A photograph of a busy highway interchange. In the foreground, there are several traffic lights on a gantry. From left to right, the lights show: a green arrow pointing down with the number 6, a green arrow pointing down with the number 5, a green arrow pointing down with the number 4, and a red 'X' with the number 3. To the far left, there is a sign that says 'LANE 2 hrs' with a downward arrow. Above the traffic lights, there is a speed limit sign showing '70'. In the background, a white bus with the number '40' is visible, along with several cars and a person in a high-visibility vest. The scene is set against a clear sky with some buildings in the distance.

# LOW CARBON TRANSPORT ON THE MOVE CONFERENCE

**Australian Technology Park, Sydney  
14 May 2015**

Prepared by conference leader, Dr Susan Pond AM FTSE  
Adjunct Professor and leader of the Alternative Transport Fuels Initiative



Established in 2006, the United States Studies Centre at the University of Sydney aims to improve understanding of the United States and to become one of the world's leading American studies centres.

Spanning the study of politics and policy, economics and business, culture and society, the Centre fulfils this mission through education, research, public outreach, and policy initiatives.

The Centre's innovative policy development and thought leadership initiatives, such as the Alternative Transport Fuels Initiative, led by Susan Pond, bring leading Americans and Australians together to collaborate in addressing common challenges.

[ussc.edu.au/research/alternative-transport-fuels-initiative](http://ussc.edu.au/research/alternative-transport-fuels-initiative)



In September 2013, the NSW Government released the Renewable Energy Action Plan to guide the state's renewable energy development and support the national target of 20 per cent renewable energy by 2020.

The NSW Government's vision is for a secure, reliable, affordable and clean energy future for the state. The Plan positions the state to increase energy from renewable sources at least cost to the energy customer and with maximum benefits to NSW.

NSW has a Renewable Energy Advocate, Amy Kean, whose role is to support the Plan by working closely with NSW communities and industry, facilitate the development of renewable energy projects, increase renewable energy generation in NSW and promote investment in renewable energy.

[resourcesandenergy.nsw.gov.au/investors/investment-opportunities/renewable-energy](http://resourcesandenergy.nsw.gov.au/investors/investment-opportunities/renewable-energy)

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## ACKNOWLEDGEMENTS

This Conference would not have taken place without the support of the NSW Government.

The NSW government is committed to renewable energy. The share of solar, wind and bioenergy in NSW's energy mix has almost doubled in the last four years.

The Renewable Energy Action Plan has positioned the State to increase renewable energy at least cost to the energy customer and with maximum benefits to this state.

The US Studies Centre acknowledges and thanks, in particular, the NSW Government Renewable Energy Advocate Amy Kean and Senior Project Officer, Energy, NSW Department of Industry, Chloe Hicks for their expert input and support.

The Centre also acknowledges and thanks its Events and Communications teams for their expert input and support, in particular Events Manager, Kathryn McNulty, Events Coordinator, Tara Wolfson, Max Halden, Media Manager, and Susan Beale, Web and Communications Manager.

Finally, the Conference was designated as a Green Powered Event, thanks to the NSW Government's Green Power Program. The electricity usage by this event produced approximately 3.2 tonnes of carbon. All of this was abated, for a cost of \$195, through the Green Power Program.



## LOW CARBON TRANSPORT ON THE MOVE CONFERENCE OBJECTIVES

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- **Promote a common understanding between the US and Australia of sustainable transport**
  - **Bring into focus the technologies and policies required to support and enhance a sustainable transport system in each country**
  - **Find new opportunities for trans-Pacific and business partnerships**
  - **Enhance our perspective of how our two countries can work together to make the world a better place.**
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### SPEAKERS AND DELEGATES

The Conference brought 130 invitation-only, high-level delegates from the USA and Australia to the Australian Technology Park in Sydney on 14 May 2015. The delegates, from academia, industry and government, spanned a wide range of disciplines.

Amongst the delegates were 12 female undergraduate engineering students from the University of Sydney, University of New South Wales and University of Technology Sydney, invited with a view to developing the sustainable transport workforce of the future.

### PROGRAM AND SPEAKER BIOGRAPHIES

The Program and Speaker Biographies are attached at the back of this document. Presentations and photographs are available on the US Studies Centre website at <http://ussc.edu.au/events/past/Low-Carbon-Transport-on-the-Move>.

The format for the conference was a series of individual speaker presentations, each followed by contributions and questions from the floor. The final session of the day was a panel discussion about setting government policy to signal and support progress towards a zero emissions transport system in Australia.

## KEY CONCLUSIONS

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- 1. Sustainable transport in any country will be fundamentally embedded in international innovation systems and markets**
  - 2. A sustainable transport system must be underpinned by sustainable energy sources**
  - 3. All benefits of renewable energy for transport must be monetized so that low carbon solutions can compete in the market and reach their full potential**
  - 4. Digital infrastructure will have a pervasive and profound effect on the transport, including physical transport infrastructure, in the years to come**
  - 5. The clean energy revolution represents the next long-wave economic cycle in energy. It provides a tremendous opportunity for business, for energy security and for our collective solutions to global warming**
  - 6. Governments, businesses and communities must work together to maximise the benefits of this clean energy revolution for their own transport system, economy and society**
  - 7. Rapidly advancing technologies and systems mean that government transport policies can no longer be compartmentalized but must be developed on a whole-of-government, system-wide basis**
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## CONFERENCE THEMES

### Sustainable Transport

- Transport, the movement of people and freight from one location to another, is an essential enabler of productivity in modern society
- Whether for road, rail, air or sea transport, the sector is largely dependent on liquid fossil fuel energy in the form of gasoline, diesel and kerosene. Each year, the transport sector consumes more than 30% of global energy, predominantly as oil. This translates into consumption by the sector of 60% of global oil production
- Transport's consumption of oil is forecast to grow because of increased demand for travel, goods and services globally and especially by rapidly urbanising countries such as China and India
- Transport's consumption of electricity is forecast to grow as mass transit systems switch to electricity and electric vehicles penetrate automobile markets

- Because of its energy supply and energy intensity, transport accounts for 23% of CO2 emissions globally. Even though it is not the most polluting sector globally, transport's share of CO2 is rising quickly relative to other energy sectors and is expected to double by 2050 if no action is taken (Ref).
- Of the 70% of Australians who live in cities, six and a half million commute each day using private vehicles, mostly cars, and another 650,000, or 10%, use public transport.
- Road dominates Australian transport energy use, around about 75%, followed by aviation at 18%. Shipping is 4% and rail is 3%
- Compared to nearly all other countries, Australia is particularly dependent on aviation to shrink the long distances within our borders and also along our international transport routes.
- The transport sector is the second largest net energy consumer in Australia



Bruce Godfrey



Paul Bryan, Robert Hill, Margaret Sewell, Joelle Simonpietri

- This dependence means that Australia consumes about two tonnes of oil per person per year, which translates in to 246 million barrels of crude oil per year and an annual outlay of around about \$60 billion or 4% of GDP
- Our dependence on oil means that transport accounts for about 42% of the carbon emissions per household
- The debate does not centre on whether CO2 emissions from transport should be reduced but rather on the nature and cost-effectiveness of technologies, systems and public policies to achieve this reduction, to achieve sustainable transport.

### **The Materials Superhighway**

- The Materials Superhighway is a revolution that has great potential to replace the physical commodities, fuels and chemicals that we use today, including iron, aluminium, chromium and other minerals on which Australia relies for its export dollars
- Every physical material we use today is going to change over the next 30-50 years, just like everything has changed in the last 30 years with the digital age
- Coupled with the digital age, this will enable commercial development of products that are superior from the point of view of sustainability, lower cost as well as their physical features (lighter, biodegradable, non-toxic, stronger, highly adsorbent)
- Converging technologies such as 3-D printing of cars made completely of biobased materials will disrupt existing resource and manufacturing sectors of the economy
- Rapid advances in genetic technologies are accelerating the revolution. These will enable production at scale of entirely new products or products that can replace and out compete any that are currently produced from oil
- Every week, three transformed products enter the market, either in materials, fuels or chemicals. This trend is accelerating

- Australia must join this materials superhighway. To do so, it must encourage local technology development and incubation. Advanced fuels and chemicals, particularly aviation fuels, represent the most affordable and sustainable entry point

### **Opening Up Markets is a Good Thing**

- The idea of the oil market as a monopoly supplier of transportation energy and chemicals is dead. Consumers and customers such as aviation and defence are demanding low carbon products. They are driving the transformation and opening up new markets
- Protection is dead. Liberalizing markets, making more room for more technologies to come to market, more molecules to come to market, will empower the materials superhighway
- Virtually any biobased technology in the world is financeable and profitable on a 9% return. Sovereign funds need to come in and put money into these technologies
- Renewable diesel market will be next. It is already a reality in the US and around the world
- In regard to opening markets through innovation, Apple built their stores and changed the world. Same with Starbucks, Levi, Coca Cola
- Why is ethanol failing as a fuel in Australia? Who is selling that message? Propel's independent and profitable distribution of renewable transport fuels in California has dispelled the myth that ethanol is failing in the market by breaking up the traditional ways of selling ethanol.
- Opening markets is a great thing. A case in point is the opening up of Australian cricket by Kerry Packer and World Series Cricket. If you change the way that people access markets, you can change the world
- New technologies need a hand up but not a hand out – i.e. protect development

but not deployment. Once a technology has reached the top of the technology readiness scale, it should be able to survive in the market.

### Monetization of all of the Benefits of Renewable Energy

- Both NSW and California are extremely vulnerable to unchecked impacts of climate change; droughts will be business as usual going forward. In the US, traditional growing areas for crops are changing. The current drought in California is likely to be business as usual going forward. We have much to lose from climate change and much motivation to seek solutions
- California is motivated to change. The State Government started in 2005/6 with the introduction of the Global Warming Solutions Act of 2006. Its legislative designation was Assembly Bill 32. It aims to return California's total greenhouse gas emissions to 1990 levels by 2020. That is a significant goal in the face of significant population and industrial growth
- AB32 contains both regulatory and market mechanisms. It includes a cap and trade program for stationary emissions. It regulates non-stationary sources of

energy and requires a 10% reduction in greenhouse gas emissions by 2020. It is a market based and technology neutral mechanism. This has spurred incredible innovation in the State, including the emergence of companies such as Tesla

- The transportation arm of AB32 is called the low carbon fuel standard. Assessment of greenhouse gas emission reduction includes a complete lifecycle analysis of the production, processing, transportation, distribution and end use of all the competing fuels
- AB32 has generated a number of positive results. Electric vehicles, only in part because of the low carbon fuel standard, have grown from a negligible part of the fleet to 2% and rising briskly. Fossil based CNG, LNG and H2 have increased. Biobased natural gas production, mostly by anaerobic digestion, has increased greatly, although most of this is used for heat and power. Biodiesel and renewable diesel use has increased markedly, although most of it is imported from other States



Scott Nargar with the Fuel Cell car



Tony Haymet, Robin Batterham and John Baxter

- There have been a number of negative results. Distortions have led to “fuel shuffling” of cane ethanol from Brazil, although this so far mainly is connected with the Federal Renewable Fuel Standard. Opponents argue that California consumers pay most of the economic costs, but most of the benefits accrue to out-of-State fuel and vehicle producers. They also argue that initial success is the “low-hanging fruit,” while greater future reductions will be much more difficult and costly
- One reason is that renewable options can be PRICE-competitive, but not COST-competitive; renewable options have many advantages, but most do not lead to financial reward for investors
- The cost structure for finding a producing crude oil is low. For all of OPEC combined, the total cost of bringing oil to the surface, including exploration, production and surface facilities, everything but shipping to the end user, is under \$10 a barrel. Oil producers are making a fine profit. Ethanol and other alternative fuel producers are making only a marginal to decent profit because their costs are higher
- The benefits of biofuels and other low carbon transportation options are several. They reduce trade imbalances, reduce dependence on foreign oil, reduce GHG emissions, create rural jobs and increase the rural tax base, prevent disasters such as the Macondo well blow out in the Gulf of Mexico, and spur innovation in many areas including materials, crop genomics, applications to health and medicine
- However, in the absence of a carbon tax or other leveling mechanism, none of these benefits put a penny in the pockets of people who we are asking to invest
- There has to be a way found to monetize these other benefits of renewables in order to make them competitive with oil and excite the private sector. We need a penalty on oil producers for the greenhouse gas emissions of the supply and use of their products

- Sustainable transport policies will only be effective if investors can monetize the full value of the benefits and obligations and penalties are imposed on fossil fuel producers for their carbon emissions

### **Fuel Cell Vehicles**

- Fuel cell vehicles have a place in our future, provided that the hydrogen is produced from renewable resources and all players in the industry cooperate to install hydrogen refueling stations
- Fuel cell vehicle technology is maturing very quickly. Mass production of vehicles has commenced in the US and Japan
- Fuel cell vehicles have the range, power, speed, performance and safety profile of their oil-fuelled counterparts
- Vehicles emit water vapour, not carbon. However, in order to reduce greenhouse gas emissions to the maximum extent possible, fuel cell vehicles need a source of renewable hydrogen, not hydrogen as it is produced currently from steam reforming of natural gas
- Hyundai Australia is building a demonstration facility that will produce green hydrogen from water by electrolysis powered by solar energy
- Hyundai is rolling out its fuel cell vehicles globally. The EU has committed 17.9 billion euros over the next six years for hydrogen infrastructure and hydrogen technology. The US currently has 72 hydrogen fuelling stations. The number in the UK, Korea and Japan is increasing rapidly
- The many companies planning on introducing fuel cell vehicles into the Australian market will need to cooperate to put in place the hydrogen re-fuelling infrastructure, which does not exist in Australia at the moment. The Australian hydrogen project, which involves both public and private sectors, is part of the forward planning being undertaken currently



## Electric Vehicles

- Electric Vehicles have a place in our future, provided that the electricity is produced from renewable resources
- Electric vehicles are only as emissions free as the process by which the electricity is made
- Charging stations for electric vehicles at home need to be on a timer so that they are not used at peak times but rather at times when household power demand is lowest
- It is even better to place charging stations in workplaces. This breaks down the psychological barrier of “range anxiety” and enables local micro grids to utilize all sources of electricity during the day when demand is high, including the batteries of fully charged but idle electric vehicles
- To illustrate what can be achieved, the University of California San Diego has established its own micro grid to service the campus which is populated during the day by 45,000 people and includes several energy intensive institutions, such as hospitals

- Micro grid components include rooftop solar, battery storage, cold-water storage and electric vehicles. Smart grid technologies are used, such as powering down when cloud cover is approaching, turning down heat in the libraries until the students arrive

## Digital infrastructure

- Digital infrastructure will have a pervasive and profound effect on the economy in general and transport in particular in the years to come
- The way we as humans interact with digital technology will change dramatically, become much more transparent
- The way we communicate is going to change. We will be omnipresent, able to connect to people and places with far greater reality than we’ve seen in the past
- In the future, we may be able to think and translate thought directly into action, without the need for access to a screen. We may find ourselves staring into info space and making gestures



Susan Pond



Richard Altman

- We will have the ability to measure everything in our environment and exert greater control. Today, there are 10 billion devices connected to the Internet. In the next 20-30 years, this number will be 10 trillion. This “Internet of Things” will lead to and be enabled by incredible development of cellular networks and scaling up of computer power
- Machines will continue to become more intelligent in line with the accelerating and massive scale up of computer power, data processing and data storage
- As a result of these transformations, digital infrastructure is going to substitute for physical infrastructure
- This will change the nexus between work and location because a fully immersive communication environment with professional grade telepresence systems will enable people to do everything from home that they currently do in an office.
- This will lead to a boost in productivity. It will also reduce our need to commute and to park
- About 30% of urban congestion is due to people looking for car parking spaces. Communications infrastructure will enable a driver to locate and book a space remotely, and drive straight to it
- These sensor and vehicle to vehicle communications technologies are also creating the platform for self-driving cars
- All of the major manufacturers are planning to introduce fully automatic, self-driving cars by 2020. After-market kits will increase the rate of diffusion of self-driving cars into the fleets
- Self-driving cars enable substantial system wide optimization. They also enable reduction in road capacity required for the future
- Modelling suggests that every car will be self-driving by 2040. In this case, the road capacity required by 2050 will be exactly the same as it is today

- A major advantage of self-driving cars will be the reduction in road accident deaths. The accident rate for current self-driving vehicles much lower than for human-driven vehicles because most accidents are caused by human error
- Digital infrastructure will lower the carbon footprint of transport by taking a huge load off overall infrastructure and increasing the capacity of the electricity grid to take up and effectively distribute renewable energy
- Digital infrastructure will bring together transport modes such as fully autonomous vehicles, car sharing, electric vehicles and mass transit into a system that could remove 9 out of 10 cars from the road. Digital infrastructure is additive today but in the future it will be substitutive
- A major emphasis going forward needs to be placed on the resilience of the digital infrastructure, including its security, and its (renewable) power supply

### **Clean Energy Revolution**

- The clean energy revolution represents a tremendous opportunity for business and entrepreneurs, for national security and for our collective solutions to climate change
- Much like the digital revolution, the clean energy revolution is beginning to change the way we live, now we interact with our environment, the way our homes and offices are constructed, the way we transport people and goods
- Global investment in renewable energy has grown five-fold in the past 10 years alone, from \$40 billion in 2004 to \$214 billion in 2013
- Renewables are a 21st-century technology-driven model. As the technology improves and productivity increases its price will continue to decline
- By contrast prices of hydrocarbons, which are finite commodities, are cyclically based, unstable and subject to the vagaries of supply and demand shocks. In contrast, prices for renewable energy from resources which are infinite – e.g. solar and wind energy – are rapidly decreasing and becoming competitive in the market

- The sweeping changes to its energy policy across the diverse branches of the US Department of Defense are being made for one simple reason - operational effectiveness. In seeking to reduce its consumption of energy and reliance on foreign sources of oil, it is significantly increasing its use of renewable energy
- Navy Secretary Mabus has announced the Great Green Fleet initiative, which is planning to use biofuels to power ships. Not only would this decrease the Navy's carbon footprint, it would be less dependent on shocks in the global oil market. The Navy also has also introduced its incentivised energy conservation program. This encourages efficient ship operations. In 2011, this helped achieve over 1.1 million barrels of fuel in under burn, a costs saving of over 11 per cent
- The trends in the past decade in the area of clean renewable energy and energy efficiency are impressive. Recent advances in solar energy, onshore and offshore wind, biofuels and biomass, hydroelectric power, fuel and energy efficiency, co-generation, even ocean wave technology, are driving the growth of the clean energy industry.
- From virtually zero production 10 years ago, the global automotive industry has produced 8 million hybrid vehicles. The US is the largest market with 3 million

hybrids on US roads today. In terms of pure electric vehicles, US production is booming, up 67 % last year. Tesla has passed Toyota as the biggest automotive industry employer in California, with a full labour force of 6,000 versus Toyota's 5,300

- The US Government energy policies are supporting many strategies to transform the energy consumption profile of the transportation sector, to undertake research, development and deployment of advanced fuels and to improved vehicle efficiency – including through the introduction of national standards for vehicle energy efficiency
- The emerging, and increasingly competitive energy technologies such as renewable electricity and batteries could completely disrupt the status quo of current utility models. For this reason, Barclays, the British banking giant, late last year downgraded the electricity-generating sector of the US high-grade corporate bond market in its entirety
- It is clear that market and technology trends are making renewable energy the staple power for our economies. This trend will grow dramatically over time



Jim Lane



Richard Altman, Hugo Llorens, Susan Pond, Jim Lane and Paul Bryan

### **Next Long-Wave Economic Cycle in Energy**

- We are on the verge of the next long-wave economic cycle in energy
- Renewable energy technologies are finally moving out of the phase of early deployment requiring government support into the phase of the private sector beginning to invest and businesses and communities are taking them up
- These economic cycles are decades long. It has been 40 years since photovoltaic technology research began in earnest. It is only now that its full potential is being recognized and brought into reality by the market. Similar comments apply to fuel cells
- We need to remember that the whole point of transport is mobility. Mobility is all about meeting the accessibility needs of people
- We are earlier in the economic cycle with electric vehicles. This leads to an interesting question for Australia. How much of this new revolution is Australia going to get as a macro-economic contribution to our economy as opposed to just being a taker and a buyer of others innovation and technologies?
- In a carbon emission life cycle sense, electric vehicles will not be low carbon without a renewable electricity supply. In Australia, to have a positive impact on emissions, electric vehicles will need to be supplied by an electricity generation system that produces less than 600 tonnes CO<sub>2</sub> per GWh. If not, vehicle emissions from gasoline or diesel cars will be lower than from electric vehicles in the Australian States that depend on coal or gas for electricity
- Electric vehicle infrastructure cannot be put into place without a strategy for greening the grid and ensuring that the costs are distributed equitably
- Greening Australia's grid will be a long and complex task. Customers will not tolerate any less reliability or quality of supply than they have now
- Australia does not have many large-scale, high-capacity, low-carbon options for electricity generation. It has more distributed generation options, such as

solar and wind, with or without storage. Electric vehicles and other battery systems can bring the storage option closer to reality and enable greening of a significant proportion of the transportation sector

- The risk that those least able to make the transition to distributed generation will end up paying more for power than customers who can needs to be managed
- The strategy for successful introduction of electric vehicle infrastructure, which will be a great cost and effort, needs to cover who is going to pay for the greening of the grid, when and how. Grid management will also become an increasingly important part of the strategy
- The upside opportunities for technologies such as electric vehicles are many. Utilities and regulators will start to embrace new business models for their sectors that will enable user and supplier to win. Increased generation of low-carbon electricity will enable greening of buildings and the transportation sector. This will reduce demand in other sectors, which frees capital up in new infrastructure for those sectors, capital that can be invested in greening of the electricity sector
- Australia will not get away from the fact we still are going to need large-scale electricity supply. However, our whole electricity system is going to be very different in 2050 than what it has traditionally been.
- We are on the cusp of that transition now. It will be important to manage that transition well so that it is not completely disruptive to our society and our economy

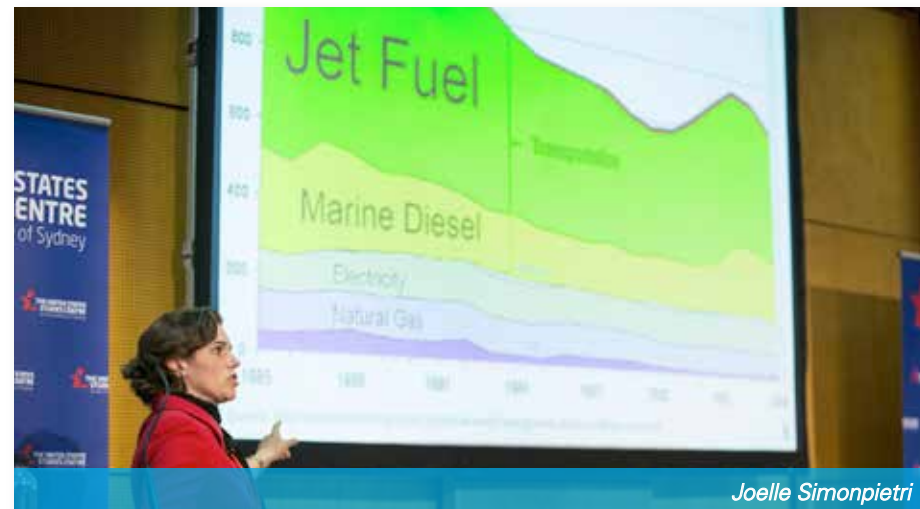
### **Alternative Aviation Fuels**

- Aviation is a transport mode that is committed to liquid fuels and to international industry goals to decarbonise
- Even though aviation consumes only 5% of all transportation energy in the US, the sector is proving to be effective in leading the development of the renewable fuel industry.

- In the US alone, commercial aviation consumes 25% of global demand for jet fuel, 85% of which flows through just 32 locations, i.e. major airports
- The public private partnership Farm to Fly Program, which focuses on the development of sustainable aviation fuels, is proving to be effective in the US and is a model that could work in Australia
- Airline demand is there, as demonstrated by a myriad of airline initiatives worldwide. Technologies are ready. The supply chain is established and operating for a few feedstocks. Lignocelulosic feedstocks have been slow to develop but will reach their potential
- The airport in the city of Atlanta burns more aviation fuel than the entire United States Navy in a single year. The basis of aviation's partnership with Defense is that it brings big volumes
- The current Farm to Fly 2.0 is supporting the goal of the US Department of Transport of production of one billion gallons of renewable jet fuel annually by 2018 from regional supply chains
- The foundations for many success biofuel production models are being laid down through this program which is a public private partnership supported by the Commercial Aviation Alternative Fuels Initiative (CAAFI), its four underpinning organizations and numerous partners, including US Defense, US Department of Agriculture and the US Department of Energy
- Strong leadership from Government is critical to the success of this program. The partnership between the Secretaries of the US Department Agriculture and Navy is a critical success factor
- Over half of US States right now have programs that qualify as State-level biofuel programs
- CAAFI has led the qualification of alternative jet fuels. Three pathways have been qualified by ASTM thus far and there are more to come
- Success depends on strong leadership and on strong engagement by the feedstock owner/producer with fuel producers, customers and government



*Helen Sargent, Graham Blight and Andrea Koch*



*Joelle Simonpietri*

- Any facility producing renewable jet fuel will also be producing other products, such as fertilizers, feed, de-icing fuels, and high value chemicals. The product mix will depend on the local feedstocks and local needs
- Several regional production facilities are being developed now in US States and regions, including in Connecticut, Florida, California, Virginia and Maryland
- Several airlines have entered into partnership with fuel producers. Examples are United Airlines with AltAir fuels, Alaska Airlines with Hawaii Bio, Southwest Airlines with Red Rock, Cathay Pacific with Fulcrum, British Airways with Solena, and Air France with Amyris and Total
- Successful State activities require strong farmer/feedstock producer engagement. In the US model, they also require an unbiased leader from a not-for-profit organization such as CAAFI, people who are extremely well connected politically in the State, and clear drivers relevant to the region, such as avoiding job losses or creating jobs, environment, repurposing of infrastructure etc. and a product portfolio that appeals to customers and investors and meets their needs
- Examples of State-based projects include: municipal solid waste in Connecticut; run-off from dairies in Vermont; woody biomass in South Carolina, and sugar beets in Florida
- Small producers in Australia could enter the renewable liquid fuel market, by making one of the boutique fuels for military purposes, e.g. JP10. JP10 is a really great fuel in the sense that it is a small market. It sells at a premium, of about \$25 a gallon.

### **US Military Energy Strategy**

- US Department of Defense commitment to increase energy security, energy efficiency and use of low carbon fuels will have global impact
- Petroleum is a very volatile commodity, second only to natural gas, as one of the most volatile priced commodities in the world. Demand for petroleum is

still large and inelastic and the US economy, people's jobs and livelihoods and expectations for the future tend to be closely tied to petroleum

- The US Quadrennial Defense Review considers that in the coming years competition for resources, including energy and water, will worsen tensions and possibly escalate regional into broader conflicts
- Trade flows through the South China Sea, including of LNG and oil, make this region critical to the national security and energy strategy of the US and Australia
- US Defense associates transportation of fuel and water along supply lines with heavy casualty losses and a significant military vulnerability
- The US Department of Defense has invested in energy efficiency, new technologies, and renewable energy sources to make it a stronger and more effective fighting force and more energy secure
- This energy strategy has three themes - more fight less fuel; more options less risk; more capability, less cost
- Energy improvements will enhance range, endurance, and agility, particularly in the future security environment where logistics may be constrained, decrease annual expenditure on fuel, and mitigate budget uncertainties
- The efforts include reducing fuel consumption by increasing efficiency and new technologies such hybrid propulsion ships or ships and aircraft operated on biofuel blends
- The US Air force was the first service to certify all of its platforms to operate on renewable fuel. The US Navy develops public private partnerships to procure ongoing supply, in addition to certification
- The Great Green Fleet is part of the US Navy's energy program directed specifically at renewable fuels. The Great Green Fleet will be made up of the

scheduled operations of existing fleets using biofuel in blends starting at 10% in January 2016

- The Navy has taken the initiative mainly because of the economic and operational realities that it faces. Its operating budget can change by tens of millions of dollars with every \$1 change in the price of a barrel of oil. In any five-year period, this can cause serious disruption to the US defense budget
- The 2016 activities around the world will highlight deployment of ships and aircraft with energy conservation measures or alternative energy for propulsion. This will be the new normal for US Defense
- The US Navy will need to purchase renewable fuels from international suppliers, including in Australia. Australian Navy vehicles participating in Great Green Fleet activities will need to be certified to operate on renewable fuels
- US Defense is about to bring out its solicitation for supply in the Western Pacific. This will be the first international biofuel solicitation by the Department. The solicitation is for fuel available from commercial suppliers, not from those at the R&D stage.

- The solicitation is open to any international supplier that can meet the specification for military grade fuels and we are actively looking for international suppliers. The fuels do need to be cost competitive

### **Australian Government Energy Policy**

- The US and Australia have different perspectives on energy security
- In contrast to the US, Australia is not focused on self-reliance and not nervous about the dependence on others for its fuel supply
- In contrast to Australia, US farmers have seen an economic opportunity in the renewable fuels industry, have influenced their legislators and played a significant part in some of the renewable energy targets that are based on agricultural products
- Any attempt, initiative or proposal to move towards zero emissions transport in Australia will have to be framed in the context of the current Australian Government Energy White Paper



University of NSW and University of Technology, Sydney engineering students



Hugh Bradlow

- The White Paper is very much a statement of principles based on three key considerations
  - » Increasing competition to keep energy prices down
  - » Increasing energy productivity
  - » Increasing investment in Australia's energy future
- The Australian government is committed to the development of a national energy productivity plan that will address the opportunities to improve, the largest of which are light vehicles and buildings. The government has the specific goal of increasing energy productivity by 40% by 2030
- Australian Government investment in the nation's energy future will be on a technology neutral basis. The government is less inclined to intervene in the marketplace to pull through any particular outcome. It is looking to all sectors to develop emerging energy technologies, whether it is on a first-mover or fast-follower basis, and to pull them through commercially.
- The Australian Government does have strong interest in the electric vehicle sector, including hydrogen fuel cell vehicles. It is relying on industry to tackle some of the barriers to uptake of alternative fuels and zero emission fuels, including consumer acceptance and uncertainty, fragmented infrastructure and vehicle conversions

### **Systems Approach to Low Carbon Transport Policy**

- Policy development is a multifaceted process. Policy objectives need to be clear because the outcomes of targeting one objective will be very different from targeting another
- Possible objectives in the field of zero emissions transport policy in Australia include:
  - » Encourage development of a local fuels industry with flow on effects, particularly in regional areas

- » Increase the uptake of zero emissions fuels, regardless of whether or not they are imported
- » Increase the uptake of electric vehicles to soak up a current surplus in electricity generation
- » Encourage Australian production of electric vehicles to re-build automotive manufacturing

- Two big unknowns in Australia today are the pending bipartisan agreement on the Renewable Energy Target and the agreement at the Paris Conference in December on Australia's post-2020 emissions reduction target
- The decline in vehicle manufacturing in Australia will make it easier to bring in more stringent fuel efficiency standards. This will be a large part of the national energy productivity plan
- Policy makers should not be surprised at how fast the energy revolution is coming this is coming. The solar revolution in NSW is a case in point. Almost 300,000 households (17%) have installed solar PV.
- The rapid pace of change means that governments need to adapt quickly
- The NSW Government is committed to transitioning to clean, safe and affordable energy. It needs to change the centralized, one-way flow electricity market to a two-way flow to allow renewable energy to flow. Unless this achieved, adding more electric vehicles in Australia could actually increase carbon emissions through the additional use of coal-fired electricity generation
- There are many issues to work on in relation to the grid— smart grid technologies, grid infrastructure, connectivity, and transmission and distribution loss. Government will need invest in this infrastructure

### **Government Leadership at all Levels is Essential**

- The US Navy's vision, statement of goals, metrics and targets are profoundly changing the way it operates



- This policy leadership is proving to be effective not only for the US military but also the commercial sector
- The leadership has led to substantial leveraging of the actual cash investment by the Navy in the form of much greater co-investment by the private sector
- No investor will enter the market when policy surrounding a carbon regime is unstable. Instability stalls innovation, stalls development, and more importantly, stalls and reduces deployment
- Transitioning to low carbon transport is more a matter of deployment than development. If Australian governments do not choose to invest in the requisite overhaul of electricity infrastructure to enable deployment of electric vehicles operating on renewable energy, Australia will not attract a large electric vehicle fleet
- Electric vehicle manufacturers will not fully fund this infrastructure change. There is not enough money in the private sector. Electric vehicle companies will invest their development dollars in countries that give them more favourable terms to do business
- A realistic cost of carbon should be applied to all industrial activity. The US as a whole has mandates for liquid fuels in the form of the Renewable Fuel Standard. These are associated with a dollar value for the % carbon reduction.
- Targets for low carbon transport in Australia should be viewed in much the same way the Renewable Energy Target (RET) for electricity generation. This would provide impetus to drive a commercial industry
- Unless governments in Australia actually take a stand, the market may well decide to increase its reliance on coal
- There are clear opportunities for local and State governments to get behind electrification of certain segments of the transport system
- Australia has cheap power right now and surplus capacity. That is not going to be the case for long and most of that capacity will be 50 years old by 2020
- We need to have a plan for an orderly transition of those generators out of the market and into uptake of storage through EVs or batteries, embedded generators, smart meters, a smart grid



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- It is the role of policy makers to start to think about it, because the transition has started and we can't tolerate a sudden, chaotic situation, which will happen unless we formulate our plans
- If there is significant electrification of the fleet, it will increase electricity demand and make it all that much harder to retire coal power plants
- Getting to a zero transport carbon target does require both public policy and behavioural change
- The science and technology are there for us now to be able to make some large steps forward, it is going to require a policy framework to take full advantage of those technological changes
- This in turn will require public opinion that significantly reducing carbon in this sector is an important thing to achieve.
- Politicians will listen to a public that actually does believe that and is urging them to take the forward-looking decisions
- If we don't lay out the challenge, our plan and how we are going to work together to achieve it, we won't get there
- We need public private partnerships to create a grand plan for low carbon transportation. This should engage governments at all levels and all of the many departments that have responsibility for various parts of the system.

## ABOUT THE AUTHOR



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Dr Susan Pond is Adjunct Professor in Sustainability and Leader of the Alternative transport fuels Initiative at the United States Studies Centre at the University of Sydney. Her interests include accelerating the transition to alternative fuels for transport, particularly by sectors with critical needs, such as aviation and shipping. Previously, Dr Pond held senior leadership and executive roles in business and academia, including Chairman & Managing Director of Johnson & Johnson Research Pty Limited. Dr Pond is Vice President of the Academy of Technology, Science and Engineering and Board Member of Engineering Sydney and Biotron Ltd. Most recently, she was a board member of the Australian Nuclear Science and Technology Organisation (ANSTO) and Innovation Australia.

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