



# **Entrepreneurial Actors in Transport Systems**

## **An Energy Cultures Perspective**

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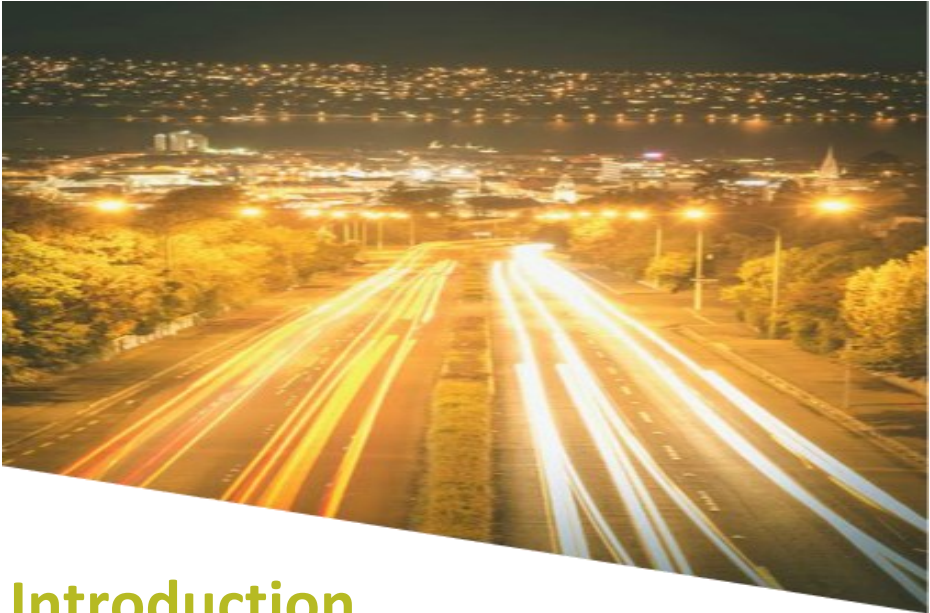
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# Contents

Introduction.....	4
Background.....	5
Method.....	7
<u>Case Studies</u>	
Astara Technologies.....	8
Cityhop.....	10
Green Cabs.....	13
Fuel360.....	14
Green Fuels.....	15
Gull.....	16
JuicePoint.....	18
NXT Fuels.....	20
Skycabs.....	22
Solvent Rescue.....	23
Urgent Couriers.....	24
YourDrive.....	25
Bringing it together: Energy Cultures in socio-technical transitions.....	26
References.....	34



## Introduction

Moving to a low carbon economy in New Zealand requires a considerable shift in the current transport system as a whole (Carrington et al, 2014). Indeed, the New Zealand transportation system in has a number of key issues including old vehicle stock, old inefficient ICE engines, lack of rail infrastructure investment, low petrol taxes relative to OECD countries and a focus on road building (Vivid Economics & University of Auckland Business School, 2012).

Given the complexity involved, shifting the current transport socio-technical systems (with the reliance on the ICE) will be difficult. Starting a business that relies on shifting such an embedded regime can thus be a hard journey.

This report looks at the entrepreneurs operating businesses that challenge the mainstream and dominant transportation regime in New Zealand. They can be considered brave people by introducing new products and services into the market that challenge the reliance on fossil fuels in transportation. This report explores each entrepreneurial venture to understand their operations, what alternatives is being offered and what the barriers are to that venture. With barriers comes opportunities and these entrepreneurs are seeing and seizing opportunities that may have the potential together to shift the regime from its current form into something that is more sustainable for the future.

# Background

Recent work in the area of socio-technical transitions examines in-depth changes to transport systems. To understand the process of socio-technical change Geels (2002) produced the following diagram to illustrate the alignment and processes that are needed, often simultaneously, for there to be a shift in any deep-seated socio-technical system. The MLP offers a way for transitions; the dynamics of stability and change, to be analysed (Geels, 2002; 2011; Geels & Schot, 2007).

The socio-technical system is split into three levels. The highest level, and the most stable, is called the socio-technical landscape which consists of the wider context of societal beliefs and values, physical landscapes and macro-economic trends, all of which influence the other two levels (Geels, 2011). The next level of the socio-technical system, known as the socio-technical regime, consists of a collective level of action, for example firms, institutions, policy makers, consumers. Finally, the bottom level of the socio-technical system is known as the niche level and this is where 'novelties' emerge, which can be thought of as those innovations that offer alternatives to the current dominant socio-technical regime. Niches are where the innovations bubble and "gain momentum if

visions (and expectations) become more precise and more broadly accepted" (Geels, 2012: 472). Overall, the dynamics between the three different layers are what brings about change to socio-technical systems. It is not a linear change but a continuous circular process of stability and change within the socio-technical system. However, it is the alignment of the three levels that constitutes a socio-technical system. This system, and in particular the regime, is constantly being produced and reproduced and modified as part of the process by the actors, firms and other social groups involved.

This report identifies some of the actors that are aiming to bring about change to the system by offering goods and services that challenge the current socio-technical system. We call these actors entrepreneurs because they, like traditional entrepreneurs, seek and exploit opportunities. However, the focus here is on a set of particular actors that exploit market opportunities to "generate new products, services, techniques and organisational modes that substantially reduce environmental impacts and increase the quality of life (Schaltegger, 2002). Called environmental entrepreneurs, they are considered a subset of entrepreneurs, are actors who create

Increasing structuration  
of activities in local practices

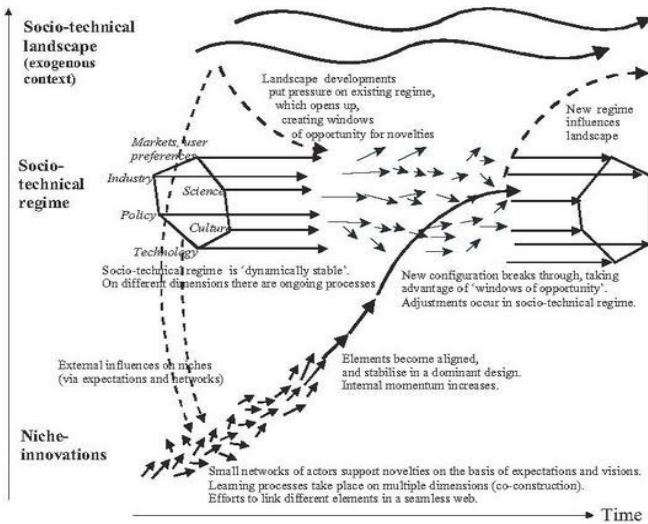


Figure 1: The Multi-level perspective (taken from Geels, 2011: 28)

rent through internalising environmental externalities. They can be seen as providing a solution to environmental problems rather than contributing to it (York & Venkataraman, 2010). These particular types of entrepreneurs are thought to be change agents as by perceiving market failure as an opportunity and exploiting that opportunity through developing a venture they have the potential to change both the immediate market and wider industry through their actions - therefore institutional change (Isaak, 2010). Consequently, we consider these actors to be worthy of further examination as it would seem that they have the potential to

destabilise current fossil-fuel regime (Geels, 2014). Drawing on a set of case studies on environmental entrepreneurial ventures in future transport opportunities this paper explores how/whether these entrepreneurs have the potential to align with and enable changes for sustainable transitions starting with niche novelties. Therefore, the focus of this report is on the role of the entrepreneur in socio-technical transitions for low carbon (sustainability) and the key question is – can they bring about the change needed in the regime to destabilise business-as-usual fossil-fuel regimes and move toward low-carbon mobility in Aotearoa/New Zealand?

# Method

The overall aim of the study was to investigate organisations that are developing eco-innovations in the transportation industry in New Zealand, and the political environment surrounding them. Participants were chosen from a systematic internet search which was updated from the Energy Cultures report (see Ford, Doering & Stephenson, 2014). Participants were selected based on their experience with eco-innovations and the transportation industry. In general, we spoke to the founders of each venture and as such they were able to give details on the business trajectory now and in the future.

A qualitative research approach was adopted due to the complex and

detailed understanding that was required. In order to approach the research qualitatively interviews were conducted that adopted a narrative approach to enable participants to tell the story of their venture. The stories were then analysed in two ways. First, to produce the brief case studies reproduced in this report and second the data was used as a whole to look at the barriers for change and what future transportation from an entrepreneurial perspective might look like.

The following cases illustrate the participants involved and outline their business ventures.



Photo by Ian Munnings (<https://flic.kr/p/4oqBxh>)

# Astara Technologies





In 2008, as a result of product evaluations for an importer, Iain Jerrett of Astar Technologies found that electric scooters with lithium batteries performed much better than those with lead acid batteries. The improved performance, weight, and efficiency got him thinking about testing these batteries further, to see what products could be developed for use in various vehicle and stationary storage applications. With a background in electronics, I.T. and project management, Iain was well-placed to explore these new territories.

Lithium batteries are everywhere. They are in our cellphones, remotes, and many other battery-operated devices. Astar works mainly with lithium iron phosphate chemistry, which is the safest of the lithium chemistries, but it is still vulnerable to overcharging and over-discharging issues. The risk increases with the size of these batteries, making their use in electric vehicles a bit more of a challenge. To reduce the risk and allow close monitoring as products are developed, Astar Technologies developed its own battery management and control systems, which monitor the battery cells, stop charging once they have reached their optimum charge voltage and balance the cells for best uniform performance. These systems prevent overheating and any resultant issues, provide real-time monitoring, and drastically increase safety.

Astar Technology's battery management systems have already been well utilised for various purposes, from cold store environments to high performance motorcycles, to electric tuk tuks! One of the more ambitious projects developed with another company is a control system for an island which runs on its own power, to assist with monitoring and control of the storage technologies employed. Astar has also supplied products for innovative new designs such as Unitec's Uniquad project – an innovative four wheel drive utility vehicle with many leading edge developments. The future seems bright for Astar Technologies, especially given that new technologies and applications in the sector will only continue to grow.

# Cityhop

Congestion costs Auckland 1.2 billion dollars, which is staggering when compared to London's \$4 billion, and much larger population. It becomes even more staggering considering that Auckland is but one city in a nation filled with car lovers. The average car is only used for 45 minutes a day, making our streets saturated with parked cars. Cars have determined our urban planning, but if we are serious about reducing congestion and vehicle emissions, we need to encourage people to own fewer cars, especially with an ever-increasing population. This is the central philosophy behind Victoria Carter's company, Cityhop, a car share initiative operating in Auckland and Wellington.

Cityhop cars can be rented either by the hour or by the day. The fleet boasts low CO<sub>2</sub> emissions, and their affordability makes Cityhop ideal for people to consider owning one car less or even no car! With car sharing, people drive less and walk or cycle more. The money saved from not owning a car is spent locally. One car share car takes about 15 vehicles off the road, and saves a fortune in car ownership!

Cityhop has been met with great public reaction and usage. Victoria is always adding car parks in Auckland and Wellington, and is also working with large car-users, health boards, universities, and property developers as they recognise the need for rethinking car parks and car use. A fleet of electric vehicles and hybrids are also on her radar in keeping with the company's commitment to sustainability.



# Green Cabs



When Callum started Green Cabs, little did he know that he would be entering a cut-throat industry, one he thinks is rife with sabotage and dirty tactics. Green Cabs have been intentionally cut off by other taxi drivers, subject to an endless series of misinformation campaigns, have had acid thrown on their cars, and have had tyres slashed and a Molotov cocktail thrown at their advertising truck. Despite all of this, Callum is adamant that he made the right call; a point that is proven considering the company's success in Auckland, Wellington, Christchurch, Dunedin, and Queenstown.

Green Cabs is about more than how it sounds; an environmentally friendly taxi company - it is about making the best use of available technology and challenging the status quo. Callum sees Green Cabs as about being 'the change you want to see in the world.' The taxi fleet consists entirely of hybrids and low emission common rail diesels. These vehicles run at a third (or less) of what traditional taxis use, and the savings translate considerably to the customer fares. The green credentials don't end there. Green Cabs also creates real, tangible change by partnering with Trees for the Future, Trees for Survival, the Department of Conservation and Wakatipu Reforestation Trust; programmes focussing on environmental restoration. In this way, Callum hopes to offset his company's emissions without the use of initiatives he considers to be arbitrary, such as carbon credits.

Aside from the normal challenges involved in starting a company, Callum has had no difficulties in integrating green technologies into the Green Cabs fleet. Furthermore, public reaction has been fantastic, with some customers swearing by Green Cabs and refusing to use anything else. This seems like an enviable end goal for any company, and lends promising insight into increasing concern and awareness for environmental sustainability.

# Fuel360

Sean Thomson had never considered himself to be particularly green-inclined. In establishing Fuel360 with the goal of cutting a business's operational costs but making money for them at the same time, he found that the collateral effects in reducing harmful emissions has made him more aware and concerned about his, and others', fuel efficiency. Now, Fuel360 produce and sell a range of fuel treatments to help engines run cleaner, with a focus on commercial and small business fleets in marine, agriculture, and transport.

Among Sean's products is FuelRight; a treatment for diesel bug. This is a bacterial growth that occurs within diesel fuel that can block fuel systems and stop equipment from operating. Traditional treatments are biocides - they use poisonous chemicals to kill the bug. In contrast, FuelRight is a safe non-biocide - 20 years of development in the making - that uses amine chemistry. This breaks down the bacterial sludge safely, while cleaning, lubricating, and conditioning the metal components within a fuel system at the same time. In doing so, it improves economy and engine efficiency, prevents bacterial recurrence, and reduces emissions. It's a revolutionary win-win, being used by the likes of Vodafone, Watercare, Northport, North Shore Hospital and Explore NZ as testament to its success. Other Fuel360 products range from tablets that improves a vehicle performance, to filtration and UV systems, to ship fuel tanks and standby gensets that maintain diesel fuel in 'Grade A' condition.

The main problem encountered by Sean is that some of his products take a long time to prove themselves. In cars, for example, it may take anywhere between 5-10,000 km for any observable benefits to arise. Coupled with a healthy dose of scepticism, Sean reports that this has caused some customers to give up on his product before the benefits take shape, On the other hand, the accumulated benefits and savings gained from using Fuel360 products have had other customers insisting that they can't afford *not* to use them. To Sean, these are the customers that make all the long hours worthwhile.

# Green Fuels

Around 2009, New Zealand was deep in the sustainability movement. The Labour government had introduced an initiative where every litre of diesel in New Zealand had to contain at least 3.5% biodiesel. Predictably, this created an instant, massive market which would have to supply around 200 million litres of biodiesel to satisfy both the law and the demand. Biodiesel New Zealand Ltd, a Solid Energy owned business, aimed to increase biodiesel manufacturing output, and this continued even when the National government scrapped the legislation years later. When Biodiesel New Zealand separated from Solid Energy, former employees Martin and Karl jumped at the opportunity. In a market with few competitors, the initiative - dubbed Green Fuels - thrived, and continued to supply to the loyal customer base formerly belonging to Biodiesel New Zealand.

The company's main product, Biogold biodiesel, is manufactured from an unexpected ingredient - recycled cooking oil. Used vegetable oil is sourced from restaurants and takeaways around the country, and may be used in its full form or blended with conventional diesel. It is 100% renewable, has a 90% lower carbon footprint than mineral diesel, and is non-hazardous, resulting in cleaner burning and improved human health. Its application is also highly valued in the South Island, because it has a much lower freezing point than do conventional mineral fuels.

Martin is confident that they are helping companies and organisations 'do the right thing' and foster a responsible attitude towards environmental sustainability. With a customer base spanning from small businesses to large corporations, Green Fuels seems to have a bright future ahead.

# Gull

There are several firsts to the Gull brand. It was the first company to sell low sulphur diesel in New Zealand. It was the first to bring a biofuel to the mainstream market. Finally, it was the first company of its kind to successfully establish and maintain a presence in a New Zealand service station market dominated by powerful corporations. Despite all of this, it remains family-owned and committed to both its customers and environmental sustainability. David Bodger believes this is one of the reasons why Gull has had so much success, especially given the Kiwi tendency to support the underdog.

Gull's biofuels come in two blends: blends of petrol with bioethanol and blends of biodiesel with diesel. Gull Force 10 and Gull Force Pro are both bioethanol-petrol blends. Both are developed locally using ethanol leftovers from the dairy industry. Traditionally spread over pasture as a low grade fertiliser (though a bad one, since it interferes with soil structure) it was soon discovered that waste whey protein could be fermented. This is the primary component of both of Gull's blends; Gull Force 10 with 10% ethanol, and Gull Force Pro, with 85% ethanol. Gull Diesel Max is a blend of biodiesel and diesel. The biodiesel is manufactured with used cooking oil; recycling from fish and chip shops and the like. Since Gull Force 10 was first introduced in 2007, Gull has been able to sell over 30 million litres of biofuels, equating to a carbon emission reduction of 70,000 tonnes. The numbers speak for themselves.

Because Gull remains a small, independent company, they retain their family values and are concerned about the effects of climate change. In David's mind, the biggest challenges faced by biofuel advocates are based around performance concerns by the general public. However, the fact that Gull's biofuels are being used by the likes of New Zealand V8 racing cars seems testament to the fact that there is absolutely no need for these concerns.





# JuicePoint



Though there are only around 1,900 electric vehicles in New Zealand as of December 2016, a small percentage on the global scale, the ever-increasing interest in them will mean that the necessity of efficient charging stations will also continue to grow. JuicePoint was set up by Mark Yates, not only with the intent of supplying electric vehicle charging systems, but also to encourage the uptake of electric vehicles in New Zealand.

A fundamental difference in fueling a diesel engine and powering an electric vehicle is that charging can be done at home. In fact, Mark estimates that 90-95% of charging will occur in a home environment, eliminating the need for extensive, additional infrastructure costs. Typically, a single charge would provide enough juice for 110-120 kilometres worth of travel, and would take about 1-2 hours from a 32 amp charger. For those who may be hesitant to make the switch to pure electric vehicles, there is a rise in prevalence of plug-in hybrids, which also have a combustion engine to alleviate any concerns.

Though the small market is one of JuicePoint's biggest challenges, Mark anticipates that electric vehicles will soon form a very significant proportion of New Zealand - and world - transport, primarily due to projected oil price rise and environmental concerns. That the government is hesitant at the loss of revenue from fuel taxes, he maintains, is a shortsighted view. In fact, having 50% of the country's cars as electric vehicles could save around 370 million dollars on health costs. A sobering thought, and one which Mark hopes will move the government with ongoing pressure and education.

# NXT Fuels

Sunlight + water = algae. A basic equation, but one which has seen Nick Gerritsen, founder of NXT Fuels, partner with multinational corporate giant UOP, contribute to the generation of the first algae-based, fully compliant bio-jet fuel (SPK) and become a leader in converting biomass into biofuels. In fact, Nick's aim is to create fuels that have the same molecular structure as fossil fuels; allowing them to be used in existing infrastructure with no additional costs or effects. An ambitious dream, but one in which he has already made considerable headway.

It started when Nick and fellow cofounders came across a 1998 U.S research study called the Aquatic Species Programme. The study investigated the possibilities of producing energy using algae. Since then, multiple U.S companies have taken to genetically modifying algae to increase their yield of lipid oil; that is, the key component involved in diesel fuel. Instead of going down the same route, Nick thought to combine the generation of algae-based fuels with opportunities for water remediation. Effectively, this would mean extracting excess, existing algae from choked bodies of water, a problem that is incredibly common in New Zealand.

The Mayor of Marlborough was more than happy to let NXT Fuels clear some ponds of algae. Combining biochemistry and applied engineering saw the opening of a hydrothermal refinery, which converted the algae into "green crude" within just 30 minutes. A press release attracted the attention of corporate giant Boeing, who put NXT Fuels on to Honeywell UOP. From this partnership came the development of SPK and the rest, as they say, is history. NXT Fuels continues to establish globally significant collaborative partnerships, in particular with GTI – the US Gas Technology Institute – and participation in a DoE funded programme focused on biomass conversion to drop-in fuels. This engagement ultimately led to collaboration with CRI-Catalyst a subsidiary of SHELL, so that today NXT Fuels has established a technology position with its partners that enables the conversion of multi-biomass into drop in petrol and diesel to US ASTM specification. NXT Fuels is consequently concentrating on establishing the first full scale commercial regional refinery project in NZ.



# Skycabs

If you were to envision what transport would look like in 2030, for built up cities currently experiencing traffic congestion, chances are you would picture vehicles on tracks zipping around between high rises. You may even picture SkyCabs, an elevated small group automated rapid transport (ESGART) system, the patented NZ innovation of SkyCabs International Ltd.

Still in the proposal stages, SkyCabs would represent a revolutionary alternative to transport. It would consist of 6-metre-long, 8-seater cabs hanging from a network of elevated, two-way monobeams. In this way, several lightweight cabs could travel in opposing directions, carrying around 4800 people per hour each way and effectively adding a four-lane motorway to a two-lane street.

With worsening Auckland congestion, SkyCabs would effectively cut transport time in half. They are designed to travel 80 km/h in urban areas, have a low operating cost, would require less land than other solutions to ease congestion, would be available 24/7, and would put Auckland on the map as a leader in sustainable, alternative transport. This is because they would have absolutely no CO<sub>2</sub> or particulate emissions. Despite these obvious merits, SkyCabs International Ltd have had considerable difficulty in procuring official support. In fact, they believe that the council is far too focussed on more expensive rail and have not responded to them, presumably on the basis that SkyCabs is unproven. The company is not giving up, and is planning on building a demo track to show the council how wrong they are.

# Solvent Rescue

From recycling paint and ink solvents, to producing liquid hydrocarbon fuels by replicating a natural, million-year-old process. They sound unrelated, but Chris Bathurst came across the latter by accident, as his company, Solvent Rescue, were looking at ways of recycling dry-cleaning solvents. These, which leave a residue of chlorinated hydrocarbon, are toxic to marine organisms making them unsuitable for the landfill. With the help of some scientific literature, Chris found that subjecting chlorinated hydrocarbon to supercritical water and a bit of caustic soda can completely remove the chlorine. It worked.

However, the literature also said that supercritical water can also break down algae, and indeed any organic (or, carbon-based) material. The chemical process ends with the production of hydrocarbons, the main compounds of crude oil. After receiving a call from multinational corporation Boeing about buying biofuel, Chris knew he was onto something big. He opened a plant that produced 1,000 gallons of this fuel every 100 days using artificial ponds. Though the Christchurch earthquakes put the plant out of action, Chris got right back into it and instead began to look towards using wood, or more specifically, cellulose, instead of algae. Though his income comes primarily from commercial solvent disposal, Chris continues to experiment in the alternative fuel sector. With the threat of climate change dictating the development of new technologies that can slot into the present oil-based economy, he hopes to provide a viable answer.

# Urgent Couriers

When Steve Bonnici was doing his MBA, he had to write a report on a component of his business, Urgent Couriers, that had a major environmental footprint. Steve believed the main environmental impact of his company was a no-brainer; courier companies burn through fossil fuels as part of their standard business operation. Therefore, Steve thought he would write his report on what could be done to improve his company's environmental footprint, and it seems that he has been highly successful in implementing these strategies.

Urgent Couriers is a medium-sized, on-demand courier company with about 25% of Auckland's market share. For sustainable strategies to be effective, they had to be economically viable, since all of the company's drivers were contractors. The early 2000s saw the release of the Honda Jazz: a low emission vehicle which worked out to be cheaper over the life of a courier car (approximately two years) in terms of fuel requirements. By 2007, 50% of the company's fleet were low emission vehicles, and they had joined the carbonZero offsetting programme, making them New Zealand's first carbon neutral courier company. Today, 87% of Urgent's fleet are low emission vehicles, and the proportion continues to rise.

Aside from reduced overall environmental impact, Steve's commitment to sustainability has delivered many other rewards, such as lowered fuel costs, increased efficiency, a point of difference in a crowded market, and a better income for drivers. Steve maintains that environmental sustainability makes great business sense, and with a host of environmental awards under his belt, there is no doubt that his efforts have been recognised.



# YourDrive

Think about the vehicle you own. Chances are, it is sitting in the garage or out on the street somewhere. How many hours has it been sitting there? In fact, over 24 hours, how many hours do you actually use it? Chances are that the answer to that question would be somewhere between half an hour to an hour, as it is for the average New Zealand vehicle. Though we use our cars for less than an hour per day, they remain our second largest asset (after our properties). Every year, we pour 8-9 thousand dollars into our cars, which sit idle for most of the day, clogging out land, roadways, and carparks. Doesn't it seem wasteful?

Oscar Ellison certainly thinks so. He started YourDrive, a peer to peer vehicle sharing business, to combat wasteful car ownership. Vehicle owners are able to list their vehicles on the website, specifying the time and dates of availability. Customers can browse through a list of vehicles near them, filtering by price or model if they wish, and arrange the rental directly with the owner. It seems like the perfect system: people without cars can rent one when they need it for an affordable price, and car owners can make money off their car which would otherwise be unused. The NZ Sustainable Business Network seemed to think so too, and placed YourDrive as a finalist in the Mega Efficiency category in the 2014 NZI National Sustainable Business Network Awards.

Though the system has been a hit with the public, Oscar notes there have been a significant number of hurdles to jump. One of the more difficult was that most New Zealand insurance policies are void if the vehicle is used commercially. Thankfully, due to a couple of forward thinking insurance professionals, they managed to create a policy that adequately protects all parties without affecting the owner's personal policy. Oscar is excited about the future and is confident the initiative will keep growing.

# Bringing it together: Energy Cultures in socio-technical transitions.

In order to understand the way in which the entrepreneurial ventures are operating the Energy Cultures Framework has been employed to separate the energy behaviours of the ventures to understand how they are currently operating in the current deep-seated socio-technical system. The Energy Cultures Framework (ECF) was developed to offer a multi-disciplinary way to understand both current energy behaviour and energy behaviour change (Stephenson et al, 2015). The simplicity of the framework is argued to be one of its key strengths. There are three key elements; material culture, what people have/own – the material goods; the practices or what people actually do; and finally norms and aspirations or what people think and how they might like to think (see Stephenson et al, 2010 for more information). These three elements work in a dynamic manner in a context that also impacts on the way in which they interact to create a culture. It is understanding these dynamics that help make sense of the energy culture. And it is putting the culture in a wider context that helps understand the socio-technical transition. This section will conclude by doing so.

## *Barriers to entrepreneurial change in the transport socio-technical system*

The Energy Culture in the alternative transport space described by the participants involved in the study, is a product of the relationship between the material culture, the energy practices and the norms and culture. It highlights a number of tensions between the aims and aspirations of the entrepreneurial founders and the wider regime that seems to be driving a business-as-usual position. It would seem that the material culture is based on car or vehicle ownership that is also a dominant part of the norms in New Zealand – we are a country of vehicle owners. The vehicle ownership statistics confirm this – there are over 3 million light passenger cars in NZ with an 83% vehicle per capita statistic (MOT, 2016) There are also a number of institutional alignments that support business-as-usual noted by participants in terms of lobby groups and large institutional players in the industry for example, oil companies and car manufacturers. These are hard to change as they

underpin the regime and landscape because they have the institutional power to shape norms and behaviour across all levels. Therefore, alignments at the niche level that might potentially bring about change need to be disruptive.

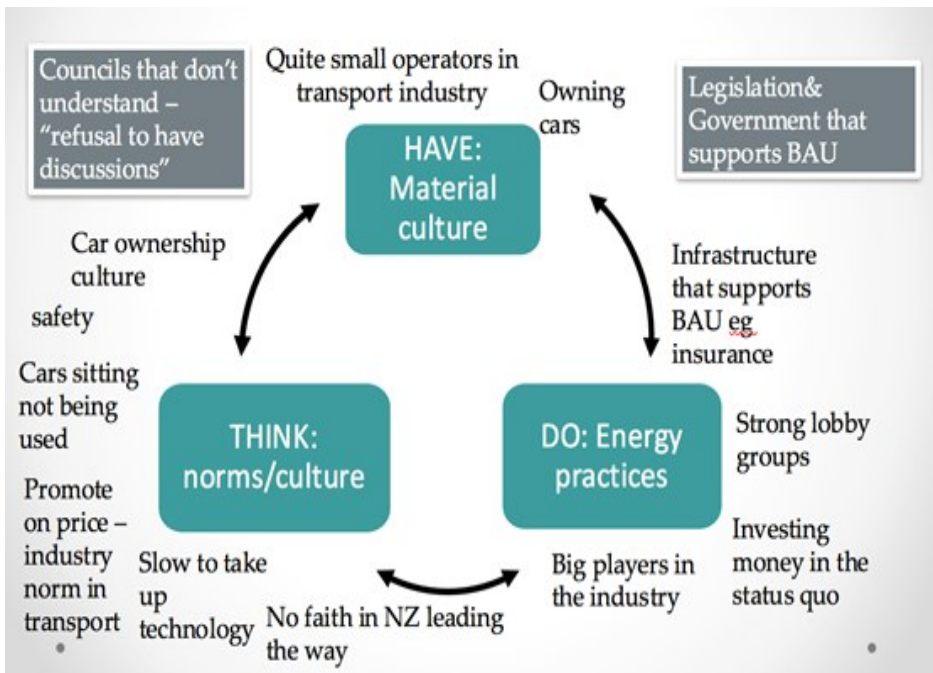


Figure 2: Barriers for change for entrepreneurs in the NZ transport system

## ***Participant perceptions of key barriers for change in the NZ transport system:***

### **1. People do not (want to) understand**

Participants discussed both the general public (consumers) and many in the institutional environment not understanding their businesses. For example - “facing that problem of just getting our name out there and people getting used to it” (participant 5). Some participants also discussed the car culture in New Zealand as being a barrier – for example “we have an unhealthy relationship with the car” (participant 10). Although many noted change in this culture, for example “New Zealand definitely had a car culture... kind of status symbols back in the day” (participant 5) but now saw more positivity with “young urbanites” for change away from cars.

A number of participants talked about how here in New Zealand “we’ve got this fabulous country here; we’ve got this pristine environment that’s 100% pure. Well, the reality is we know it’s not 100% pure what we’re trading on is the imagery” (participant 6). Thus, as another participant commented, “we talk about our green credentials, we talk about all sorts of things but then we just pour shit into the rivers and run diesel vehicles” (participant 4).

The duality of New Zealand being pristine, yet at the same time knowing that it is not, contributes to the inertia of change that participants describe. For example, participant 1 describes this as “Kiwis are apathetic” and participant 19 states that, “we are still on the sidelines having an argument about something not realising that the content and the context has already changed so I think New Zealand has to be a lot more engaged globally and a lot more intelligent in decision making.” Hence, participants discuss the image of New Zealand as clean and green producing a norm where we are complacent for change as a significant barrier that they need to overcome to bring about an acceptance of their product or service.

Institutions such as central and local government were often described as unsupportive and lacking flexibility. Common comments from participants included “you need kind of proof that your [business] model is working before you can get the change” (participant 5). Other participants discussed that current laws protect the status quo and that they find it hard as “in effect they protect that industry from any kind of disruption outside of that” (participant 5). Some participants mention the current attitude they encounter as a barrier to their venture eg “engineers of transportation authorities...very very

road and public transport centric so anything that isn't one of those has a real hard time making progress" (participant 2). Similar comments are made regarding local government too – for example "they're polarised...any debate is just polarised and not practical, not helpful debates of discussions." Others discussed other institutional barriers including insurance eg "insurance has been a massive issue" (participant 5) and reactions to going up against industry norms "we've had our drivers dealing with road rage incidents" from firms in the same industry because, as they state "we had an offering that they couldn't compete with, basically we are cheaper in price so it was a big concern for them" (participant 12). Overall, there was a feeling that as a disruptive business they faced barriers involving a lack of education, knowledge and support of alternatives to the status-quo both from consumers in general and institutions they came into contact with.

## 2. Cash issues

There are three barriers involved with the economics of the ventures. First, there is the cost of the product or service itself. Most of the ventures had yet to reach economies of scale with the technology but are competing against technology that has done so, for example, as one entrepreneur noted: "the cost of [ICE] motors has gone down and down and down in real terms" (participant 5).

In comparison the emerging technology used in these new ventures means that it can be seen as expensive. Second, the cost of the products and services needs to be able to be justified through a financial basis and not an environmental or ethical choice. Meaning that if consumers choose an environmental friendly product as a conscious purchase decision then they may be prepared to pay more for that product. However, participants were wanting their products or services to be seen as an economically viable option as well as a greener way of operating and so it was important for them to achieve that position.

Finally, there are the costs associated with the development of a new technological venture. As one participant said - "they call it money or finances or investment and things like that and it's definitely the main barrier, it is a bit of shame but that's life" (participant 1). As with many traditional ventures financing start-ups and the take-off stages are difficult, especially with cash-flow and the participants involved in this study were no different in this regard.

## 3. Scaling is hard to do

The final barrier coming through in the data was associated with scaling up the business. There were two sub-themes



Photo by Phillip Capper (<https://lic.kz/p/nEyLg>)

in this barrier. First, scaling up a start-up technological venture is difficult – as one participant noted “with the technology supply is an issue” (participant 9) and “it’s just very hard to get scale [because] our population is too small and the technology is very expensive” (participant 10). Second and inter-connected with the first point scaling up market share was also mentioned as a barrier. Given there are dominant technologies in the current market changing consumers and institutional environments were noted as a barrier to the venture. For example, “[Change will come] from the public, it’s not going to come from the government because the government only do what the public want anyway. I

think we’re going to have to do it ourselves and get a measure of enthusiasm” (participant 1). A couple of participants mentioned that they receive positive reactions but also need to convert that to action. Indeed, some were quick to note that getting positive reactions and translating that into sales or customers is not always the same. For example, “mainly positive young urbanites kind of young professionals seem to get it a lot quicker, how that is converting to sales is still iffy” (participant 5). Another participant mentioned that changing economics could drive change, for example, “if fuel costs went through the roof for any reason that would accelerate it” (participant 9).

The above barriers, while reproduced here separately are inter-related in practice. When considering them in light of the multi-level perspective it can be seen that there are many changes needed at the regime level in order for shifts in transport socio-technical systems to occur. These technologies are bubbling at the niche level and need to align to be able to cause disruptions. Kemp, Schot and Hoogma (1998) discuss three processes of alignment - learning, articulation of expectations and building of social networks. These are the important ways in which barriers can be broken down in the current socio-technical system for change. Participants are recognising all of these in their perceptions of the barriers. They understand that learning is important as they know that people do not understand their ventures and the technology involved. Participants also know that the expectations in New Zealand are not matching international expectations and nor matching the realities of resource use and degradation in New Zealand. Finally, building social networks is a crucial part of these entrepreneurs aligning the technologies at the niche level and this was discussed across the interviews with varying reports of success. However, this is seen emerging in the next section which looks at potential for a different transport future for New Zealand.

### *Possible future entrepreneurial change in the transport socio-technical system*

The next EC diagram looks at what is needed to bring about change for these businesses to succeed and bring about change at the regime level. Drawing on the multi-level perspective and the Energy Cultures (EC) Framework it would seem that change is going to have to be disruptive in order for a transition to occur. The business-as-usual energy culture was underpinned by powerful institutional forces that were able to create a number of barriers to any change of the current 'culture.' Any changes to business-as-usual will need to be well aligned at the niche level to disrupt the current regime. The following EC diagram depicts some of the thoughts for change from the participants in this study.

While the material culture is showing clear signs of changing, albeit marginal compared with business-as-usual, the practices and norms do not show clear signs of change from the entrepreneurial perspective. Model 2 outlines the key changes that participants mentioned for change. The clear messages from participants include the need for the public to change, perhaps through education and for supportive practices that enable to up-take of the technology

available. These are quite significant and far-reaching changes that destabilise this current socio-technical system. As one participant pointed out – there is a need for ‘courage’ for norms to shift.

However, this data gives us the ability to reflect on the question - at what point might the current business-as-usual change? Using the lens of the ECF it would seem that there needs to be a dynamic relationship between the pillars of material culture, practices and norms/aspirations. One by itself is not enough to drive the change necessary. At present there is a material culture change in the products and services being offered in the market. However, the market is yet to respond. While this might be explained through the innovation adoption process both the literature on automobility (Urry, 2004) and the ECF point to more than market knowledge. Indeed, the path dependence that is constantly produced and reproduced through the current mobility system locks in practices and norms that might be hard to shift. Nothing though is fixed forever and the two contextual boxes in the model contain forces that have

the potential to shift how people think and what they do. First, changes in oil prices, that have undoubtedly driven the economic viability of the technology today, but is not yet not priced high enough to be a tipping point for the majority of the market. And second, changes in practices are being driven by governments overseas. Participants see places overseas being more advanced than New Zealand and some even suggest that it would be easier for them to move overseas for sales. Most participants are more optimistic and offer that change may be driven by practices overseas and that New Zealand will follow – “I think we will be behind but we’ll follow fast because everyone will see what’s going on and we’ll take it up as well” (participant 5).



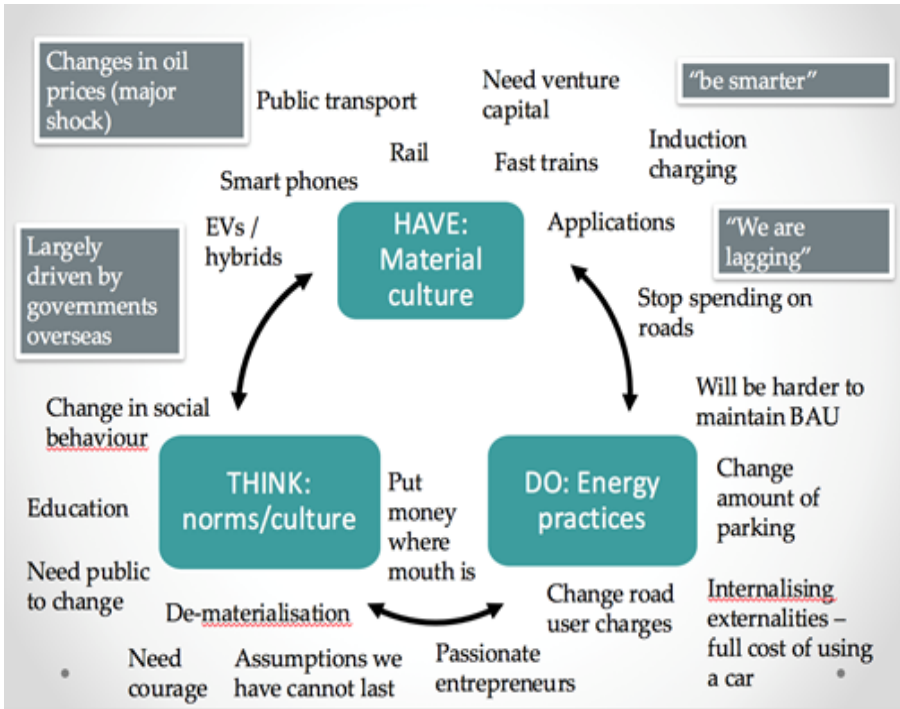


Figure 3: A Socio-Technical System in Change

# References

- Ford, R., Doering, A., Stephenson, J. (2014) Transport Transitions in New Zealand: A Scoping Study. Report prepared for the Energy Efficiency and Conservation Authority (EECA), Centre for Sustainability, University of Otago, Dunedin, New Zealand. ISBN: 978-0-473-27690-4
- Geels, F. W. (2002). Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study. *Research Policy*, 31(8), 1257-1274.
- Geels, F. W. (2011). The multi-level perspective on sustainability transitions: Responses to seven criticisms. *Environmental Innovation and Societal Transitions*, 1(1), 24-40.
- Geels, F. W. (2012). A socio-technical analysis of low-carbon transitions: introducing the multi-level perspective into transport studies. *Journal of Transport Geography*, 24, 471-482.
- Geels, F. W. (2014). Regime resistance against low-carbon transitions: Introducing politics and power into the multi-level perspective. *Theory, Culture & Society*, 31(5), 21-40.
- Geels, F. W., & Schot, J. (2007). Typology of sociotechnical transition pathways. *Research Policy*, 36(3), 399-417.
- Isaak, R. (2010). The making of the ecopreneur. In Schaper, M. (Ed), *Making Ecopreneurs: Developing Sustainable Entrepreneurship*, Gower: Surrey. pp13-26.
- Ministry of Transport (2016) Transport volume: Fleet information. <http://www.transport.govt.nz/ourwork/tmif/transport-volume/tv004/>. Accessed 28/10/2016.
- Royal Society of New Zealand (2014) Facing the Future: Towards a Green Economy for New Zealand. Royal Society of New Zealand: Wellington.
- Schaltegger, S. (2002). A framework for ecopreneurship. *Greener Management International*, 38(1), 45-59.
- Urry, J. (2004). The 'system' of automobility. *Theory, Culture & Society*, 21(4-5), 25-39.
- Vivid Economics, & University of Auckland Business School (2012) *Green Growth: Opportunities for New Zealand*. Auckland.
- York, J. G., & Venkataraman, S. (2010). The entrepreneur–environment nexus: Uncertainty, innovation, and allocation. *Journal of Business Venturing*, 25(5), 449-463.

