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Switching off the gas distribution network: Consumer, network, and emissions impacts

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Castalia's approach

Task 1: Kick-off and confirm key modelling inputs

Kick-off call with Gas Industry Co. EECA MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT HĪKINA WHAKATUTUKI

Workshop the assumptions

- Customer profile and projected growth
- Appliance replacement and reconfiguration
- Energy sector landscape
- GHG emissions

Task 2: Model GDC cash cost impact

Residential Commercial Industrial

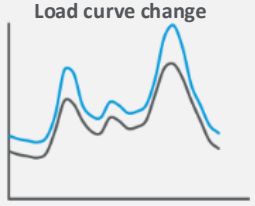
Costs to consider:

- Appliance replacement cost
- Reconfiguration cost
- Energy consumption cost
- Replacement and maintenance cost

Task 3: Estimate the cost of electricity distribution network upgrade

Determine increased electricity demand

Load curve change



Assess cost implications

Task 4: Estimate the GHG emission impacts

Estimate generation capacity expansion needed → **Determine** generation mix → **Calculate** GHG emissions

Task 5: Workshop the draft findings

Present assumptions and findings on:

- Consumer cash cost impact
- Distribution network upgrade costs
- GHG emissions

Task 6: Draft Final Report

Develop draft Final Report → Revise based on GIC's comments → Finalise and submit

Consumer cost impacts—methodology

Task 2: Model GDC cash cost impact

Residential Commercial Industrial

Costs to consider:

Appliance replacement cost	**Reconfiguration cost**
Energy consumption cost	**Replacement and maintenance cost**

- We estimated consumer costs under (1) business-as-usual and (2) switch-off scenarios, with 2029 being the switch-off year
- Included key cost components: appliance replacement, reconfiguration, energy, and maintenance.
- Residential switching assumptions based on three household typologies (assumptions sourced from Electrify NZ; Australian residential switch-off studies, multiple NZ appliance and install sources and all cross-checked)
- Commercial and Industrial switching assumptions used EECA research of costs of energy alternatives

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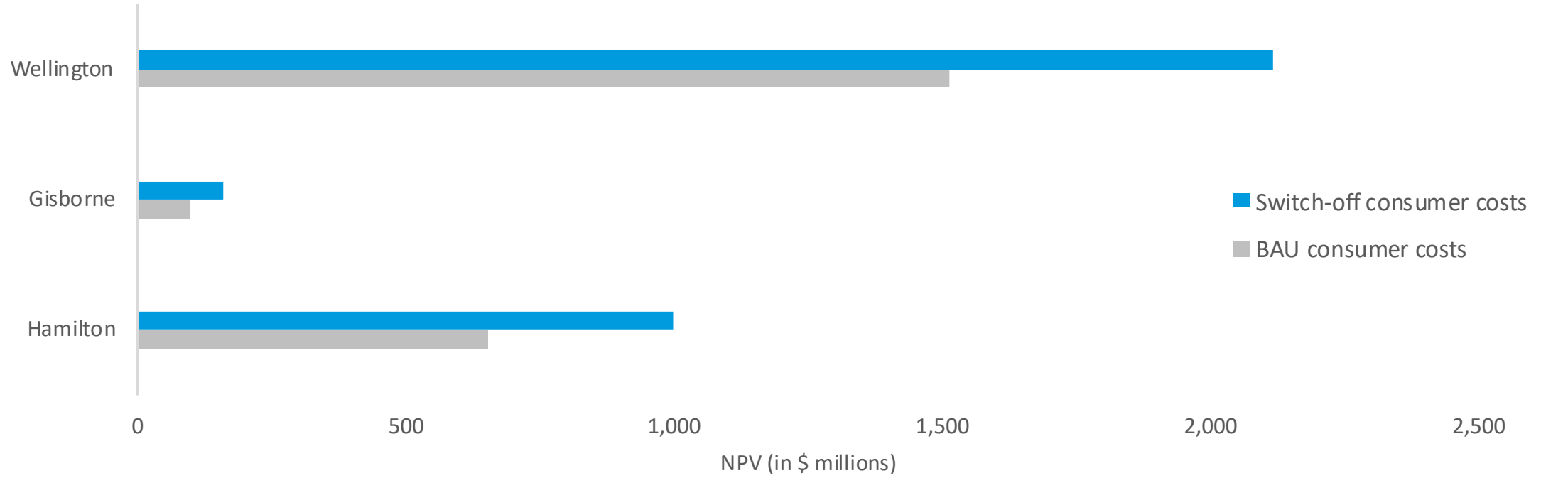
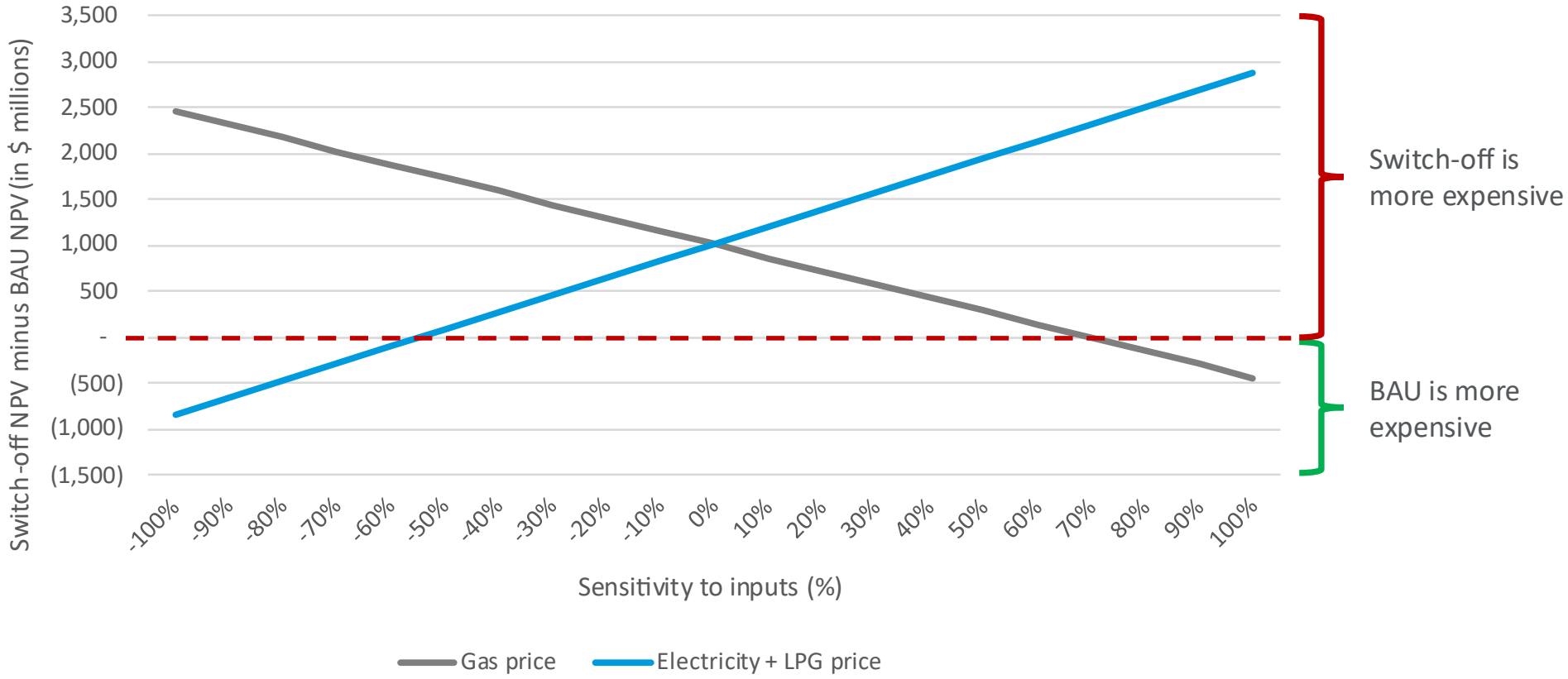
Consumer cost impacts

- Consumers face higher direct cash costs from switching off the gas network than under the BAU scenario
- Holding historical energy prices constant, switching off the gas network increases consumer costs by $1 billion, a 45 percent rise compared to the BAU scenario



Sensitivity of results to changes in energy prices

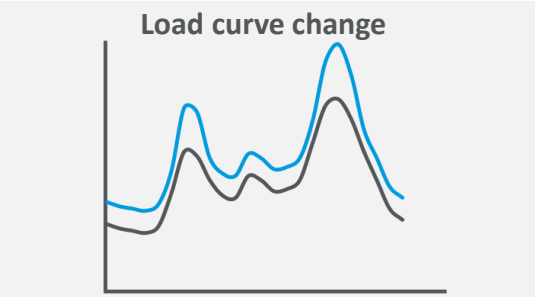
- Energy consumption is the largest cost driver for consumers, accounting for 85 and 71 percent of the total consumer costs in BAU and Switch-off
- Electricity and LPG prices would need to fall by about 60 percent or gas prices would need to rise by around 70 percent for Switch-off to become cheaper



Network upgrade costs—methodology

Task 3: Estimate the cost of electricity distribution network upgrade

Determine increased electricity demand

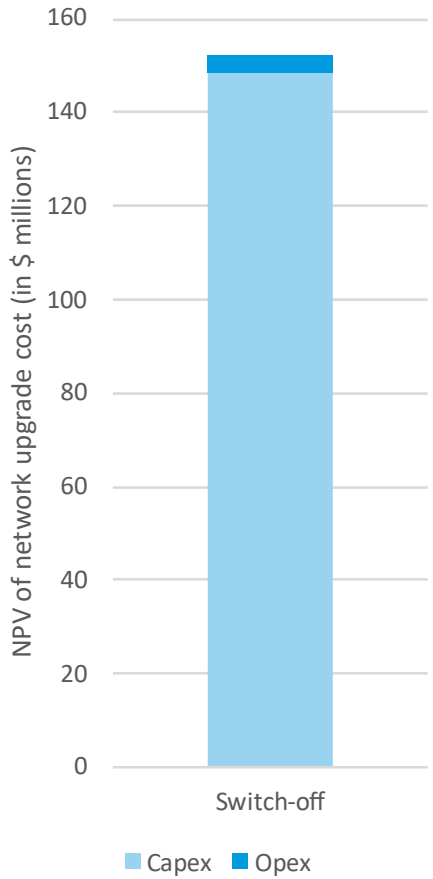


Assess cost implications

- Estimated the additional load from switching gas appliances (residential, commercial, industrial) to electricity
- Measured the impact of additional electricity demand on peak load
- Calculated the network upgrades and costs required to meet higher peak demand using Commerce Commission and EDB disclosures (capex and opex)

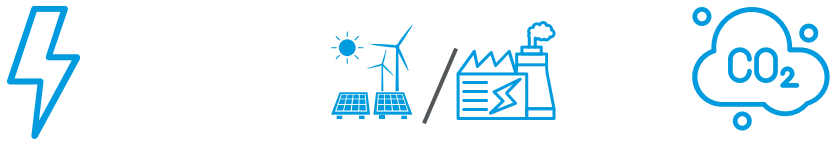
Network upgrade costs

- Switching off gas increases peak electricity demand by around 9 percent in Hamilton, Gisborne, and Wellington.
- Capex costs dominate the network upgrade costs, on average accounting for 98 percent of total NPV.



GHG emissions impacts—methodology

Task 4: Estimate the GHG emission impacts for whole North Island



Estimate generation capacity expansion needed

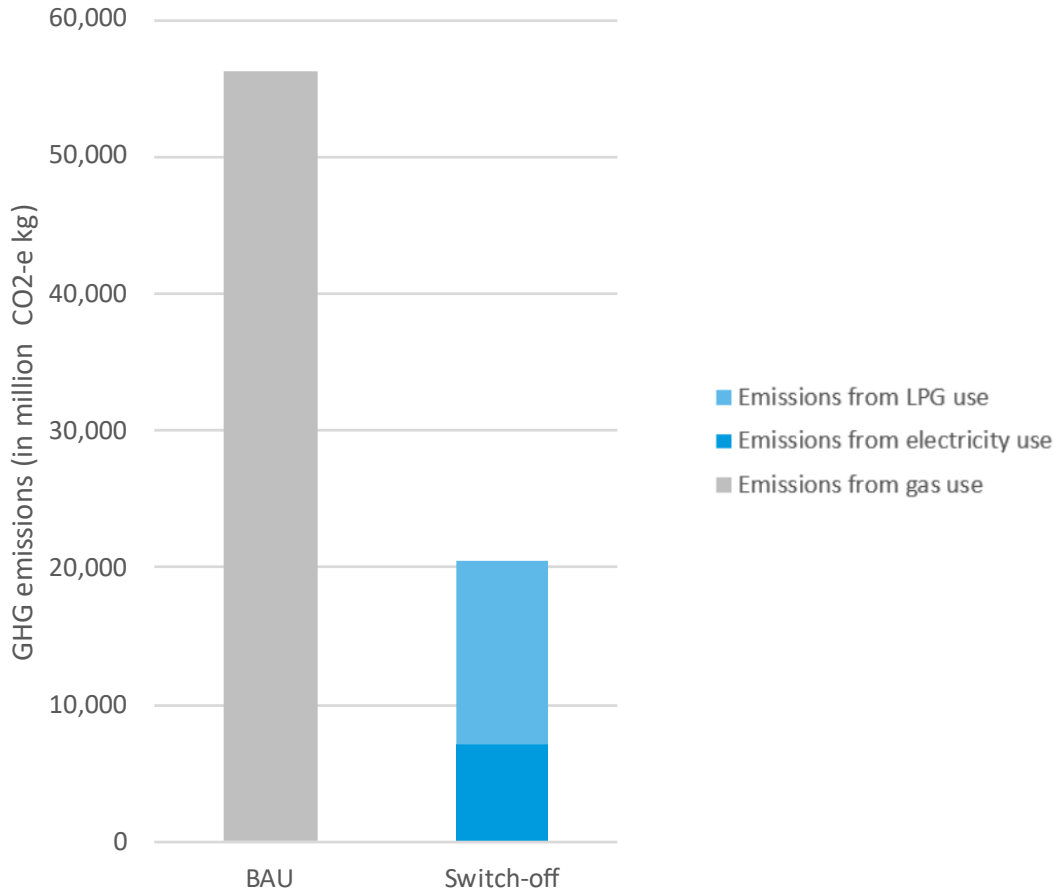
Determine generation mix

Calculate GHG emissions

- Load duration curve will shift up due to electrification in switch-off scenario—key question is: how will that additional load will be supplied?
- Used North Island generation expansion model to determine which generation sources would be built given long-run costs and capacity and availability factors
- Calculated the emissions from the new generation mix
- Compared these emissions with those from using gas directly in homes and businesses

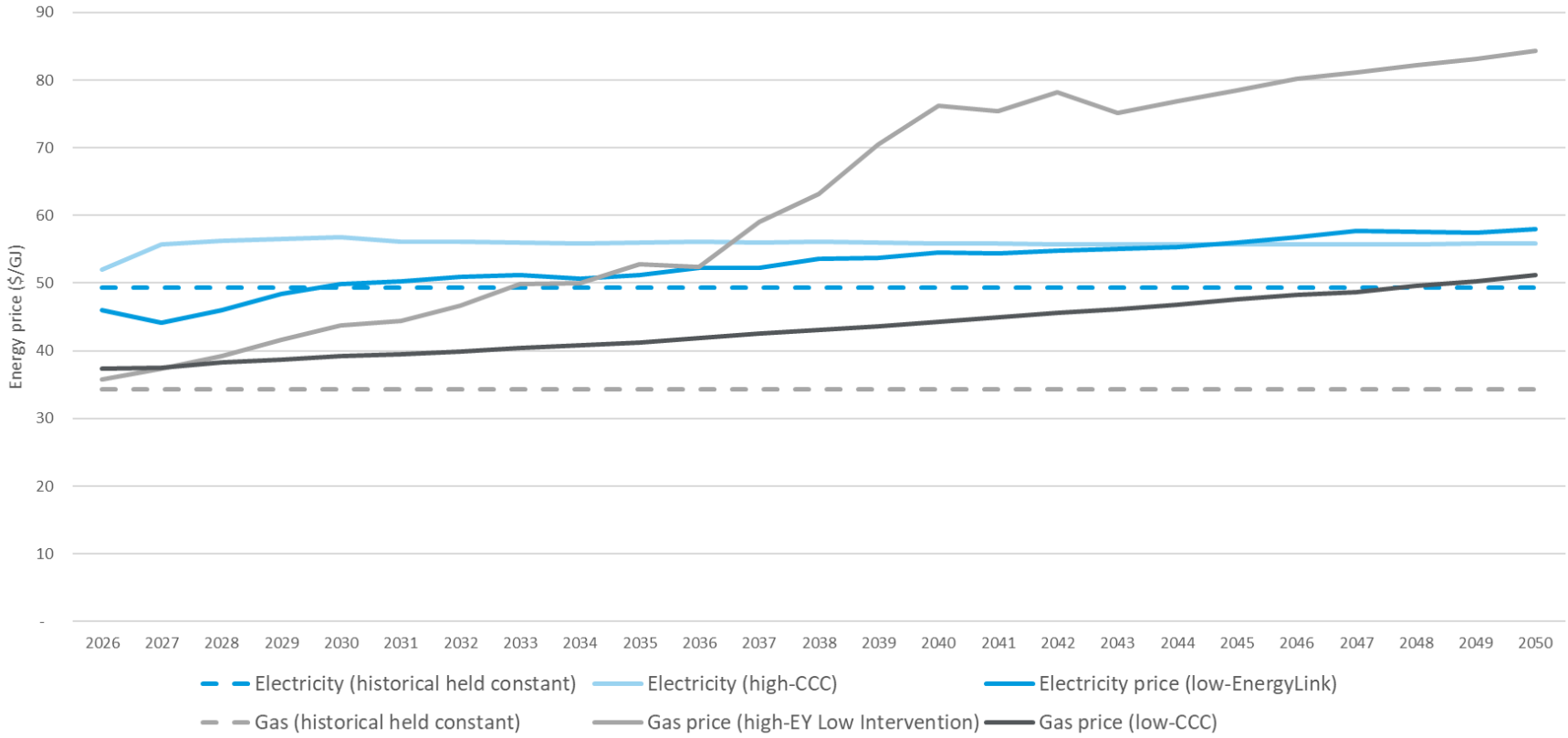
GHG emissions impacts

- We estimated that onshore wind will meet most of the increased electricity demand (93 percent) with gas peaking plants accounting for the rest.
- Over the 2029–2050 period, switching off the entire North Island gas network is projected to cut GHG emissions by about 34 million tonnes of CO_2e, a 63 percent reduction in emissions compared with BAU



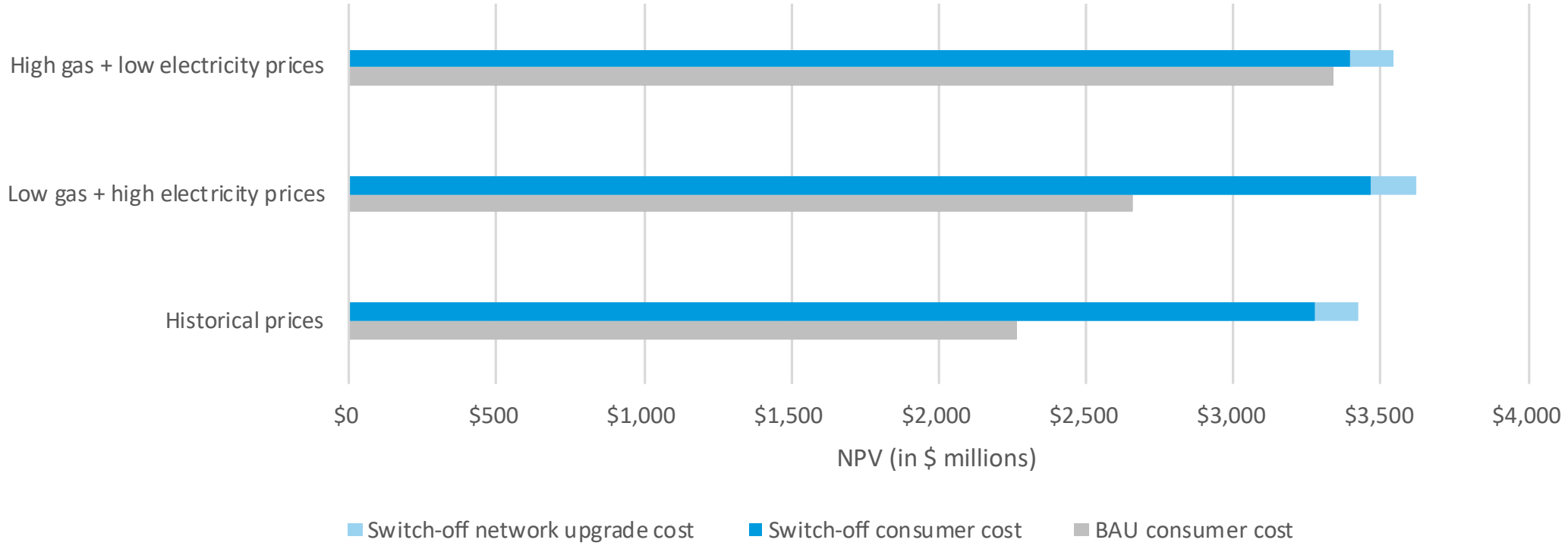
Energy price scenarios

- Energy prices are difficult to predict with certainty, but it is certain that gas and electricity prices will change over the forecast period
- Several credible sources project different trajectories for gas and electricity prices
- We used these prices to model scenarios and test the modelling outputs



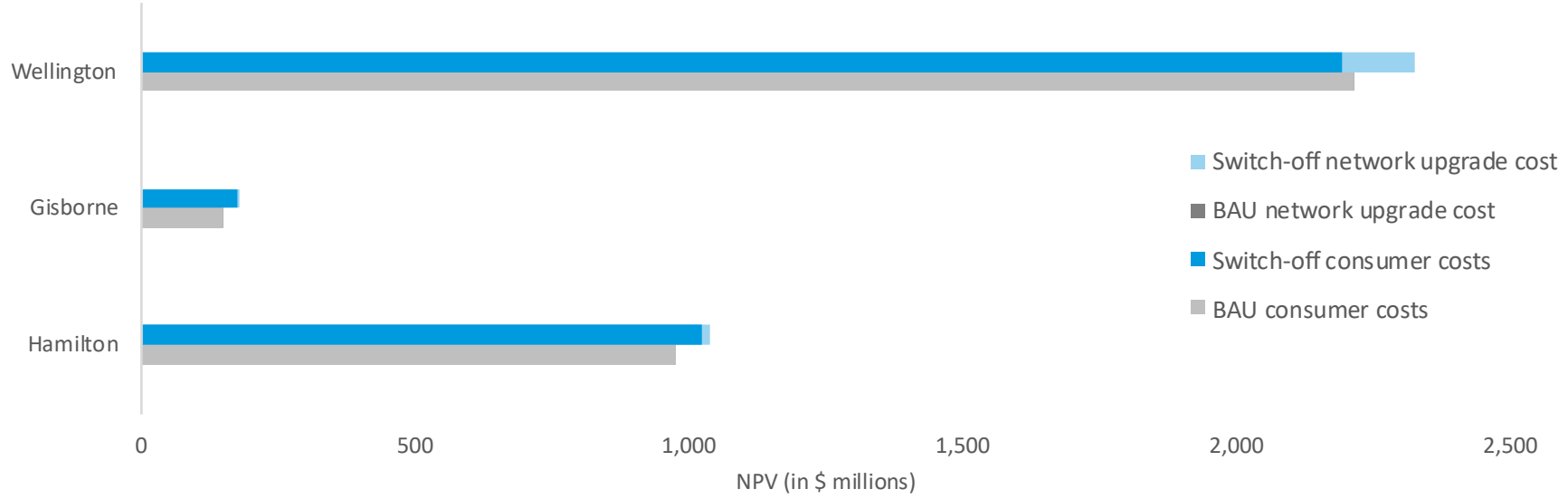
Results under different energy price scenarios

- The Switch-off scenario remains costlier than the BAU scenario under the different price scenarios
- The difference is much smaller under the favorable conditions for electrification (high gas + low electricity prices)



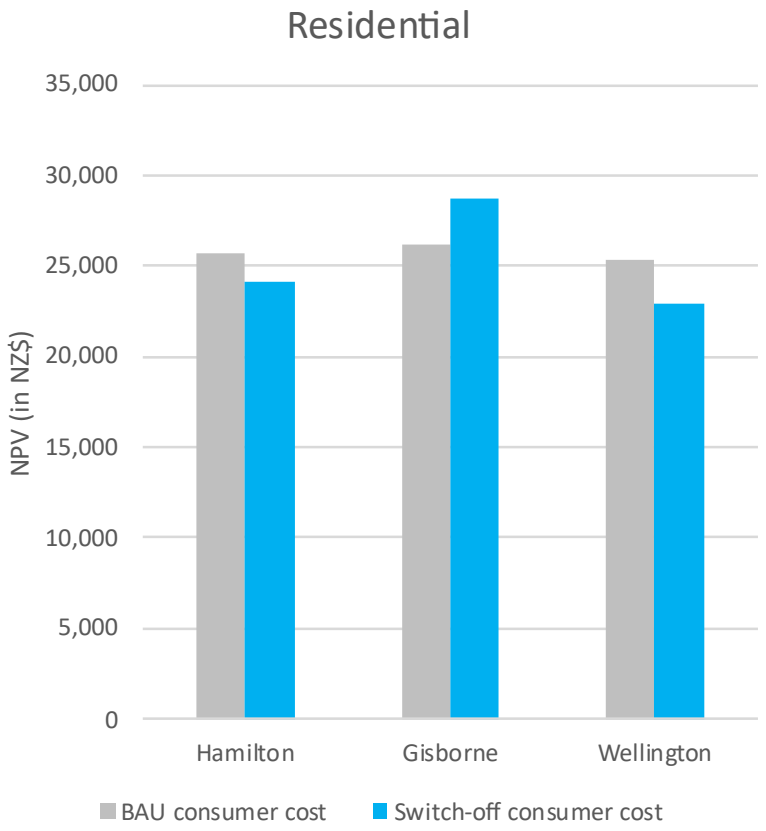
Consumer and network costs—High gas and low electricity prices

- Compared with results under the historical-price baseline ($1.2 billion), the relative cost of the Switch-off scenario is reduced by 83 percent
- The Switch-off generates consumer savings in Wellington, driven by a higher proportion of residential demand



Residential consumer costs per user—High gas and low electricity prices

- Commercial and industrial consumer costs are always higher under the Switch-off scenario across all regions and energy price scenarios.
- However, Switch-off residential consumer costs in Hamilton and Wellington are lower under the high gas and low electricity price scenario. Gisborne's Switch-off scenario remains more expensive due to a relatively higher electricity price compared to the other two regions.



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