To whom it may concern,

This submission provides a critique of the Electricity Authority's (EA) Green Paper, "Working together to ensure our electricity system meets the future needs of all New Zealanders," from the perspectives of biophysical economics, the Energy Cost of Energy (ECoE), and the Limits to Growth. While acknowledging the EA's aim for a more decentralized electricity system and its potential benefits, this critique argues that the Green Paper's underlying assumptions, rooted in conventional economic thought, may overlook fundamental biophysical realities and lead to unachievable strategic aims.

The Economy as an Energy System, Not Solely Financial

A central tenet of biophysical economics is that *the economy is fundamentally an energy system, not primarily a financial one*. Conventional economic theory often ignores the physical basis of wealth creation, focusing instead on financial metrics and assuming indefinite growth on a finite planet. However, all economic activity, including energy use, inherently involves the use of land, water, and other physical resources, leading to pervasive ecological disruption that should not be relegated to mere "externalities".

Energy Cost of Energy (ECoE) and Net Energy Decline

The Energy Cost of Energy (ECoE), also known as Energy Return on Investment (EROI), is a critical biophysical metric that measures the energy obtained from an energy source relative to the energy invested in its extraction and delivery. This concept is vital because it determines the net energy available to society for all purposes other than energy acquisition itself.

Declining Net Energy:

Global net energy production growth has slowed and is rapidly approaching a peak, coupled with a decline in the quality of traditional fossil fuel sources. This means that more energy is required just to obtain energy, leaving less for the broader economy. I have more detail on this on my recent submission to the draft Southland Regional Energy Strategy: bit.ly/NS_MESS

Renewables and ECoE:

While the financial costs of solar photovoltaic (PV) and battery energy storage systems (BESS) are declining, financial affordability does not equate to energetic viability on a macro scale. Renewable energy systems still require significant material inputs and fossil fuel-dependent industrial processes for their manufacture, deployment, and ongoing maintenance, directly linking their ECoE to that of fossil fuels.

System-Level Costs:

When accounting for the intermittency of renewable sources like wind and solar, the system-level costs—including the need for massive storage capacity and grid upgrades to ensure reliability—significantly reduce their overall net energy return. Estimates suggest that maintaining current levels of socio-political complexity with contemporary solar flows would require an expansion of technologically-mediated storage capacity by three orders of magnitude.

Implications for Electrification:

The Green Paper rightly identifies the increased demand for electricity from household electrification (appliances and vehicles), noting that this could range from 150% to 300% of current supply. However, it may underestimate the biophysical challenges of meeting this demand, particularly if current levels of economic growth and consumption are assumed to continue. An economy based on electricity will inherently differ from one powered by fossil fuels, and it is likely to be smaller.

Limits to Growth and the Imperative for Sufficiency

The concept of "Limits to Growth," first articulated in 1972, posits that indefinite economic and population growth on a finite planet is impossible. This perspective suggests that society must prepare for a future of degrowth (degrowth.nz), which implies a deliberate reduction in energy and resource consumption.

Incompatibility with Growth:

The significantly reduced energy demand required for a safe climate is fundamentally incompatible with the prevailing economic growth model, as energy is a primary driver of economic expansion. Policies focused solely on increasing energy efficiency or promoting technological solutions (a "technological fix") without addressing consumption levels are unlikely to achieve the necessary scale of change.

Beyond Economic Metrics:

Relying on financial mechanisms and price signals alone is insufficient for evaluating the feasibility of an energy system. The current financial system often has a "growth imperative" built into its structure, leading to ever-increasing debt that requires continuous GDP growth for repayment, further exacerbating environmental pressures.

The Need for a "Net Energy Lens":

Strategic decision-making must incorporate a "net energy lens" to avoid pursuing energy transitions that are not viable in biophysical or thermodynamic terms. This includes recognizing that electricity, while efficient at the point of use (e.g., EVs vs. ICE, heat pumps), still requires significant primary energy inputs for its generation and distribution.

Social and Political Considerations:

Transitioning to a post-growth society necessitates a shift in the overall objective of the economy towards well-being for all and a stronger focus on redistributive policies. It also requires understanding and engaging with how social power affects access to energy services and participation in decision-making, moving beyond the mythical "average consumer" to empower citizens.

Critique of the Green Paper's Assumptions

The Green Paper's vision for a decentralized system, while positive in intent, risks being shaped by an "economic fantasy" that ignores these biophysical constraints. The emphasis on "efficient transition" needs to be re-evaluated against the reality of declining net energy and the potential for economic contraction. The suggestion that household investments in PV and BESS should be considered "critical energy infrastructure" and eligible for concessional finance is a welcome step towards recognizing localized energy assets. However, the financing mechanisms themselves must be grounded in an understanding of true biophysical costs and not solely market-mediated financial returns.

Recommendations

To ensure the New Zealand energy transition is truly robust and resilient, I recommend the following:

Integrate Biophysical Economics:

Mandate the integration of biophysical economic analysis, including ECoE and net energy assessments, into all energy policy, strategic planning, and energy modeling. This should be undertaken by an independent entity with expertise in systems science and dynamic analysis.

Prioritize Demand Reduction and Sufficiency:

Explicitly prioritize strategies for *significant reduction in energy demand* (eco-sufficiency/degrowth) alongside renewable energy deployment. This will make the transition to 100% renewables more feasible and align with climate goals.

Rethink Economic Objectives:

Shift the overall objective of the economy from perpetual growth to maximizing well-being for all within ecological and energetic limits. This requires exploring alternative economic models and indicators beyond GDP.

Reform Financial Mechanisms:

Develop and implement financial frameworks that are consistent with biophysical realities. This could include exploring concepts like negative discount rates for renewable energy projects to reflect their increasing energetic value over time.

Foster Public Engagement:

Ensure genuine and broad stakeholder engagement, including local communities and iwi, in decision-making processes, recognizing that social and cultural factors are critical for effective policy implementation. Address cognitive biases that lead to an over-reliance on techno-optimism.

Comprehensive Risk Analysis:

Incorporate the high probability and high impact risk of near-term shortfalls in liquid fossil fuel supply and the increasingly severe issues driven by the decline in net energy into national risk assessments.

I am happy to speak to this submission should the chance arise.

Ngā mihi nui,

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