What sustainability issues will arise from the large scale adoption of electric c...

What sustainability issues will arise from the large scale adoption of electric cars? With the recent introduction of the electric car into Ireland, I am going to outline some of the sustainability issues that will arise from their large scale adoption. The car has already received backing by the government who have recently announced their plans for the induction and eventual change over to electrically powered vehicles. What is an Electric Car? An electric car, is a vehicle which like the typical cars seen throughout the world, has four wheels, doors, windows and a roof.

The difference between the typical common car and the electric car, comes when you look at the power source, in the common car an Internal Combustion Engine is used to convert fuel (generally unsustainable fossil fuels like diesel or petrol) to mechanical energy, the Electric Car uses electric motors powered by batteries or an onboard fuel cell. The common car with its Internal Combustion Engine has advantages and disadvantages; the cost to purchase a car with an internal combustion engine compared to an electric car is lower, as there is the ability to mass produce a product which is still in huge demand.

In today’s world oil derived fuel is accessible and relatively cheap to the consumer, as the infrastructure is already set up to enable the simple and quick refuelling of the car. The negative side to the common car is the fuel which it used, all of the fuels for Internal Combustion engines are derived from oil. The worldwide production of oil has peaked and oil production is now dwindling, this is not easily seen by the consumer purchasing the fuel who might be oblivious to the fact.

With an increasing demand for oil and an ever decreasing supply it is becoming more and more difficult and expensive to produce oil which is useable, oil is now so valuable that there are wars over supplies. Another negative side to the Internal Combustion engine is its inability to convert the energy from the fuel into usable mechanical energy, during the combustion process the fuel is converted to useable mechanical energy but there is also heat and noise energy given off, this is an unwanted waste of fuel.

The issue of harmful gas emissions when the oil fuel is burned is another major downfall with the Internal Combustion engine, as when the fuel is combusted it releases carbon dioxide and carbon monoxide as well as hydro carbons and ozone. Some of these gases are toxic and harmful to humans but the big issue is with the carbon dioxide emissions, as it contributes to global warming or " the duvet effect" which is an ongoing problem throughout the world.

Transport powered by fossil fuels is responsible for 20% of Carbon Dioxide emissions worldwide. It is the sustainability issues of the common car's Internal Combustion engine which sparked the need for the development of a new way to travel, the electric car which has come out on the top of the list for new more sustainable transport methods. Different types of Electric cars An electric car is a vehicle that is powered by simple electric motors, how the electricity to run the motor is created or stored can vary.

The most common type of electric car is one which has a large or a number of smaller batteries which stores electricity from an external power supply, generally the mains electricity grid. The other more sustainable type of electric car is one with an onboard power station, capable of producing its

own electricity. A hydrogen fuel cell uses hydrogen to produce electricity through the process of electrolysis, the combination of hydrogen and oxygen creates an electric current and gives off a by-product of water.

As hydrogen is the most abundant element on earth, there is a sustainable supply of fuel, the only problem with hydrogen is the difficulty faced when harnessing and storing the fuel. Hydrogen generally comes bonded to other elements; this chemical bond is difficult to break, after harnessing the pure hydrogen it has to be pressurised and turned into a liquid for easy transportation. Although the process seems complicated it is no more complex than extracting oil from the sea bed, which is being done on a daily basis to fuel the Internal Combustion engines already on the roads today.

The hydrogen fuel is similar to petrol or diesel, it is a liquid when put under pressure. The pressure is the other problem with hydrogen, but with simple modifications the infrastructure already in place for existing fuels like petrol and diesel, the hydrogen fuel could become main stream without difficulty and relatively quickly. Government Plans: New charging points, at parking spaces The Irish Government announced their campaign for the future, they plan to have 10% of all cars powered electrically by the year 2020.

The 10% target was first announced in the Carbon Budget, presented by Minister for the Environment John Gormley in October 2008. In order to make this a viable plan the Government have collaborated with the Electricity Supply Board (ESB) and have developed a simple way of charging (refuelling) the battery powered electric car away from home, as the battery will lose its charge after a long journey leaving the driver with no way home. The

charging points are small, American style parking meter design which the car is simply parked beside and plugged in left to charge.

The first four of these charging points have been set up in Dublin and unveiled by the ESB in March 2010, a further 1500 charging points are due to be put in place in Dublin, Limerick, Galway, Cork and Waterford. The Government see it as their priority to have these charge points throughout the country, unlike other countries who just seem to focus only on the big cities which are densely populated, their plan includes the immediate inclusion of all towns with a population of over 1500 people, with the expectation for nationwide coverage after the success of the initial phase.

The charge points will come in different types, varying in power rating which affects charge times. The higher power charge points are expected to charge a battery in 20 minutes; these high power points are to be set up to replace filling stations along side motorways for " in journey charging" e. g. driving from Dublin to Cork. These high power " juice points" are expected to be put in place every 60km. The mid range points give a 2-3 hour charge, and will be placed at typical parking places e. g. charge while shopping or at work.

The standard charge point with similar power to the standard socket found in the home, charge time at lower power should take 6-8 hours e. g. overnight charging at home. The Government expects to have 2000 electrically powered cars on the roads by 2011, and are implementing tax breaks for enthusiasts who purchase the more sustainable and environmentally friendly electric cars; there will be a grant of up to €5000 and also Vehicle Registration Tax (VRT) excluded, this combined with road tax exclusion

would bring the electric car price down low enough to compete with the price of the common car with its Internal Combustion Engine.

The grant aids will be in place for a maximum of 6000 cars, after which the scheme to get the high efficient cars on our roads would be seen as a success. With these tax breaks, a tax shortfall is foreseeable, combined with an expected cost of €39m to subsidise the first 2000 cars. The cars set for the Irish market come from Renault-Nissan, which limits the choice to a small number of cars. The Renault Fluence(left) and the Nissan Leaf (right) are the two models set for the Irish market, drastically reducing the choice which the consumer is used to.

Renault is leasing the battery which powers the car for a price of €100 per month, whereas Nissan are still not sure if they are even going to include the battery in the price of the car. This will reduce the attractiveness of the cars, and further increase the costs. Production of the electricity to power the cars In order to make the Electric Car sustainable, the electricity used to charge the battery would have to come from a sustainable and clean source. Ireland’s electricity at the moment comes from a range of power stations, with only 11% of the electricity coming from renewable sources.

The majority of the country’s electricity comes from dirty unsustainable fossil fuelled power stations. This unsustainable electricity would be supplying the power to recharge the batteries of the electrically powered cars, which would eliminate the some benefits of carbon neutrality from the electric car. This table shows where all of Ireland’s electricity comes from; in order for the electric car to be a complete success the supply of electricity must also be sustainable.

The electric car company Tesla say that in the worst case scenario the car would only be producing 80g/km of CO2, even with the electricity coming from inefficient source, which is still lower than the most efficient Internal Combustion Engines available today. With Irelands high potential for wind energy production soon to be further exploited, the conversion from oil fuel to electrical could be seen as a change to self-sufficiency, not having to rely on ever declining supplies from the east.

Effect of batteries, lifespan and replacement. In a conventional Internal Combustion Engine there are over 1000 moving parts, making it susceptible to break down or fail. In order to keep these types of engine in good working order, regular servicing and maintenance has to take place. In the electric car their drive train is a simple electric induction motor which has only one moving part which greatly reduces the need for servicing and lowers maintenance costs.

The batteries used in electric cars vary greatly depending on the size and weight of the car, a modern lightweight ZEBRA battery which makes use of new technologies and ideas, is one type being used in a range of vehicles. A ZEBRA battery of 0. 12m3 and 184kg is capable of delivering double the energy of the old lead-acid battery of 0. 19m3 and 525kg; this enables the car to be lighter which reduces the amount of energy needed to make the car move.

The ZEBRA battery has been thoroughly tested and demonstrated a lifespan of over 14 years, with no gassing or self discharge; this means the battery is maintenance free. Lithium Exports in 2008 Lithium Imports in 2008 Lithium production in the future The sustainability of the Lithium in the batteries is

another issue which will have to be faced when considering the large scale adoption of electric cars. Lithium is already in high demand to power the many million mobile phone and laptop batteries in use around the world.

Japan, China and South Korea have 98% of the worlds Lithium battery production. China is importing almost half of the raw Lithium with a plan to produce their own when the demand is there; they feel that it is still cheaper and easier to import it presently. The huge demand for Lithium has sparked the need for research into new alternative ways of producing it. South Korea has announced its plans to commercially extract Lithium from sea water by 2015, but there is much doubt around the idea, as there is not enough demand to cover the enormous cost of desalinising huge volumes of sea water.

The idea of extracting the Lithium from the sea water could become mainstream in a number of years when the consumers demand increases. Seoul has also set aside $12bn for attainment of the raw materials from Bolivia, which is believed to have the world’s biggest deposits at the “ Salar de Uyuni” salt flats in the Altiplano plateau of the Andes Mountains. The salt flats have a thick crust of salt which covers a pool of brine, which is rich in lithium. It is expected to contain 50 to 70% of the world's lithium reserves.

Bolivia is one of the poorest countries in South America but has over half of the world’s reserve of Lithium; the extraction of the raw material could be the boost which the countries needs. The production of the Lithium would create employment for local communities, and revenue for the country giving improving the country’s economy. Often times with the extraction of

raw materials, as seen worldwide, it is only the companies who see the profits, leaving the local communities out.

The local flora and fauna is often exploited and driven out of their habitat, which can lead to extinction. Although the salt flats are almost lifeless there are some animals and plant life which frequent the area, Flamingos are one of the birds which use the flats as a breeding ground in early winter, these extravagant birds which get their beautiful colour from the food they eat which are native to the salt flats. Many of the dominant countries have already allocated vast amounts of money to secure a steady supply of Lithium by buying into Bolivia reserves.

Piles of Salt after extraction Salty brine from which the Lithium is extracted The Bolivian flag flying above Salt flats Alternatives to Lithium New studies being conducted, have found that Zinc-Air battery technology is proving to be a viable alternative to Lithium Ion batteries. The Zinc-Air idea is in early stages of development and production, and is expected to enter the market on small scale in products like hearing-aids; if it proves successful there are plans in place to upscale the technology to mobile hones and laptops and further to electric cars. The research so far has brought about some promising findings for the Zinc-Air technologies; it has the potential to deliver three times the power of the Lithium Ion battery, with reduced size and weight. Lithium-Air is another technology with expected potential for electric cars, but is only in early stages of development and won’t be ready for large scale production in the near future. Performance, Maintenance of the engine, and lifespan

The electric car, unlike its predecessor with hundreds of parts, makes use of simple electric motors with only one moving part. This greatly reduces the amount of expected problems. The car itself will need maintenance, tyres and lights etc. Retraining the mechanics- The mechanics already trained to service and maintain common cars, would need their qualifications upgraded to deal with the electronics of the electronic car. Although the technology in the battery powered cars is straightforward, some further training would be needed to ensure the safe maintenance of electrical equipment.

Appearance/Types- Performance- Standard internal combustion engine cars are rated with bhp and torque whereas the electric motor has a kWh rating, but they are related. The prejudice connected with the electric cars, is that they are slow and won’t be able to do all of the things typical oil fuelled engines can do. With the electric motor delivering all of its torque all of the time acceleration is no problem, 0-100km in 3. 7s faster than a petrol guzzling Porshe 911 GT-3. Peoples trust in the new technology

With all new technologies comes doubt, people are often afraid of change and feel that things need time to prove themselves. The technology used in the electric vehicle has been around for decades seen as early as 1835 used in public transport. Over the years has become more refined and efficient, it has now switched its focus from public transport, where it is already in use, to the individual types of transport which causes so much pollution 20%-25% of CO_2 emissions. The electric car is therefore not new technology as the base on which it has been developed has been in use for already.

This proving time should enable the immediate adoption of the electric car as there should be no prejudice. Tesla’s flagship, high performance roadster

Tesla model S, 2012 family saloon Disposal of cars when finished, how much can be recycled The battery in Tesla’s electric car have a long lifespan of 160, 000 kilometres before it begins to lose its ability to charge and discharge at the efficiency needed to keep the high up the cars high performance. The cells for the Tesla battery are made in Japan, where the environmental laws are strict and products have to meet the RoHS standards.

The RoHS bans the placing on the EU market of new electrical and electronic equipment containing more than agreed levels of lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyl (PBB) and polybrominated diphenyl ether (PBDE) flame retardants. This means that there are no heavy metals or toxic materials allowing the battery to be land filled in a worst case scenario. Tesla batteries can be reused in other less demanding applications, off grid storage or load levelling when the demand for electricity is low but it is still production.

This is a huge problem faced by power stations as there is huge costs involved changing power output between peak times. The batteries will eventually lose their ability to hold charge completely, at this stage they will need to be disposed of. Specialist companies have been set up to recycle batteries from electric vehicles, Kinsbursky Brothers an environmental management company and Toxco the world’s largest recycler of lithium batteries have teamed up to form the most efficient recycler of electric cars. The batteries are shredded and separated into their original elements, some of which can be reused in new batteries and other products.