Earth Router – Low Carbon Tours

DATA SCIENTIST: Robin Lowe

Following his contributory experimentation via/to the Tyndall Centre for Climate Change Research Super Low Carbon Roadmap, and slower, more complex than anticipated feasibility outcomes forecasts for Heavy Load Battery Electric Vehicles provided by technicians within Scania and others, the ACT 1.5 project moved to commission and work alongside data scientist Robin Lowe to create a high-efficiency, single screen smart portal to plan cross-continent tours in a way that significantly reduces GHG emissions, with immediate effect. We also received invaluable input and industrial guidance from Alex Bruford at ATC Live, Marc Picken at West Management and David Levy at William Morris Agency, for which the project is most grateful.

Earth Router is a tool that calculates low carbon emission tour routes for the live music sector. The tool makes tour planning simpler, minimising carbon dioxide emissions and fuel costs associated with tour logistics by calculating optimised tour schedules that reduce transport distances.

Industrial users (such as agents, management teams or tour managers) can input a range of different parameters that reflect their tour into the tool. These parameters include:

- A start point - *This does not need to be a venue as the tool will include the emissions to travel from the start point to the first venue within the emissions calculations.*
- Up to 75 venues/cities/towns
- Specific dates that venues are available.
- Set limits on the maximum number of consecutive shows and required days off – *owing to production requirements/physical needs.*
- Add from 8 different transport modes *to give the user the ability to customise their tour logistics*
  – including Tour buses, a range of HGVs, Cars, Private + Commercial flights, Air freight...
- The ability to add specific dates the user is not available – *this can be used to work around personal schedules.*

- Maximum travel limits per day *(Distance or Time)*

The Earth Router processes the information input by the user and outputs the minimum emission tour route calculated which includes, the:

- Tour Schedule

- Estimated direct and indirect CO_2 emissions *produced by the tour's logistics.*

- Estimated emissions if 100% blend drop-in HVO fuel (verified 100% waste product/no virgin land use) is used.

- Prompts when rail alternative routes are available – *to further reduce emissions, these alternatives can be selected with the tour's estimated emissions updated accordingly.*

The Earth Router tool is written in the Python programming language and the current solve time for the Smart Router is around 2 minutes. Emissions have been calculated using emission conversion factors provided by the Government's annual 'Greenhouse gas reporting: conversion factors' reports. Google's API is embedded in the tool to access the vast array of geographic data on Google Maps (such as coordinates, distances, travel times and rail routes) that form the calculations.

<u>Current Costs:</u>

In its current form, the tool is without a server (see next stages for deployment), as such the only cost associated with the tool is from using Google's API. Google charges on a pay-per-use basis and so these costs are heavily dependent on usage. Google offer $200 free credit per month before charging begins. Specifically, the tool uses Google's distance Matrix API and Direction's API to determine the distance and time to travel between venues and rail routes.
Below are the estimated costs of the data required from google for certain tour sizes:

- 10 venue tour = £0.30
- 20 venue tour = £1.00
- 30 venue tour = £2.15
- 40 venue tour = £3.70
- 50 venue tour = £5.60

Next steps for activation deployment:

In its current form, the tool can perform all of the above. To drive this tool into deployment, the next stages will involve designing a user-friendly, visually appealing user interface. This will have an interactive map that displays the tour route as well as HVO suppliers, with visual popups and displays that showcase the tour emissions and prompts on rail alternative routes available. This should update dynamically as the user interacts with the results.

A suitable server to host the application will also be required. Currently we are looking into the possibilities in this domain, ideally an environmentally friendly option would be suitable. Testing has begun to gauge an idea on the size of server required to host an application of this type.

Alongside minimising emissions, the ability to minimise fuel costs is a significant advantage of the Smart Router tool. There is scope, therefore, to add a fuel cost estimation into the results output.