

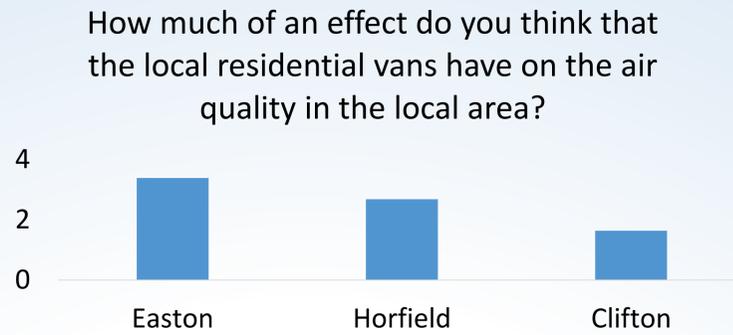


Problem Statement

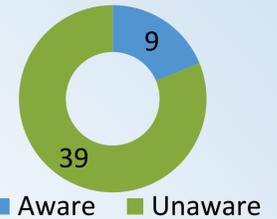
Residents Against Dirty Energy (RADE) are a community group who's aim is to reduce carbon dioxide and particulate emissions created from static burning. This project focusses on wood burning being used as a heat source for those who live in vans and the methods which can be used to reduce the emissions created either through alternative fuel sources or improved thermal efficiency.

Research

Key data from our survey of 48 Bristol residents:

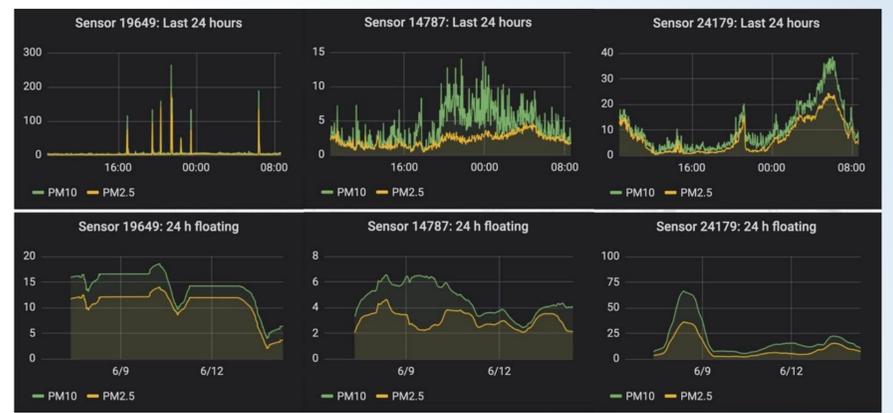


Are you aware that homeless residents burn fuel in close proximity to residential areas?



This research has highlighted the public perception and the scientific data related to the issue. The key findings were:

- Residents in areas with van residents perceive their air quality to be lower than the overall Bristol air quality
- Most people are not aware about van residents burning fuel
- Those that are aware feel that van residents lower their air quality
- Particulate matter emissions are worse at night
- Particulate matter emissions are worse near main/congested roads



Data from local Luftdaten (2019) sensors

Requirements

1. No release of particulate matter into the van
2. No release of particulate matter into the area around the van
3. No combustion of hydrocarbons
4. Maximum unit cost of £100 for the end user
5. Maximum one off cost of £250 for charitable organisations
6. No requirement of electrical power from external sources
7. No health and safety risk to the end user

Project Timeline



Proposed Solution – It's All About Efficiency

- **Electric Heating:** Research showed that generating energy to power an electric heater in a green way was not feasible due to the high wattage required by the heater.
- **Hydrocarbon Combustion Heating:** During the study it was found that the only economically sustainable method of producing heat for a van was to burn hydrocarbons, as a result the focus of the detailed potential solution section of the report was to REDUCE emissions from the van not completely eliminate them. By reducing heat loss and improving burning efficiencies, less hydrocarbons need to be burnt in the van to maintain the same temperature, this means an overall reduction in carbon particulate emissions. This was to be done in three key areas:
 1. **Insulate the van** – By reducing the thermal conductivity coefficient of the van it is possible to reduce the heat energy loss to the surrounding air. Several off the shelf solutions exist to do this, but a cheaper alternative is to pack the walls of the van with rags, plastic bags or plastic bottles.
 2. **Improve the burning efficiency** – An improved burner design, such as a wood gas burner, can be produced using scrap materials and will result in a much higher burner efficiency.
 3. **Section the living area of the van** – By fully sectioning the van into a living area and driver compartment, the volume of air to be heated will be reduced meaning less energy (burnt hydrocarbons) are required to achieve the same temperature. Also this removes a significant source of thermal loss through the driver windows.

Next Steps

- Develop prototypes for wood gas burner and insulation methods.
- Further discussions with YardArts on best way to educate the wider van community on clean energy.
- Technical analysis of best free resource insulation materials (plastic bags, plastic bottles, rags)

Key Learning

- How to manage communication issues at critical milestones within the project.
- Opportunity to work with community groups and understand the challenges faced by small organizations.
- The importance of gateway community groups to access and influence vulnerable end users.