



SPECIAL REPORT

NEW ZEALAND WIND ENERGY OUTLOOK 2010

ANALYSING THE CHALLENGES AND THE
PATHWAY AHEAD

ENDORSED BY:



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Wind Outlook – From the Editor

Electricity generation from the power of New Zealand’s wind just makes sense.

All over the world, and in much less windier places, wind farms are being built at a rapid rate.

Factors such as: the continual thirst for electricity from growing economies; advancements in wind turbine technology; declining other sources of energy, and; incentives for renewable generation around the world, are fuelling this growth.

But in our small, pristine natural environment, the physical, visual and even aural footprint of the wind farm have emerged as factors needing careful if not unique attention for New Zealand. And this problem applies to both developers and the law of the land.

Electricity has been cheap for years in New Zealand on the back of hydro schemes adequate to power the country, cheap Maui gas, and the socialised or hidden nature of the costs of delivering electricity in the pre-reforms era.

But this is now changing, and electricity prices are on the rise.

Wind farms are seen by some as expensive to develop at present and it is hotly debated as to whether they are economic at current electricity prices without any form of subsidy or incentive.

But, with rising gas prices, an emissions trading scheme and a few other exceptions, only geothermal generation stands in the way of wind generation as the next most desirable form of electricity generation.

The variable nature of wind slots nicely into the march towards the smart grid where a much more dynamic electricity system evolves.

This Wind Energy Outlook provides coverage around current and proposed wind farms in New Zealand and an overview of the issues the wind movement faces.

The technology is amazing. I climbed up one of the Te Rere Hau turbines in 2008 when the Manawatu was enjoying a steady 40 knots – what an awesome renewable resource.

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PREVIOUS PRINT REPORT: Advanced Metering Infrastructure. Enabling New Zealand’s smart grid

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Peter trained as a journalist and was most recently employed as senior communications advisor at the Electricity Commission. Prior to that he has worked at Mobil and Telecom, also in communications roles. He has a strong understanding of the energy sector.



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The rise of the wind farm

New Zealand has frequently been described as “the Saudi Arabia of wind” - implying a rich resource is there for the taking.

But rather than an army of wind farms dotting the landscape to tap the rich gusts and meet our growing power needs, wind farm development has been slow to take off.

For those in the wind farm industry and those wanting to promote a more sustainable electricity mix, the speed of development has been frustrating.

Pragmatists will say that all electricity generation projects are challenging to get away, and that wind generation in New Zealand has now passed the frontier stage and some very promising developments are beginning to commence.

But all will agree that the process around resource consenting has become one of the biggest drags on local wind farm development.

Perhaps too we will see the early opportunists that engaged in a land grab around many potential sites in New Zealand fall by the wayside as their hopes for lucrative government subsidies fade.

ON WIND FARM ECONOMICS AND LONG RUN MARGINAL COST (LRMC)

“LRMC is effectively meaningless for a wind farm because while it might tell you the cost, it doesn’t give you any indication of the value of an investment for a company in terms of spreading its generation geographically and in terms of fuel source”

Adam Muldoon, wind development lead – Meridian Energy

There are many proposals and ideas for wind farms on the table in New Zealand but many are not evolving into actual projects flowing through to the order books of turbine manufacturers. Those order books are being filled by overseas countries fuelled by large subsidies and different electricity generation dynamics.

INCREASING WIND FARM DEVELOPMENT A CASE OF WHEN, NOT IF

Fraser Clark, chief executive officer of the New Zealand Wind Energy Association (NZWEA) says that risks around fossil fuel supplies and the cost of carbon are driving wind

investment globally. Whereas New Zealand, he says, has experienced long term regulatory uncertainty around the price of carbon.

“This has had an impact on investment,” he says. “Trustpower had said it would not commit to the Mahinerangi wind farm until we had a price on carbon.”

“We now have a price, although there is still some uncertainty, albeit shrinking, around the planned price review in 2011”

New Zealand has some of the best conditions in the world for wind farms. The country’s position in the “Roaring 40s” and its long, stringy and rugged geography provides for this endowment. It provides a long barrier in the way of the strong and regular winds coming off the surrounding seas. These strike the hills and mountains and accelerate upwards creating near perfect conditions for wind generators.

The high energy yields of the recently commissioned West Wind farm and the wind farms of the Manawatu are among the best in the world. The commercial viability of such projects is supported by the fact West Wind and the under-construction Te Uku wind farm are, according to an industry expert, the only farms in the world developed without some form of subsidy.

A Connell Wagner (now Aurecon) study for the Electricity Commission said that the country’s wind generation potential capacity was a massive 41,000 MW producing 130,000 GWh a year. To give that figure some perspective the country’s current total generation capacity is about 9000MW and annual demand is about 40,000 GWh.

While no-one seriously believes that we could ever exploit more than a relatively small portion of that resource, there is no denying that the wind opportunity in New Zealand is still huge relative to our total energy needs.

At current electricity demand growth of about 2 per cent a year it would take many decades to make a dent in the resource, given that we would still have our hydro and geothermal (and presumably some gas and coal) generating a large portion of our power.

And while we can’t export electricity directly, the economic opportunity a massive and low cost energy source might provide in a resource- and carbon-constrained future, could make the country an attractive manufacturing investment option that other countries reliant on coal- and gas-based electricity may find hard to match.

WIND FARM DEVELOPERS FACE MULTITUDE OF FACTORS

Clark says that wind farms help electricity generators manage fuel and energy risks. "Wind is more reliable over a year than hydro and it is free, so it becomes a useful hedge against the risks of rising energy costs and no rain."

Wind could also be a good limiter on electricity prices. "They could rise an awful lot faster if relying on scarce or competitively sourced fuels," he says. "Even water is becoming competitive due to the pressures of agriculture and recreation. Wind will pull down spot prices although it will still have to recover its long run marginal cost."

Connell Wagner's analysis says the majority of that opportunity is in the North Island, particularly the lower half. The country's largest windfarms are in the Manawatu and Wellington hills, where a number of other significant projects are also planned. (For a full list of wind farms operating in New Zealand and those in various stages of development, see pages 14-15).

IMPORTED TURBINES PROVIDE FOR HIGH COST SENSITIVITY

Wind industry participants say that wind farm economics are highly sensitive to capital costs. This includes turbine costs, development costs and associated transmission investment.

Turbine costs have increased in double digit percentages in recent years. The global subsidy-driven boom inflated demand and manufacturers could not keep up, making it a sellers market who could pick and choose their projects.

The recent economic downturn has seen prices come back somewhat with the cancellation of orders, along with the emergence of some Chinese manufacturers, but there are few other downward pressures on prices.

This is making it hard to plan and it is believed a number of planned and even consented projects are unlikely to go ahead. The Electricity Commission's recently released annual security assessment has significantly downgraded the amount of wind and other new generation it expects to see coming into service by 2011, pushing back over 400 MW to 2013 and beyond.

Brett Hewitt of major turbine manufacturer Siemens, which supplied turbines to Meridian for West Wind and now Te Uku, says that even with minimal infrastructure spend, large projects were hard to get over the line. He believes that a number of sites that had consents were unlikely to be viable.

KEY TAKEAWAY #1:

NEW ZEALAND IS DEVELOPING WIND FARMS WITHOUT GOVERNMENT SUBSIDIES OR INCENTIVES

He says there was a reasonable "corridor of opportunity" from the Wairarapa to Hawkes Bay, but he doubted much would happen soon.

"There are maybe one or two projects that could be built in the next few years but the pipeline of projects is pretty thin."

"The development market is still immature," he says. "We still only have two developers of any scale – Trustpower and Meridian. Other developers are having trouble making their sites economic."

Wind generation lead at Meridian, Adam Muldoon, agrees and says that it is difficult to get a handle on which projects are 'real'. He said expectations had been unreasonably fuelled all round by a land grabbing mentality. Speculators had rushed to lock-in sites expecting some form of subsidy, so land and access prices had been bid up. Most

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of those projects have stalled, but that had left 'real' wind farm developers to deal with a legacy of unrealistic expectations on rentals from land owners.

THE TRANSMISSION IMPACTS – PRICING METHODOLOGY AND FARM LOCATION

Sensitivity to transmission costs has been demonstrated by TrustPower which has said its 200MW Mahinerangi farm will only be built up to 30MW due to the current cost allocation of HVDC transmission charges. Another example is Te Uku - its capacity has been reduced by 20 MW below the consented level to 64MW, saving around \$6 million in transmission costs.

Transmission costs can be a significant hurdle for wind developers due to the often isolated locations that are preferred for wind farms. The current transmission pricing regime requires that the beneficiaries of non-core grid assets should pay the full cost of new investments. That means that first movers into an area may be disadvantaged as they face the full cost of new lines from day one, while later comers face much lower costs. Small windfarms struggle to afford such costs and it's unlikely to be a coincidence that the Wellington and Manawatu windfarms are close to major transmission lines.

DIFFICULTIES AROUND TRANSMISSION PLANNING

"When there is so much speculation and uncertainty around these farms and so few putting in money it's hard for the regulator or Transpower to 'take a punt.'"

Kieran Devine, system operator – Transpower



But there is also a chicken and egg situation. Lines tend to take significantly longer to plan and build than wind farms, but the electricity rules and investment discipline limit the ability to pre-invest when plans and sites are uncertain. It may also be driving large scale developments to make the cost affordable even if the sites aren't the 'best' in terms of generation performance.

Developers, planners and regulators are struggling to deal with this complex issue according to Kieran Devine, system operator at Transpower. "When there is so much speculation and uncertainty around these farms, and so few putting in money, it's hard for the regulator or Transpower to 'take a punt.'"

The Electricity Commission has in part recognised this

issue when it established a 'Transmission to Enable Renewables' project to investigate the dichotomy.

THE MOVING TARGET THAT IS THE RESOURCE CONSENT PROCESS

While commercial and site considerations may be playing a significant role in the shaping of the New Zealand wind industry, one subject stands out in terms of the concerns it raises and the emotional response of industry – resource consents.

There appears a strong perception that a long, expensive and unpredictable resource management process is unnecessarily, if not unfairly, hampering development by poorly weighting competing interests. The recent rejection of Meridian's \$2 billion 630MW Project Hayes proposal has produced some strident criticisms. Meridian is reported to have spent \$7.9 million on the project to-date.

The decision's rejection of Meridian's cost-benefit analysis and its call for consideration of the costs and benefits of alternative projects has left some incensed and is being perceived as changing the role of the RMA.

Meridian chief executive officer Tim Lusk says the decision has implications for all big projects. "It's not just the implications that this decision has for Project Hayes or other big renewable energy projects that concerns us," he says. "This decision represents a major obstacle for all manner of infrastructure projects such as roads or transmission lines; anything that has a significant impact on the environment."

"Under the decision as it stands, a comprehensive and explicit cost-benefit analysis of a project is now required," he says. "To satisfy this test an applicant must not only quantify all the costs and benefits of its project, it must also meet an economic test which requires evaluation against other hypothetical projects. This expands the RMA process into an economic management system controlling all new generation and is a significant hurdle for any future applications."

But Wellington resource management lawyer James Gardiner-Hopkins, a partner at Russell McVeagh, has a different view. He says that where there are significant adverse effects and matters of national importance in play, thorough cost-benefit and consideration of alternatives has always been required. Though he does believe that the Court would have gone too far if it was requiring a comparison with all realistic alternatives, or that Project Hayes be shown as a superior to all alternatives.

"The RMA is not about licensing areas, or necessarily securing the 'best use' - but about achieving sustainable management of any particular resource."

But ultimately, he says, Project Hayes was declined because the Court found that it would be an inappropriate place to build the wind farm in such a nationally important natural landscape.

Of course up until the Environment Court decision, the Project Hayes site had never been identified as an Outstanding Natural Landscape. This was never contained in the district plans and so the issue becomes identifying these landscapes before wind farm or other infrastructure developers move into the consenting phase of a proposed project.

A similar decision was reached in the Unison Te Waka case, although the Court gave significant weight to Maori issues as well.

Gardiner-Hopkins says the key issue emerging from the case law for wind farm developers is how to balance the national benefits of wind farms, such as climate change advantages and meeting energy needs, against what are often significant local effects. While other major infrastructure developments face similar hurdles, he says the issue is particularly acute for wind farms, which often have significant visual or landscape effects on landscapes of high value.

A number of industry observers and participants noted the apparent irony that protecting an unobstructed view

of a few hillsides in a country where thousands of such views existed seems more important than it is in countries with limited undeveloped space such as Germany.

The anxiety over resource consents is frustrating developers and suppliers. Hewitt of Siemens says there is huge uncertainty in the market over recent court cases.

KEY TAKEAWAY #2:

THE WIND FARM SPECULATOR-DRIVEN LAND GRAB AROUND NEW ZEALAND HAS LEFT LAND OWNERS WITH UNREALISTIC EXPECTATIONS OF LAND RENTALS FROM WIND FARMS

“We in New Zealand spend an inordinate amount of time in court trying to please a small minority,” he says. “Our company is getting pretty nervous about the ability to build projects, and this affects our ability to attract resources from within Siemens.”

SMALLER FOOTPRINT WIND FARMS – EASIER TO DEVELOP?

Windflow Technology is the only wind turbine manufacturer in this region and it has pursued a very different commercial strategy to the major manufacturers

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Operating Wind Farms


TARARUA WIND FARM		
Capacity	161MW	
Ownership	TrustPower	
Location	Tararua Ranges, Manawatu	
Turbines	3 stage build: 1 & 2) 103 x Vestas V47 0.66MW, 3) 31 x Vestas V90 3MW	
Built	1999-2007	

WEST WIND		
Capacity	143MW	
Ownership	Meridian Energy	
Location	Makara, Wellington	
Turbines	62 x 2.3MW Siemens	
Built	2009	

TE APITI		
Capacity	90MW	
Ownership	Meridian Energy	
Location	Tararua Ranges, Manawatu	
Turbines	55 x 1.65MW Vestas	
Built	2004	

WHITE HILL		
Capacity	58MW	
Ownership	Meridian Energy	
Location	Mossburn, Southland	
Turbines	29 x 2MW Vestas V80	
Built	2007	


TE RERE HAU		
Capacity	48.5MW	
Ownership	NZ Windfarms	
Location	Tararua Ranges, Manawatu	
Turbines	97 x 0.5MW Windflow 500	
Built	2006-ongoing	


HAU NUI		
Capacity	8.65MW	
Ownership	Genesis Energy	
Location	15-20km southeast of Martinborough, Wairarapa	
Turbines	7 x 0.55MW, 8 x 6MW Enercon E-40	
Built	1996	




Single Turbines



GEBBIES PASS		
Capacity	0.5MW	
Ownership	Windflow Technology	
Location	Christchurch, Canterbury	
Turbines	1 x Windflow 500 0.5MW	
Built	2003	

WELLINGTON WIND TURBINE		
Capacity	0.225MW	
Ownership	Meridian Energy	
Location	Brooklyn, Wellington	
Turbines	1 x Vestas V27 0.225MW	
Built	1993	

SOUTHBRIDGE		
Capacity	0.1MW	
Ownership	Energy3 Generation	
Location	Southbridge, Canterbury	
Turbines	1 x 0.1MW	
Built	2005	

such as Siemens and Vestas. Windflow now has 65 turbines “up and spinning”.

The Christchurch company believes the future for New Zealand is not bigger farms with massive turbines but smaller turbines set in low key, low visual impact farms, connecting or embedding themselves more into local electricity networks. They not only are able to cope with the lack of subsidies but are built to handle the consequent need to locate in high wind sites to ensure maximum generation yield.

Windflow marketing manager Sheralee MacDonald says the development options widen with smaller turbines. “Our turbines make it easier to do small projects,” she says. “You have a wider range of options and can access more places and make use of existing distribution and roading networks - you can make a project more cost effective per kilowatt hour.”

She says the appetite around wind farms has changed. “Big wind farms are getting big opposition. The consenting environment is quite uncertain and Hayes has put a much bigger risk around this.”

“By contrast our Long Gully project (in Wellington) went through fairly well,” MacDonald says, although Long Gully is now also in the appeal process.

THE PROJECT HAYES DECISION

The decision's rejection of Meridian's cost-benefit analysis and its call for consideration of the costs and benefits of alternative projects has left some incensed and is being perceived as changing the role of the RMA.

MacDonald believes that regulators could remove some of the consenting fear around mid-range projects - which end up encouraging large projects - by providing certainty over where it is ok to place windfarms and where it is not.

TrustPower's wind generation lead, Deion Campbell, says New Zealand should consider the German approach that uses guidelines for managing common issues and provides development envelopes which allow flexibility within them so that developers aren't locked into a single type of turbine if technology or economics change.

Clark says the Wind Energy Association is following such a path. “You need to understand your site to know what the risks are. We have seen more flexibility in resource consents with different companies taking different approaches.

Some have specific designs for a site while others are more looking for a development envelope within which they could pursue a range of turbine configurations. This has posed some challenges in the consenting process and approaches are still evolving.”

He says one of the issues in the consent process is lack of consistency of information required. The association is trying to gain agreement on a range of guidelines about what kind of information is needed and how things such as noise will be measured, and looking to develop best practice guides for developing a windfarm.

“If we can get agreement on the process and what information is required then you can quickly move onto the important things that the RMA is all about which are effects and mitigation,” says Clark.

THE CASE OR NOT FOR GOVERNMENT SUBSIDIES FOR WIND FARM DEVELOPMENT

Siemens' Hewitt says the lack of progress with wind farm developments means it can be hard getting the attention of, and resource commitment from, corporate decision makers. Particularly when there are significant subsidies being doled out by richer overseas governments that provide certainty around investments. He laughs when saying he would love to have access to such subsidies but recognises that it is “extremely unlikely”.

But TrustPower's Campbell and Meridian's Muldoon both say they don't want subsidies or feed-in tariffs. They say such incentives could lead to inefficient wind farm sites being built just to capitalise on a subsidy, and such incentives were subject to government whim, so could be reversed. “We like having to compete,” says Campbell.

But along with Windflow and Fraser Clark, Campbell and Muldoon do think that wind is not being treated fairly compared to competitor fuels, more specifically fossil fuels and pointing to the overt encouragement and tax breaks for gas exploration, and the lack of comparable incentives for renewable energy sources. They believe a more level playing field would provide more incentive for wind investment.

THE MOST EXPENSIVE FORM OF NEW GENERATION, OR DOWN TO THE EYE OF THE BEHOLDER?

Wind is seen by some as producing expensive electricity. Its long run marginal cost is seen to be higher than other forms of new generation higher according to MED and Electricity Commission documents.

Muldoon expresses irritation at the focus on LRMC. He says

that LRMC is effectively meaningless because while it might tell you the cost, it doesn't give you any indication of the value of an investment for a company in terms of spreading its generation geographically and in terms of fuel source.

Industry commentators say that the portfolio benefits of wind generation are very difficult for analysts to identify and understand, and that each power company will have differing investment drivers and views as to wind's value. They say that for a company like Meridian, North Island wind generation makes a lot of sense as it has few other fuel alternatives and it helps it manage its HVDC risk.

Muldoon rightfully guards Meridian's business case formula for wind farm development.

While each wind farm must stand alone as a business case, Muldoon strongly hints at the portfolio integration benefits wind adds to a gentailer's book, particularly for those with hydro assets for firming.

"Each project we analyse on a standalone basis," he says. "Having said that, each project for an integrated power supplier will improve your own business, otherwise why develop them?"

Muldoon points to the 2008 dry winter and gives an example of the integration benefits of wind in Meridian's predominantly hydro portfolio. "White Hill [58MW] earned its annual revenue in one month because we didn't have any water in the South Island," he says.

Another point Muldoon raises is the longer run consistency of wind in terms of knowing what its output will be over a 12 month period. "Wind is consistent which means we can trade our portfolio knowing how much our farms are going to be generating because the wind here is really consistent and we can use that against how we bid our hydro in," he says.

Defending against some analysts and commentators' critiques of wind farm economics, Muldoon raises the question of visibility of ongoing operational expenditure in the overall business case model.

Meridian's latest farm, West Wind, was subjected to a degree of criticism for its \$430 million price tag for a power station with a capacity of 143MW. Would it ever make any money? they asked.

Analysing West Wind's build cost on a per megawatt basis produces some pretty high numbers by comparison to other forms of generation and indeed other wind farms.

But Muldoon points to the ongoing maintenance costs, West Wind's performance to-date, and its forecast life.

"No one knows how much we spend on opex, nor do they know our forecast life for the farm," he says.

KEY TAKEAWAY #3:

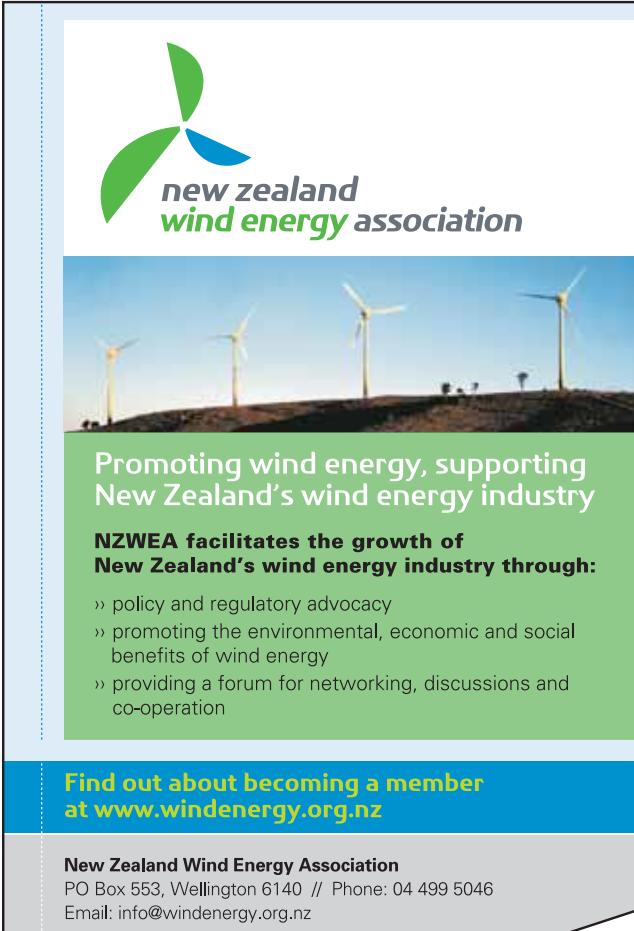
THE RESOURCE CONSENT PROCESS IS EXPENSIVE, TIME CONSUMING AND IS ONE OF THE MAJOR ISSUES HAMPERING WIND FARM DEVELOPMENT

"In December we had a capacity factor at West Wind of 51%, with a couple of turbines over 60% - now that is outstanding for a wind farm."

Turbine costs are also misunderstood says Muldoon and he suggests no one player really knows what costs are possible until they're into a sizeable contract. "Not everyone sees the same turbine pricing that we see," he says. "We are the biggest player in Australasia in terms of turbines purchased and our ongoing pipeline and what a consultant sees in terms of turbine prices isn't the same as what we see."

He also says that, much like an oil and gas explorer, Meridian treats its wind farm investigation costs as a separate ongoing expense line – just another part of the business - as opposed to sinking them into individual wind farm projects.

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The graphic features the NZWEA logo at the top, which consists of three stylized leaves in green and blue. Below the logo is a photograph of several wind turbines on a hillside under a clear blue sky. The text is arranged in a clean, modern layout with a mix of green, blue, and white backgrounds.

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GRID INTEGRATION CONSIDERATIONS

One of the oft levelled charges against increasing levels of wind generation is that wind's variability will impact the system in a way that other forms of generation don't, making it less stable and secure, and more expensive to operate, due to the increased need for instantaneous reserves and potential issues with frequency variation.

Electricity Commission director of system operations Darryl Renner, says high levels of wind can be integrated over time "but it is going to cost". He says there was likely to be debate over how these costs are allocated, and that could be an issue for smaller standalone generators which don't have a portfolio of generation to spread risk and costs across.

KEY TAKEAWAY #4:

WIND FARMS INTEGRATE WELL INTO GENERATION PORTFOLIOS WITH FLEXIBILITY SUCH AS HYDRO OR GAS-PEAKING

The Commission had been running a series of wind projects for a number of years to prepare the path for greater wind levels. However, he says that with not as much wind coming on stream as expected, time frames had changed for looking at such issues, so there was not as much urgency.

Clark says he feels regulation was heading in the right direction. He says the association recognises that wind farms are going to have an impact on the system but that costs should be shared fairly across all those who influence them, indicating that not all new costs should be laid at the door of wind generators.

"The technology is changing and wind can do things it couldn't before, such as fault ride through and frequency support." He pointed to a recent event where West Wind had supported the Wellington region after a problem at the Haywards substation. "Let's make sure the regulator and system are aware of what wind can do."

On the subject of integration Transpower's Devine is unequivocal. "There is no technical limitation on the amount of wind the system can accommodate."

But he agrees with Renner that there would be costs. "The limits are instead commercial. We think you can get to 20 per cent [of supply] without having to spend serious money on the grid."

Above the 20 per cent level it becomes cheaper to manage

supply variability by managing demand, however that point was still about 10 years away. Devine says that demand is inherently more variable than supply anyway, with consumers switching load on and off without notice. System operators have to manage that as a matter of course.

He expected the frequency keeping band would have to increase in the future to cope with the increased variability on the system from more wind, but he thought Transpower's AGC system, which can send despatch instructions direct to generators, could help spread the market for frequency keeping to more power plants, and so lower costs.

Renner says a priority area where the Commission and Transpower were working closely together was modelling techniques for better forecasting and the dispatch process. "The better your prediction the more efficient solution you choose and the lower the cost."

Devine says about 25 per cent of his business's research spending was on forecasting. A lot of work was being done with NIWA and other international players on weather forecasting. They are looking at a range of options but expect to have a much better tool in place in a couple of years.

GLOBAL TURBINE TRENDS POINT TO BIGGER IS BETTER

Wind turbines are likely to continue to grow in output and size.

Unlike Windflow's direction, the major global manufacturers like Vestas, GE and Siemens believe that big is good, and the way forward is with bigger blades and taller towers. Over the last 20 years the Danish turbine maker Vestas has increased power output 54 fold to more than 3MW, following a similar power increase path to computing.

In many respects this need for scale is a self fulfilling promise. The capital cost and civil works required for an isolated wind farm, combined with the intermittent nature of wind mean that the bigger your turbines and the more you install, the more you can eke out of a site. And many of the development costs such as consenting and design may be the same for a big farm as a small, so again the encouragement is to get as much for your investment as possible.

Local turbine suppliers say towers here are unlikely to get to the physical size of the offshore European arrays as New Zealand does not need to go offshore to access stronger, more consistent winds. But local suppliers believe there is plenty of scope for the large 3.6 MW turbines being installed in the North Sea. The Te Uku wind farm under construction in the Waikato is going to be the first windfarm in the southern hemisphere to get 49 metre long blades.

The focus for operators and manufacturers will continue to be on improving yield – that is the amount of time they produce useable power. There will be increasing moves towards direct drive turbines, which eliminate gearboxes that have traditionally been a major stress area, and so improve efficiency and reliability. Better understanding of turbine technology and the wind characteristics of individual tower sites, and the application of sophisticated electronic controls mean a turbine can be individualised and effectively tuned for its site.

Improvements in electronics in combination with blade pitch and variable speed will help smooth wind farms' output where in the past the main method of controlling output was altering blade pitches. This will make them more grid compliant, ensuring consistent power quality and contributing to system stability.

THE PATH AHEAD FOR NEW ZEALAND WIND FARM DEVELOPMENT

With a resource as diverse and abundant as New Zealand has, wind's future as a growth power source seems secure. Political and commercial incentives have seen countries with lesser resources and more physical constraints have far higher penetrations of wind energy.

Wind on the surface is a delightfully simple and attractive power source that matches our national values and international image. Many see the modern turbines as benign if not elegant sculptures enhancing many landscapes, a combination of 21st century precision engineering and ancient technology.

But it does face development challenges, though most are not unique and none insurmountable. The resource consent process worries many, it faces commercial barriers in terms of competition and cost of development, and it may face skills and resource issues if development opportunities become uncertain.

Globally wind is on a huge growth path and is no longer a new form of energy. Vestas recently installed its 40,000th turbine and, where wind turbine construction was seen as a high-tech but fringe part of the power industry, there are now large scale manufacturers appearing in India and China as developed and developing countries struggle to balance power demand with concerns about CO2 emissions.

New Zealand does not have unlimited demand for electricity. Wind generation has to compete for investment money to fill that need and unlike many countries in these carbon constrained times, New Zealand has no immediate shortage of renewable options driving the push to wind. A key question for investors is investment timing, which may mean wind will take longer to fulfil its promise than had been forecast over recent years.

Devine believes that the immediate strategic issue for wind here is that it has a strong renewable competitor in geothermal with many similar environment credentials, which he says currently has a slight cost advantage - "but it is small". Geothermal has an advantage of being baseload. Contact Energy and Mighty River Power, both with major wind farm plans on the books, are currently making actual investments in building large geothermal power stations.

KEY TAKEAWAY #5:

THE ECONOMICS OF WIND FARMS ARE IMPROVING ALL THE TIME WITH RISING COSTS OF OTHER FORMS OF ENERGY, AND TECHNOLOGY ADVANCEMENTS

Hewitt of Siemens worries that not only do we have an ageing engineering workforce, we have a thin advisory market with few people having practical wind development experience which is causing projects to take longer than they should, while a number of possible sites were being ruled out too early through inexperience. He is also concerned that in a global market with increasing demand, that a lack of projects will mean New Zealand is increasingly seen as marginal for development which will push up costs.

Finally the rejection of Meridian's Project Hayes wind farm resource application has many in the industry worried about the whole process and its implications for wind farms in general. The feeling is that it should be easy not hard to build a windfarm in New Zealand with its abundance of space.

There are differing views of the significance of the Hayes decision, but one area identified that could improve matters is the certainty that a national policy regarding the development of wind farms could provide for all parties. A national policy statement on renewable energy has been under development for some years but has yet to emerge – an update is expected this year.

The Government has signalled its wish to see developments such as wind farms fast-tracked through the streamlined Environment Court referral and Board of Inquiry and Environmental Protection Authority (EPA) processes, but that provides little comfort for developers if there isn't adequate guidance on weighing competing national and local interests, and a consistent approach to landscape assessment.

It appears that fixing this key area would resolve a lot of anxiety amongst the wind industry. It is not a quick fix, nothing is in the power industry, but it may provide a confidence boost to accelerate some of the many projects that are planned and that may eventually fulfil our billing as the 'Saudi Arabia of wind'.

WIND FARMS UNDER DEVELOPMENT IN NEW ZEALAND

NAME	DEVELOPER	LOCATION	CAPACITY	TURBINES	EST. COST
Te Uku	Meridian Energy	Te Uku, between Hamilton and Raglan, Waikato	64.4 MW	28	\$200m
Te Rere Hau stage 4	NZ Windfarms	Tararua Ranges, Manawatu	16 MW	32	
Horseshoe Bend	Pioneer Generation	Teviot River, 15 km from Roxburgh, Otago	2.25 MW	3	\$3m
Long Gully	Windflow Technology/Mighty River Power	South of the Brooklyn turbine, Wellington	12.5 MW	25	
Mahinerangi	TrustPower	Mahinerangi, Otago	200 MW	100	\$400m
Central Wind	Meridian Energy	Between Taihape and Waiouru, Central Plateau	120 MW	52	
Kaiwera Downs	TrustPower	Gore, Southland	240 MW	83	\$380m
Weld Cone	Energy3 Generation and Nick and Carol Webby	Near Ward, Marlborough	1.5 MW	3	
Mount Cass	Mainpower	Waipara, Canterbury	69 MW		\$150m
Mill Creek	Meridian Energy	Ohariu Valley, Wellington	71 MW	31	
Project Hayes	Meridian Energy	Lammermoor Ranges, Otago	630 MW	176	\$2000m
Slopedown	Wind Prospect CWP	26km south east of Gore, Southland	150 MW	50	
Turitea	Mighty River Power	Tararua Ranges, Manawatu	360 MW	122	
Waitahora	Contact Energy	Puketoi Ranges, south east of Dannevirke, Hawkes Bay	177 MW		\$500m
Hauauru ma raki	Contact Energy	Port Waikato, Waikato	540 MW	180	\$2000m
Titiokura/Te Waka	Unison Networks and Roaring 40's	Northwest of Napier	150 MW	50	\$294m
Chatham Islands	The Chatham Islands Enterprise Trust	Chatham Islands	0.5 MW	2	
Ahipara Gumfields	Meridian Energy	South of Ninety Mile beach, Northland	60 MW	36	
Awakino	Ventus Energy	East of Awakino, Waikato	41.6 MW	32	
Awhitu	Genesis Energy	Awhitu Peninsula, Waikato	18 MW	18	
Barrells Road	Wind Farm Developments	Tararua Ranges, Wairarapa	12 MW		
Belmont Hills	Greater Wellington Regional Council	Belmont, Lower Hutt, Wellington	80 MW	81	\$138m
Cairnmuir	Roaring 40's	Cairnmuir Ranges, Cromwell, Otago	60 MW		\$150m
Castle Hill	Genesis Energy	Castle Hill, east of Masterton, Wairarapa			
Glinkes Gully	Northpower	South of Dargaville, Northland	20 MW		
Horowhenua	Horowhenua Energy	Northeast of Shannon, Wanganui	30 MW		
Lulworth	Energy3 Generation	Lulworth family farm, 6.5 km south of Ward, Marlborough			
Mokairau	Eastland Infrastructure	30 km north east of Gisborne, East Coast	10 MW	3	\$20m
Motorimu	Allco Wind Energy	Palmerston North, Manawatu	110 MW	80	\$200m
Mt Bengier	Investec/Windlab Systems	Roxburgh, Otago			
Mt Stuart	Pioneer Generation	10 km west of Milton, Otago	6 MW	9	
Omamari	Meridian Energy and Landcorp	North of Dargaville, Northland	100 MW		
Pigeon Bush	Meridian Energy	8-9 km southeast of Martinborough, Wairarapa		45	
Pori	Allco Wind Energy	Palmerston North, Manawatu	80 MW		
Pouto	Meridian Energy	Kaipara, Northland	300 MW		
Puketiro (Battle Hill)	Renewable Energy Systems (RES)	Pauatahanui, Wellington	150 MW		
Rock and Pillar	Windpower Otago	Middlemarch, Otago	25 MW		
Rototuna	Mighty River Power	Rototuna, Northland	250 MW		
Stoney Creek	Greater Wellington Regional Council	Southeast of Martinborough, Wairarapa	60 MW		
Taharoa Wind Farm	Taharoa C Incorporation	Near Kaiwhia Harbour, Waikato	100 MW	22	
Taumatatotara	Ventus Energy	10 km from Taharoa, Waikato	44 MW	22	
Te Pohue	Hawkes Bay Wind Farm	34 km from Napier, near Te Pohue, Hawkes Bay	225 MW	75	\$350 m
Tiwai Point wind farm	Rio Tinto/Meridian Energy	Invercargill, Southland	200 MW		
Wainui Hills	Wainui Hills Wind Farms	Wainuiomata, Wellington	30 MW	10	
Waverley	Allco Wind Energy	Waverley, Wanganui	135 MW	45	

NOTES

1. Stage one build of 30 MW to be embedded.
2. Variety of turbine options being considered.

3. Board of inquiry then adjourned for 12 months.
4. Stage 1 for 20 MW is consented, larger Stage 2 rejected.

