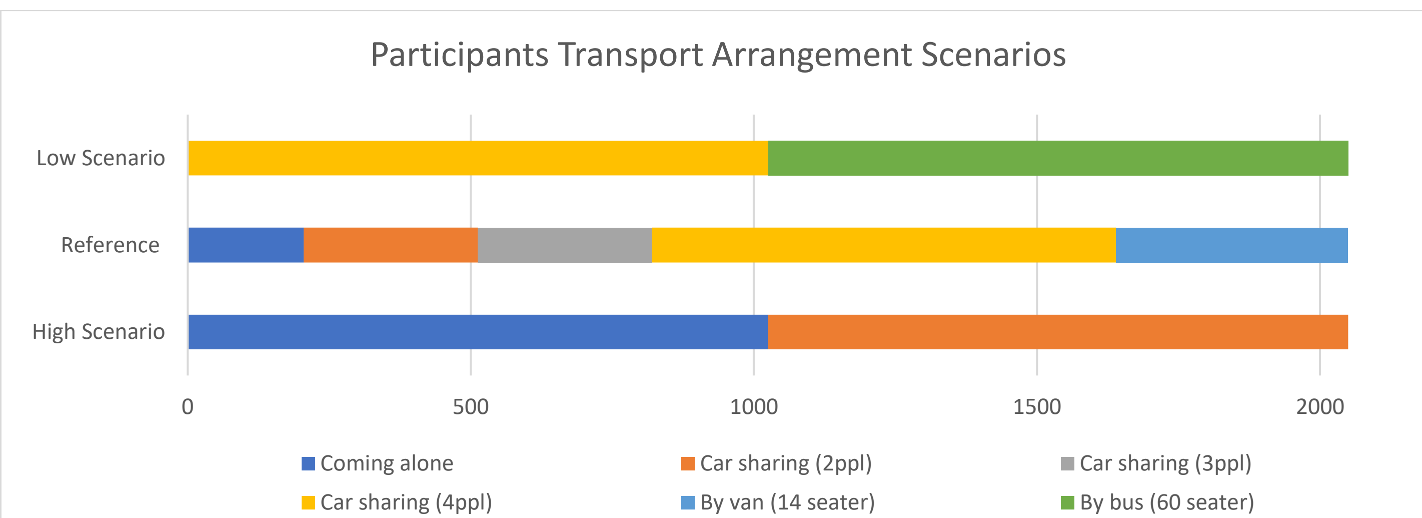
This note outlines the methodology used for calculating the event's carbon footprint. It has been prepared inhouse and while we have strived to make it as representative of the truth as possible, includes several assumptions and approximations. The complexity of gathering precise data will be self-evident throughout, and any actionable feedback with accurate figures or related coefficients to improve this assessment is welcome.

Methodology

Participants journey: The CIEL Ferney Trail 2020 is expected to receive 2050 participants, coming from all corners of Mauritius Island. The only way to reach Ferney is by road, therefore we anticipate that a large part of the event's carbon footprint is from participants transport. Since the exact journey of each person is not currently measured or known, we consider the distance to be travelled from key residential areas of Mauritius to Ferney: from Rose Hill (45.7 km), Tamarin (57 km), Grand Baie (75 km), Port Louis (55.7 km), and Curepipe (32 km). We suppose that the average participant will travel the average of these distances, 53 km, twice (way in & way home).

Participants transport arrangements: Based on observations from previous years, people reach the event in their private vehicle, often car-pooling and we assume some may hire 14-seater vans. No large buses (60 seats) were noticed in the past. We take the following as our "middle scenario", deemed closest to the real situation: 10% coming alone, 15% carpooling - 2ppl per car, 15% carpooling – 3ppl per car, 40% carpooling – 4ppl per car, 20% by van (14 seater). This breakdown results in 666.25 cars and 29.29 vans.

To illustrate the impact of people's transport choices, we choose to assess two "extreme scenarios". A High Footprint Scenario where 50% come alone and 50% carpooling with only 2 people per car, and a Low Footprint Scenario where 50% come carpooling – 4ppl per car and 50% by 60-seater bus.



Vehicle fuel consumption: Participants vehicles will vary greatly and gathering exact fuel efficiencies will be of little added value to this exercise. Instead, we average all passenger cars consumption to 6.7L/100km, as per the “post-2008 new passenger car fuel efficiency” for Japan – given a significant proportion of Japanese cars in Mauritius. We deem this figure a reasonable average. We assume all passenger cars being fueled by gasoline.

For vans, we use the Toyota Hiace as reference due to its popularity in the island, with a fuel consumption of 8.4L/100km[1]. For buses, given a potentially great variation of vehicle technology[2], we assume 30L/100km. We assume all vans and buses being fueled by Diesel.

Volunteers transport: The 2020 event will receive the help of 100 volunteers. Since this number is less than 5% of the number of participants, we do not apply all three scenarios and only apply the middle scenario for transport arrangement.

Goods transport: The event requires food, beverages, additional shelter (marquise, tents, etc) and toilet facilities, sound system, etc. as well as materials from various sponsors. These are brought onsite via trucks: 10 light trucks (0.12L/km diesel – optimistic figure) and 2 heavy duty trucks (0.32L/km diesel[3] - pessimistic figure for GVW<16t trucks). These will drop materials between Friday and Saturday, and return to pickup on Monday, meaning 4 trips each of the average 53km distance. As buffer, we count 2 additional trucks each making two trips, to account for additional errands. In addition, a 10kg parcel delivered by airfreight from Johannesburg South Africa is accounted for, using the ICAO carbon emissions calculator[4]. We take the parcel as being 1/8th of a passenger’s mass, and therefore divide the emissions result of a passenger by 8.

It must be noted that the carbon footprint of the goods themselves is not accounted for here. Similarly, we do not account for the footprint of extracting, processing and shipping transport fuels to Mauritius.

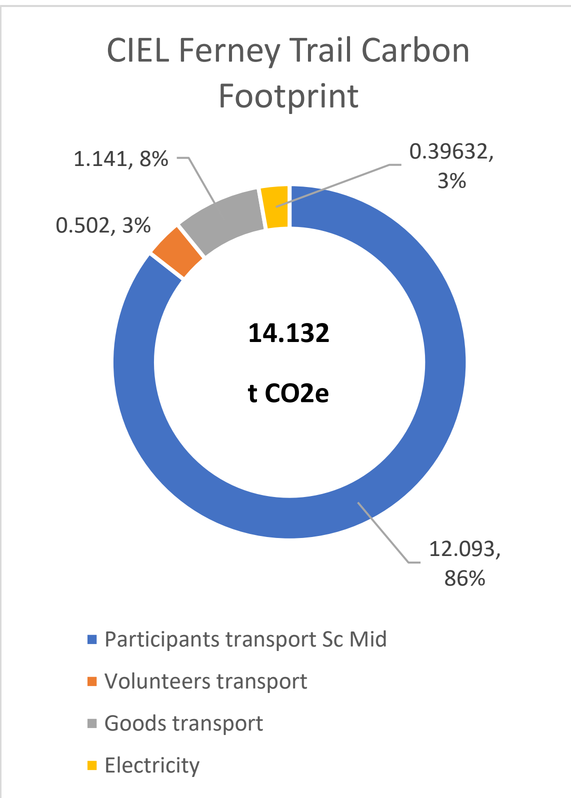
CO2 emission factors: the 2006 IPCC Guidelines for National Greenhouse Gas Inventories[5] remain the reference set of documents for calculations methodology and choice of emission factors. Volume 2: Energy, table 3.2.1. provides the default kg CO2/TJ value for various fuels including Motor Gasoline (69300) and Gas / Diesel Oil (74100). Table 1.2. provides the net calorific values (NCV) for these fuels, 44.3 and 43 TJ/Gg respectively. The product of emission factors and NCV gives an emission factor per kg of fuel and multiplying by fuel density (0.78 and 0.832 respectively) results in emission factor per volume. We obtain 2.39 kg CO2/L for Motor Gasoline and 2.65 kg CO2/L for Diesel. These emission factors are multiplied by the volumes of fuel consumed by vehicles to obtain the corresponding carbon footprint.

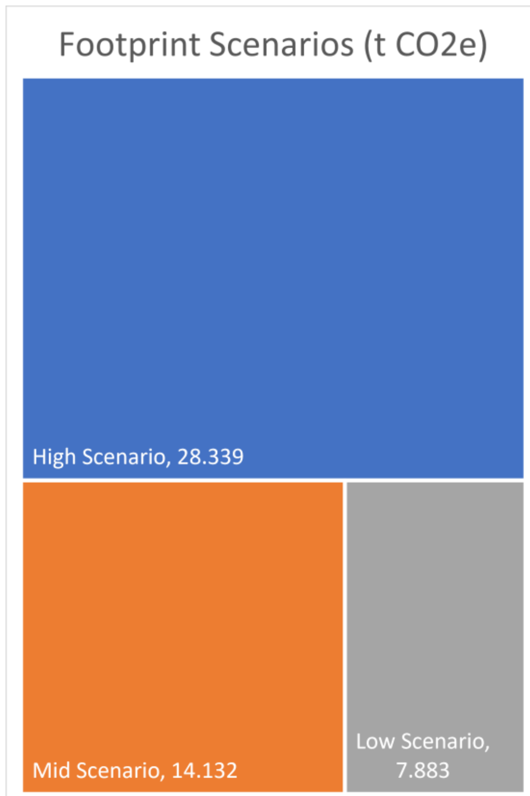
Emissions from N2O and CH4: Vehicles emit Nitrous oxide and methane in varying quantities, however these gases have Global Warming Potential (GWP) 280x and 56x that of CO2 over a 20 years horizon. In the absence of more accurate data, we use figures from Table 3.2.5. – Emission factors for European Gasoline and Diesel Vehicles (mg/km), Copert IV Model. As above, we assume all passenger cars run on motor gasoline, and all vans, buses, and trucks run on diesel. N2O and CH4 emissions are also dependent on driving conditions (urban cold start/hot start, rural and highway). For simplicity, we subdivide all trips into 10% urban cold start, 20% rural and 70% highway, and take all vehicles as Euro 4 technology / class.

[1] https://car-emissions.com/cars/model/Toyota/Hiace/2011
[2] https://defimedia.info/public-transport-dworld-motors-says-anyuan-buses-are-highly-fuel-efficient
[3] https://theicct.org/sites/default/files/publications/Efficiency_standards_HDVs_EU_Briefing_051618.pdf, https://www.transportenvironment.org/sites/te/files/2016_09_Blog_20_years_no_progress_methodological_note_final.pdf
[4] https://www.icao.int/environmental-protection/CarbonOffset/Pages/default.aspx
[5] https://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html

Emissions from purchased electricity: To determine these, we use the grid emission factor for Mauritius, validated by the UNFCCC[6], at 0.9908 tCO2/MWh, or kgCO2/kWh. It is currently difficult to isolate and estimate the consumption of the CIEL Ferney Trail. One method would be to compare consumption onsite between August and September 2019, and assume the difference is due to the event. Since it takes place during the crop season, however, daily energy used onsite varies according to the use of crane and other equipment, which itself depends on harvest conditions, namely weather and other factors. We therefore make the hypothesis that the event consumes twice as much energy per day, over two days, as the site would on a normal day (100kWh). We therefore obtain 400 kWh.

Results





Conclusion

This analysis provides an order of magnitude for the total carbon footprint of the CIEL Ferney Trail and its components. It contains several assumptions and will be refined when new and more accurate data becomes available. At this stage however, we believe it is a fair representation, for the purpose of communicating with participants and suggesting increased carpooling to lower the event's footprint. CIEL Ferney trail is for the first time not handing out participant or volunteer t-shirts, finisher cups, lunch and other "goodies". The CO2 reduction this action represents has not yet been quantified.

[6] https://cdm.unfccc.int/methodologies/standard_base/2015/sb129.html