Wind Farm Investment in New Zealand

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Energy Centre
Low-emissions transition

- Government’s target of net-zero carbon by 2050
- Energy sector accounts for 40% of the total GHG emissions
- Government’s goal: 90% of electricity generated from renewables by 2025
- Currently wind generation contributes 6%
- NZWEA target’s of 20% wind energy
Research questions

Q1: How does an increase of wind penetration influence the nodal price?

Q2: Is the MOE larger during the peak demand, and smaller during the off-peak demand?

Q3: Can we use answers to question (1) to predict the regional price reduction for each node and to further explore where to build wind sites?
Econometric Models

Spatial Models – The Transmission Line Capacity in MW
Average network hourly price effects of an increase of 10% in wind penetration on nodal price
The regional price effect $/MWh of a 10% point increase in wind penetration at BPE
The regional price effect $/MWh of a 10% point increase in wind penetration at HAY

- $0.41
- $0.23
- $0.21
- $0.16
- $0.11
- $0.11
- $0.11
- $0.39
- $0.26
Price prediction and simulation

-$0.25
-$0.20
-$0.10
-$0.20
-$0.19
-$0.23
-$0.21
-$0.24
-$0.11
-$0.15
-$0.25
-$0.10
-$0.20
-$0.20
Price prediction and simulation

Estimated net annual savings (million $) per MW installed

Net savings (million $) per MW installed

-1 0 1 2 3 4 5 6 7 8 9 10

BPE HAY HLY HWB OTA ROX TIW TKU TWZ WKM

LRMC ($82/MWh) LRMC ($110/MWh)
From national point of view: where to build?

Estimated net annual savings (million $) per MW installed – (Rank#)
LRMC ($82/MWh)

- $0.61 mil - (9)
- $0.59 mil - (8)
$2.79 mil - (2)
- $0.32 mil - (6)
$0.77 mil - (4)
$1.79 mil - (3)
- $0.44 mil - (7)
- $0.19 mil - (5)
- $0.66 mil - (10)
$8.44 mil - (1)
Take away

- Results show that private investment in additional wind capacity leads to positive gains in economic value.

- However, it’s not clear if private investment is financially profitable. Investing in capacity at a given node can reduce the return to a generator’s assets in the network.

- Reaching the goal of 20% electricity from wind generation depends on growth in demand. Maybe, this can come about from growth in electrification of transport.
Thank you for your attention!

“We cannot direct the wind, but we can adjust the sails.” –Dolly Parton

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Research on wind development feasibility studies

- Associations between wind and hydro power, and electricity demand and prices.
- The STH sites are most favourable sites for balancing the hydro storage levels. But high transmission costs.
- Positive correlation between CKS1, MWT3, CNI and NTH sites and electricity demand. Less transmission costs.
- Combining this information with findings from our study, we conclude that CNI2 (node TKU) is the best wind site due to its highest net annual savings.
Matching SWEM nodes to NIWA wind sites

North Island
*Node-wind site*
- BPE (300.3 MW)-MWT1 (Manawatu)
- HLY (64.4MW)-NTH1 (Waikato)
- OTA-NTH1
- WKM-NTH1
- TKU-CNI2
- HAY(142.6MW)-CSK1(Wellington)

South Island
*Node-wind site*
- TWZ- STH3
- ROX- STH3
- HWB (36MW)-STH2 (Clutha)
- TIW (58MW)-STH2(Southland)