



*Investment in electricity infrastructure in a
small isolated market: the case of Ireland*

15 October 2009

*Seán Diffney, John Fitz Gerald, Seán Lyons
and Laura Malaguzzi Valeri*



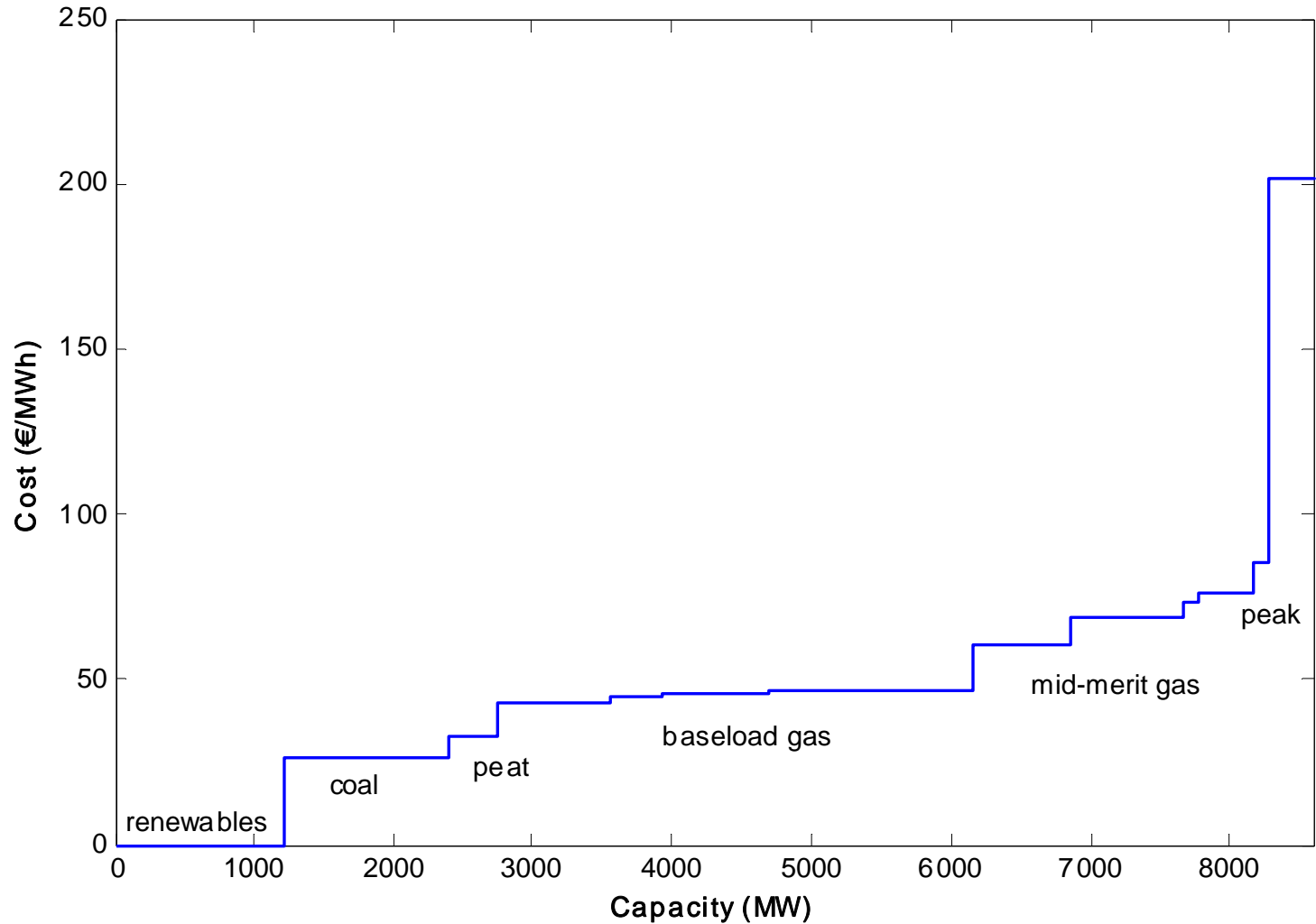
Overview

- *Scenarios for the SEM in 2020*
- *What happens if*
 - *more wind? (is more wind better?)*
 - *more interconnection to Great Britain?*

- *How can we minimize costs?*
- *Costs for the whole system?*
- *Costs to consumers?*

- *Where we are now*
- *How current knowledge can inform future decisions*
- *Analyze scenarios for electricity generation in 2020*

SEM merit order dispatch curve, end 2007





Where we start from

- *All-Island market (November 2007)*
- *2008 fuel mix:*
 - *~60% natural gas*
 - *~20% coal*
 - *~7% peat*
 - *~6% wind*
- *Large investment in transmission and distribution*
 - *Even larger if substantial amounts of wind generation are connected*
- *investment in generation*
 - *especially if renewables are to supply 30-40% of demand*

Living in an uncertain world

- *In past year high fuel volatility*
 - *Oil \$160/barrel July 2008*
 - *Oil \$32/barrel January 2009*
 - *(natural gas prices follow)*
- *High carbon permit price volatility*
 - *0 at the end of the first round of ETS (end of 2007)*
 - *Maximum around €30/tonne*



Background

- *Compare costs and benefits of 2000MW, 4000MW or 6000MW of wind (all on shore) for All-Island system*
- *2020 snapshot*
- *Use different scenarios on:*
 - *fuel and carbon permit prices*
 - *levels of interconnection*

Key assumptions

- *No transmission constraints within systems*
- *No ramping costs for thermal plants*
 - *Wind is curtailed to keep baseload plants running at minimum efficient capacity*
- *Optimal use of interconnector, as perfect arbitrageur*
- *GB modelled as Ireland - pool with capacity payments – with GB-specific input data*
- *2020 snapshot (no dynamic effects)*



Elements of total net cost

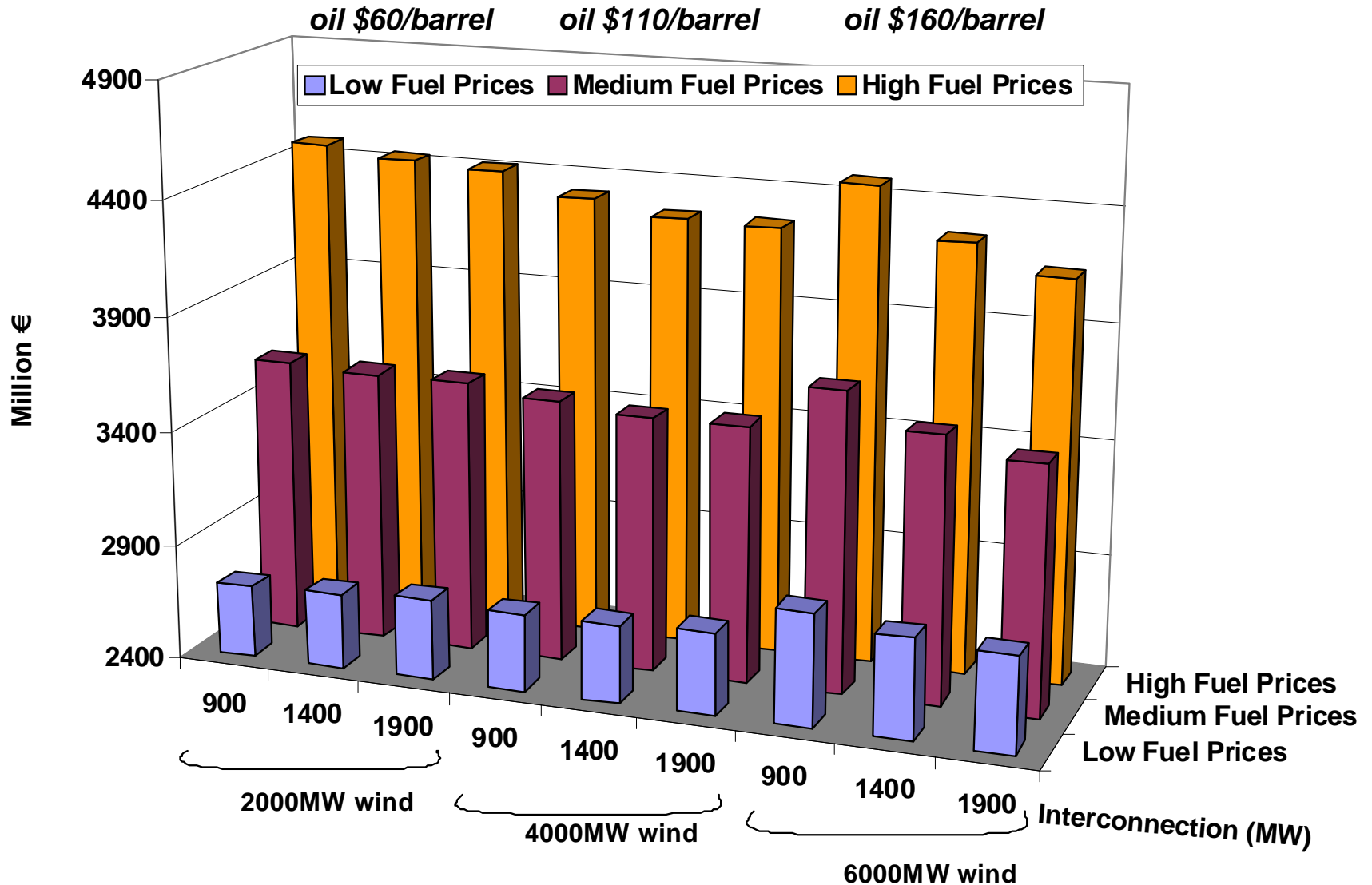
- *Consumer net costs:*
 - *Cost of wholesale electricity*
 - *Cost of capacity payments*
 - *Increased transmission cost to accommodate large wind*

- *Generator net costs:*
 - *Revenue from wholesale electricity*
 - *Capacity payments*
 - *Fuel and carbon cost*
 - *Yearly O&M cost*
 - *Annualized capital cost of plants*

- *Interconnector net costs*
 - *Arbitrage revenue*
 - *Annualized capital cost*

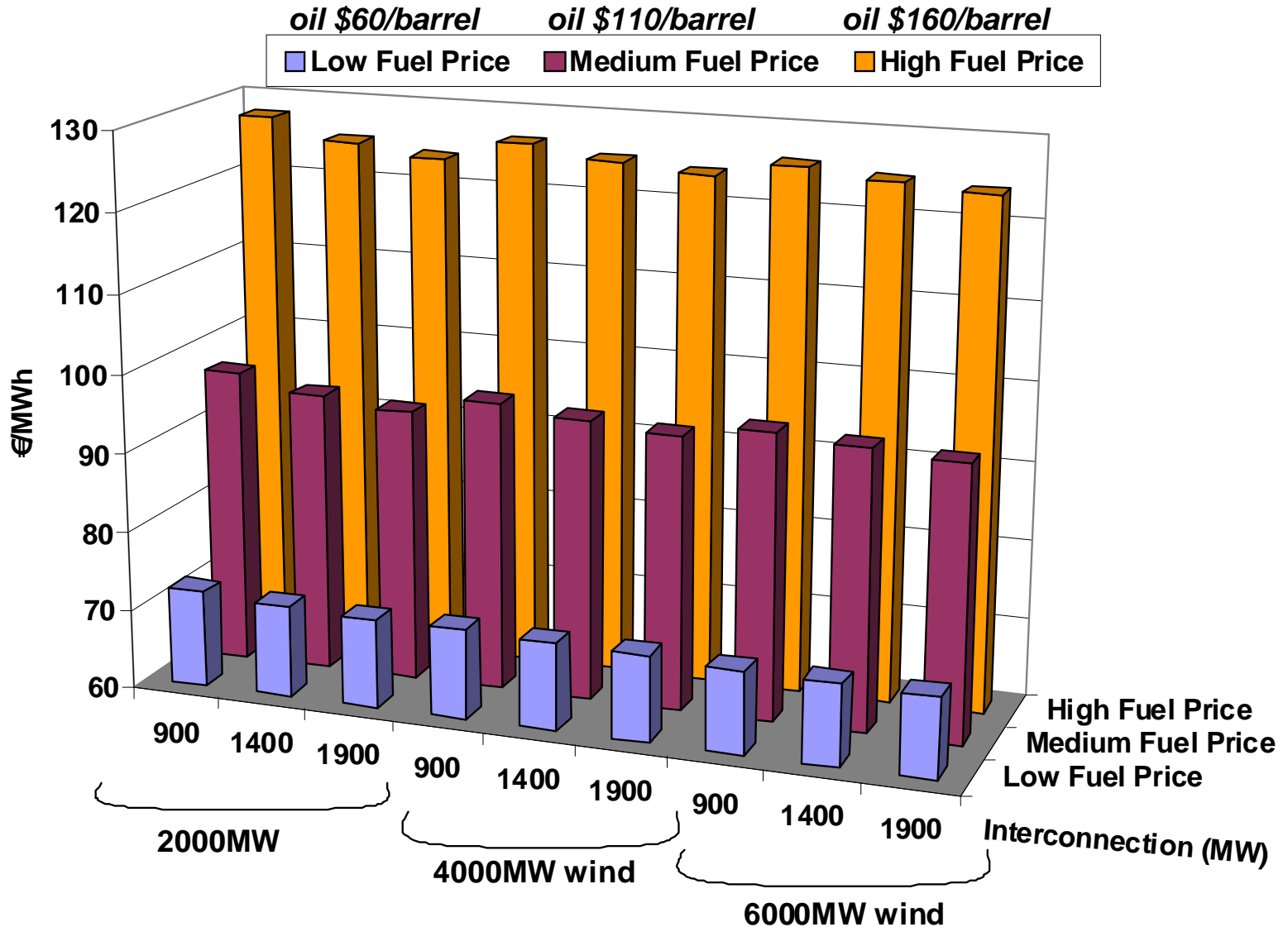


Annualized net cost to electricity system, € million, €38/ton CO₂

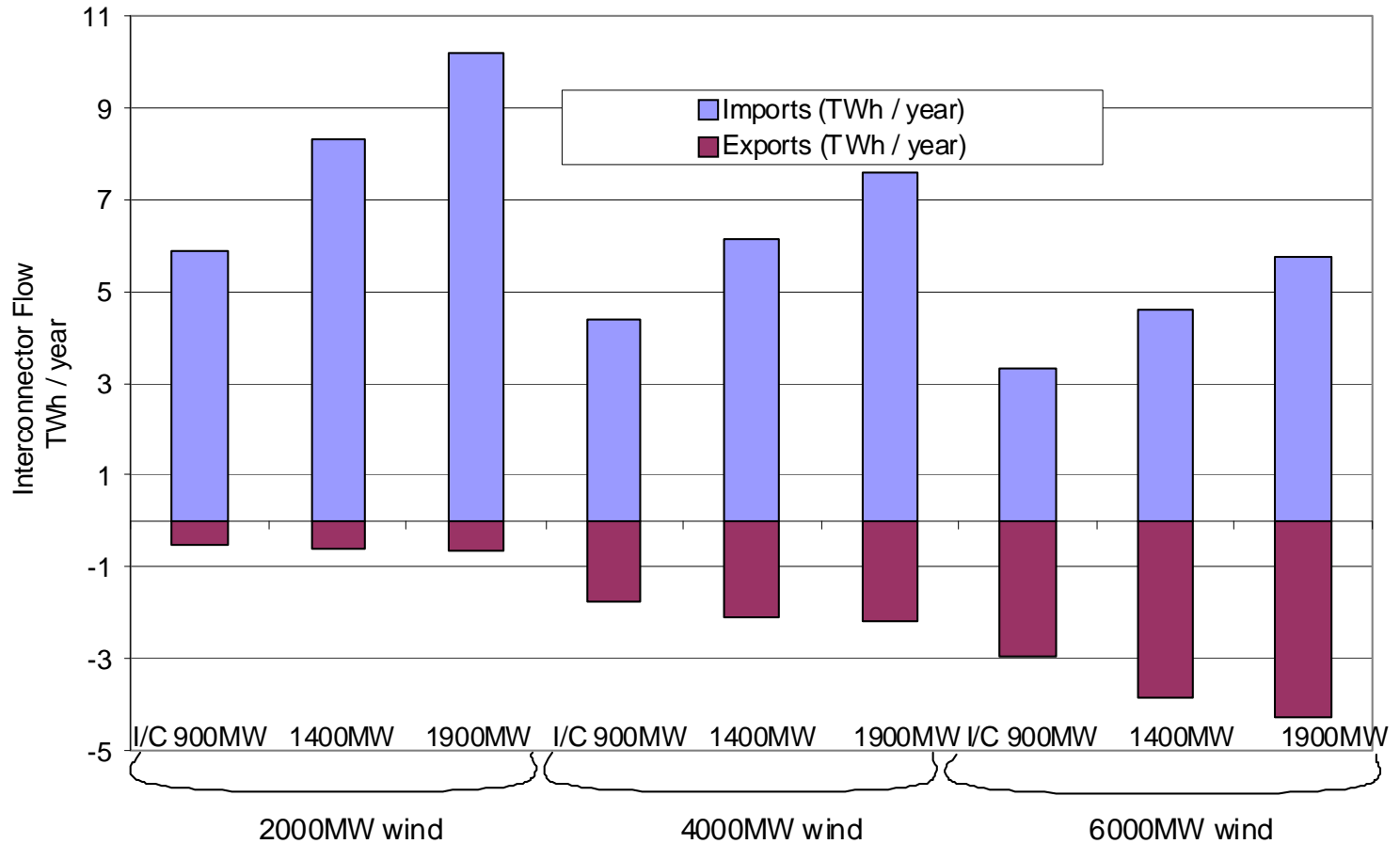




Wholesale consumer price €/MWh (avg SMP + capacity payments/MWh), €38/ton CO₂



Interconnector flows, TWh/year

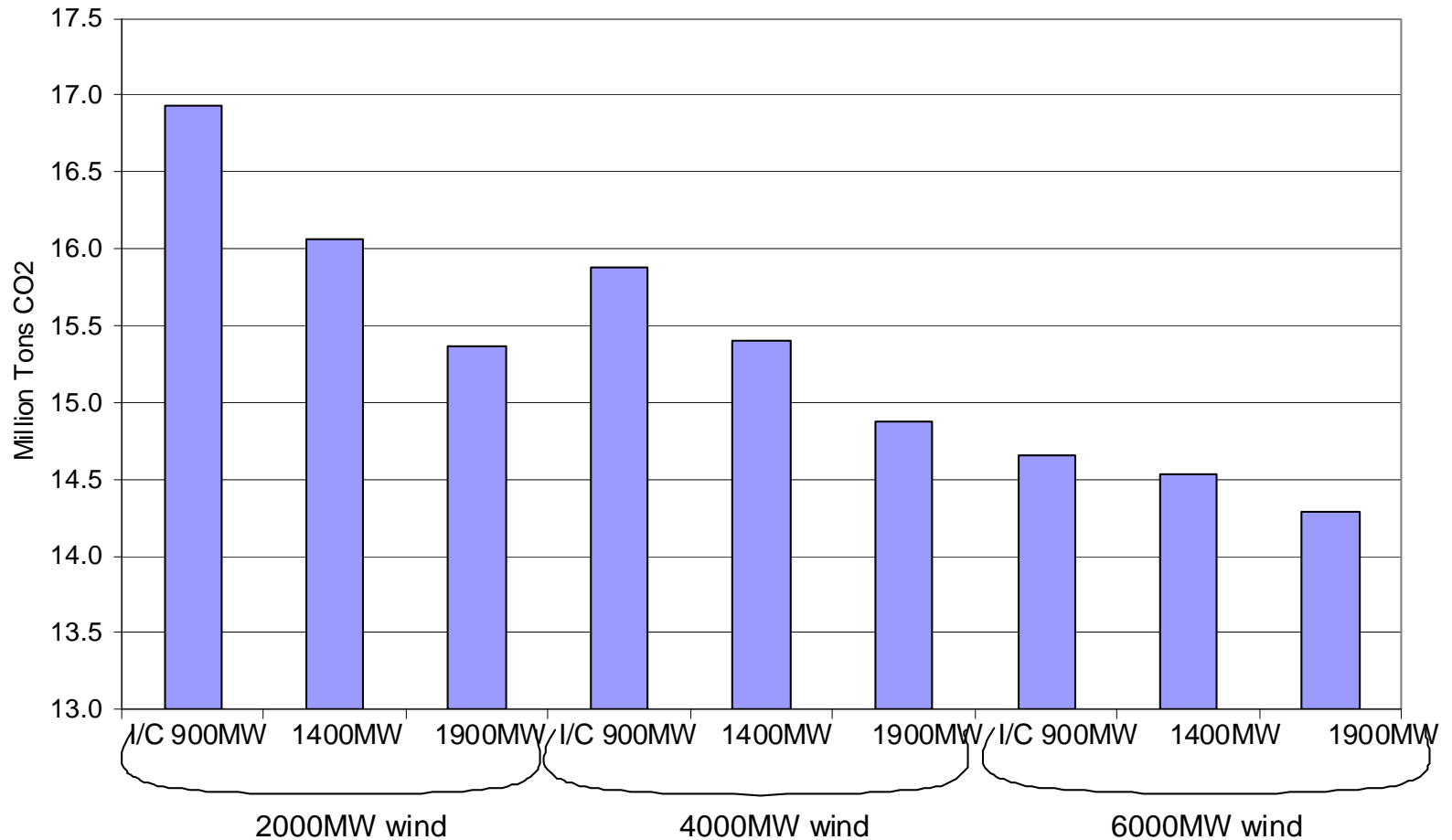


Assumptions: medium fuel & carbon prices, low demand, GB planning adequate

Higher wind reduces net imports; Higher interconnection boosts trade.

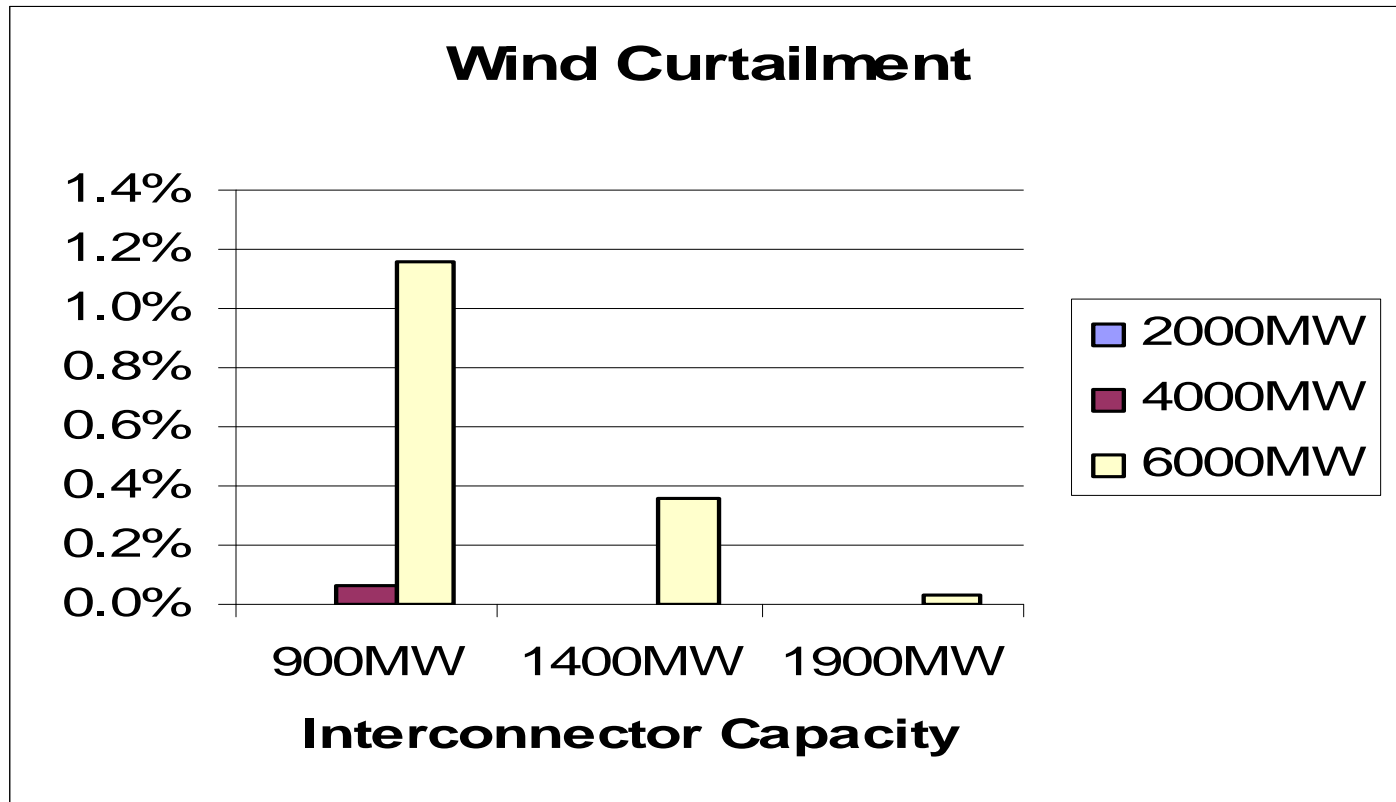


Total Irish emissions, million tons CO₂



oil at \$110/barrel; carbon at €38/ton CO₂

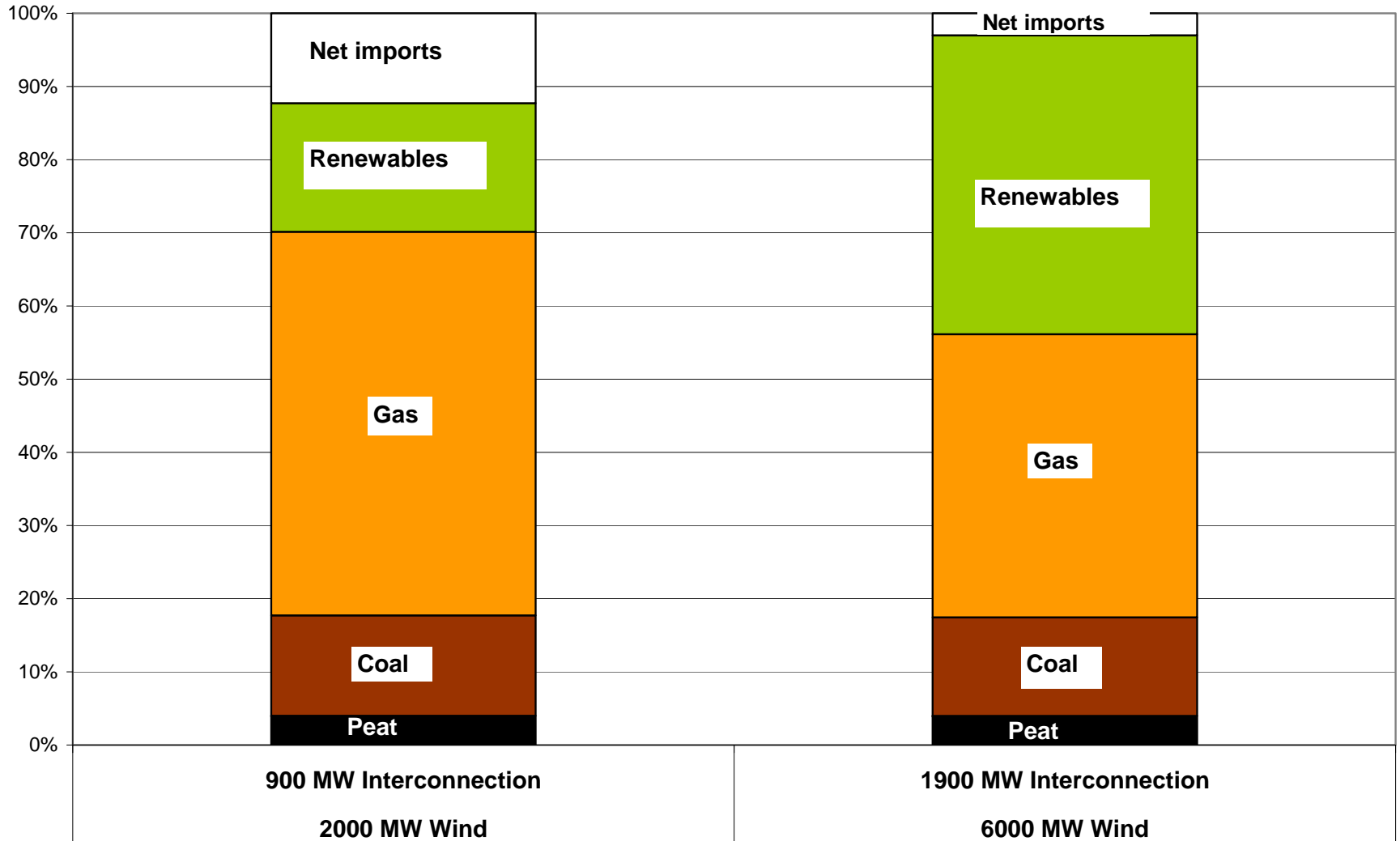
Wind curtailment (% of wind output constrained off)



oil at \$110/barrel; carbon at €38/ton CO₂



Fuel mix (% of demand)
oil €110/barrel, €38/ton CO₂



Findings/caveats

- *6000MW vs 4000MW vs 2000MW*
- *A lot of wind with little interconnection does not make sense*
- *Issues of IC operation*
 - *How it is dispatched*
 - *Governance and transaction costs*
 - *Selling to incumbent/dominant players*
- *Exogenous factors (fuel prices) important*
 - *No solution best for all scenarios*