BEFORE THE NOVA SCOTIA UTILITY AND REVIEW BOARD

In the Matter of the Electricity Act	**)**	
and	**)**	**Matter No. M05092**
the Tidal Energy Feed-in Tariff Rate	**)**	
for Development Tidal Arrays	**)**	

DIRECT TESTIMONY OF

PAUL CHERNICK

ON BEHALF OF

THE CONSUMER ADVOCATE

Resource Insight, Inc.

AUGUST 30, 2013

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I. Identification

Q: Mr. Chernick, please state your name, occupation, and business address.

A: I am Paul L. Chernick. I am the president of Resource Insight, Inc., 5 Water St, Arlington, Massachusetts.

Q: Summarize your professional education and experience.

A: I received an SB degree from the Massachusetts Institute of Technology in June 1974 from the Civil Engineering Department, and an SM degree from the Massachusetts Institute of Technology in February 1978 in technology and policy. I have been elected to membership in the civil engineering honorary society Chi Epsilon, and the engineering honor society Tau Beta Pi, and to associate membership in the research honorary society Sigma Xi.

I was a utility analyst for the Massachusetts Attorney General for more than three years, and was involved in numerous aspects of utility rate design, costing, load forecasting, and the evaluation of power supply options. Since 1981, I have been a consultant in utility regulation and planning, first as a research associate at Analysis and Inference, after 1986 as president of PLC, Inc., and in my current position at Resource Insight. In these capacities, I have advised a variety of clients on utility matters.

My work has considered, among other things, the cost-effectiveness of prospective new electric generation plants and transmission lines, retrospective review of generation-planning decisions, ratemaking for plant under construction, ratemaking for excess and/or uneconomical plant entering service, conservation program design, cost recovery for utility efficiency programs, the valuation of environmental externalities from energy production and use, allocation of costs of service between rate classes and jurisdictions, design of retail and

wholesale rates, and performance-based ratemaking and cost recovery in restructured gas and electric industries. My professional qualifications are further summarized in Exhibit PC-1.

Q: Have you testified previously in utility proceedings?

A: Yes. I have testified more than 250 times on utility issues before various regulatory, legislative, and judicial bodies, including utility regulators in thirty states and five Canadian provinces, and two U.S. Federal agencies. This testimony has included the review of many utility-proposed power plants and purchased-power contracts.

Q: Have you testified previously regarding procurement of renewable and distributed energy resources?

A: Yes. I have testified in numerous proceedings on avoided costs and tariff designs, as listed in my resume.

Q: Have you previously testified before this Board?

A: Yes. I testified in the Board's review of the following cases:

- Nova Scotia Power's Demand Side Management Plan for 2010 and Demand Side Management Cost Recovery Rider in May 2009 (Matter No. 01439).
- The proposed purchased-power agreement between Nova Scotia Power Inc. ("NSPI") and a biomass project to be constructed at the NewPage Port Hawkesbury pulp and paper mill (Matter No. 01496).
- Nova Scotia Power's proposal to build the biomass project at NewPage Port Hawkesbury (Matter No. 02961).
- Heritage Gas's 2010 rate case (Matter No. 03454).
- Nova Scotia Power's proposal to increase production depreciation rates (Matter No. 03665).

- The Board's review of proposed feed-in tariffs for certain distribution-connected renewable projects (Matter No. 03632).
- The Nova Scotia Power general rate application (Matter No. 04104), with respect to cost allocation and rate design.
- The Board's review of proposed a proposed load-retention tariff and rate (Matter No. 04175).
- The application of Efficiency Nova Scotia Corporation (ENSC) Electricity Demand-Side Management Plan for 2013–2015 (Matter No. 04819).
- The application of NSPI and Pacific West Commercial Corporation for a load-retention rate mechanism for the Port Hawkesbury paper mill (Matter No. 04862).
- The Board's review of NSPI's 2013 Annual Capital Expenditure Plan (Matter No. 05339).
- The application of NSPI for approval of the South Canoe Wind Project (Matter No. 05416).
- The Board's review of the Maritime Link proposal (Matter No. 05419).

I have also assisted the Consumer Advocate in preparing comments in the Board's reviews of NPSI's Nuttby, Digby, and Point Tupper wind project proposals (Matters Nos. 02195, 02763 and 02983), NSPI's Renewable Energy Tax and Accounting Depreciation (Matter No. 03795), the Capital Expenditure Justification Criteria review (Matter No. 04600), and the Renewable RFP (Matter No. 04838).

II. Introduction and Summary

Q: On whose behalf are you testifying?

A: My testimony is sponsored by the Nova Scotia Consumer Advocate.

Q: What is the purpose of your testimony?

A: I offer the Board some insights into the shortcomings of the Tidal Feed-in Tariff (FIT) rates proposed by the Board's consultant, Synapse Energy Economics, Inc., in the prefiled evidence of Geoffrey Keith and Mirko Previsic, August 16, 2013.

Q: Please summarize your observations on the Tidal FIT rate proposal.

A: Ratepayers, the province, and tidal developers would be better off if the Tidal FIT rates were designed using a lower return target and allowing a significant portion of the tariff escalate with inflation, rather than being fixed in advance. The Board should also defer approval of any Tidal FIT rate until Synapse does a better job of documenting its input assumptions.

Q: Are there any overarching considerations that the Board should bear in mind in approaching the task of setting Tidal FIT rates?

A: Yes. Setting the Tidal FIT rates requires dealing with some important aspects of this particular combination of technologies and regulatory process: availability of data, limitations on the capacity to be allowed to sell under the Tidal FIT, and the purpose of the Tidal FIT.

Q: Please describe the data-availability issues in this proceeding.

A: The basic problem is that the Tidal FIT rates cannot be derived from well-known and easily reviewed data. The FIT regulations require that the FIT rates be based on the costs of the technologies. Very few in-stream tidal projects have entered service, even as test or demonstration units. Furthermore, the range of potential costs for developmental in-stream tidal projects is quite wide, compared to the wind plants that make up most of the potential (and most of the approved capacity) in the Community FIT program.[1] Synapse estimates "that equipment

[1]Approved COMFIT Projects Status, NS DOE.

costs for devices installed in the Bay of Fundy could range from $4,200 to $5,500 per kW" (CA IR-11). The UK Carbon Trust estimates that the cost of tidal projects will decline by about 20% over the first 30 MW or so of global deployment (Accelerating Marine Energy: The Potential for Cost Reduction—Insights from the Carbon Trust Marine Energy Accelerator, July 2011, Figure 22b). Synapse's estimate of the cost for the developmental rate has varied as follows:

- $500/MWh for a 20-year contract and a 13% IRR in the initial May 24, 2013 draft tariffs, which would have been
  - $514/MWh for the 15-year contract used in the later versions, or
  - $454/MWh for 15 years and a 10% IRR;
- $481/MWh for 15-year contract and a 10% IRR in the August 5, 2013 revised draft tariffs;
- $545/MWh in the August 16, 2013 evidence.

This high level of uncertainty means that developing any cost-based rate will require considerable judgment. Appropriately selecting the rate inputs will require that those with access to data (particularly Synapse) share that information with other parties and the Board.

Q: Please describe the unusual aspects of the purposes of the Tidal FIT.

A: The Tidal FIT is not intended primarily to increase renewable energy supply in Nova Scotia, as has been the case for the NSPI and NS DOE requests for proposals, nor to allow local community entities to participate in renewable development, as is the case for the Community FIT. Instead, it appears that the Province has the "intention [for] the Developmental Tidal Feed-in Tariff (FIT)… to support technology advancement and the development of a domestic industry around tidal energy." (NSDOE IR-1)

In terms of global competition as a site for tidal power development, Nova Scotia appears to have a tidal resource as favorable as any in the world, and much better working and living environments than northern Scotland or the Orkneys, the major resource competitors. Installing, maintaining, and monitoring tidal equipment would be feasible on many more days in the Bay of Fundy than in the Pentland Firth. It should not be necessary for Nova Scotia to match the UK rates currently offered (which Synapse estimates at $422/MWh, subject to the risks of varying market prices for renewable credits and energy) or proposed (£305 or $484/MWh, from Synapse Evidence at 34).

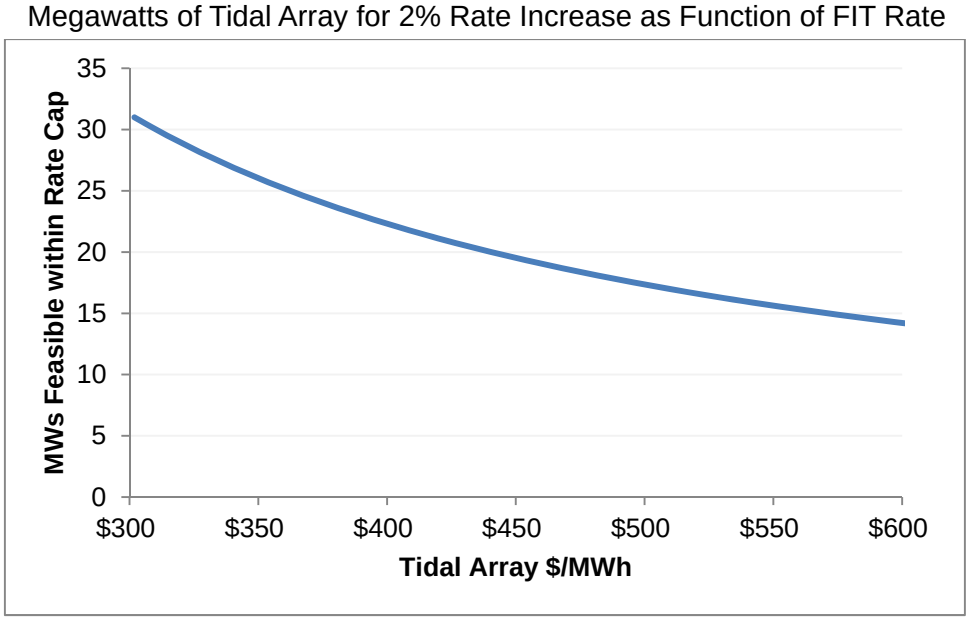
Nova Scotia's living and working environment may be more comparable to Ireland and Maine, both of which have attracted tidal installations with much lower rates: a FIT of €220 (about $300/MWh) in Ireland and a negotiated contract of $215 USD/MWh (about $221/MWh) in Maine (Synapse Evidence at 36). The setting of the Tidal FIT rate should recognize the nature of the competition for establishing a tidal-power industry.

Q: Please describe the implications of limits on Tidal FIT capacity.

A: The amount of tidal capacity developed under the Tidal FIT will be limited by the rate effect on consumers. This is in contrast to the Community FIT, which was constrained by specific capacity limits (for small wind) and by access to distribution lines. Higher Tidal FIT tariff rates would result in fewer megawatts of tidal projects being permitted under the FIT. Development of fewer and smaller tidal projects would tend to undermine the DOE's intention to establish a local industry serving the global market. Developers are more likely to establish research, development, and production facilities in Nova Scotia if they have opportunities to deploy multiple projects representing multiple generations of design and manufacture, at a price that is as good as is available in competitive

locations, than if they have a one-shot opportunity to install an array at a very high price.

As shown in the below figure, about one less megawatt of tidal FIT array can be accommodated under the 2% rate cap for every $10/MWh increase in the tariff in the $300/MWh to $400/MWh range, or for every $20/MWh increase in the tariff in the $400/MWh to $500/MWh range.[2]



Considering the above, the benefits to Nova Scotia may be maximized by tidal FIT array prices in the $350–$450/MWh range.

III. Tidal Feed-in-Tariff Rate Design

Q: Putting aside the specific values in the proposed tariffs, has Synapse proposed appropriate designs for the Tidal FIT?

[2]This computation is based on Synapse's response to NSPI IR-1, Table 2, assuming a 38% capacity factor, $50/MWh avoided cost, $1.3 billion in non-tidal revenue requirements, and no test units operating at the time the arrays are in full operation.

A: There is much positive in the proposed Tidal FIT rate design that is not typical in feed-in tariffs, and Synapse should be commended for those features. Specifically, Synapse deals well with the transition from initial test units to arrays, and with the economies of scale.

Rather than treating an initial test unit and a subsequent array as two separate projects, Synapse proposes treating the test unit and the array as two phases of one project, with the higher test-unit tariff available for a single unit for a maximum of three years. The rate for the follow-up array would be lower than the rate for an array that did not receive the favorable test-unit tariff in the early years.

Synapse also proposes declining block rates, so that larger units or arrays would be paid a lower rate over some threshold. A lower rate should be adequate for larger plants, due to economies of scale. In addition, the lower rate for large arrays reduces the extent to which they would use up the rate impact headroom allowed for the entire Tidal FIT program.

IV. Proposed Tidal Feed-in-Tariff Rate Levels

Q: Has Synapse adequately explained the derivation of the proposed Tidal FIT rates?

A: No. Synapse does a good job of documenting the manner in which it computed the Tidal FIT tariffs from the input cost and performance values (e.g., development, construction, operation, decommissioning), and also provides a fair amount of detail on the components of each cost category (e.g., structural components; power take off, rotor and electrical; subsea interconnection; and environmental monitoring systems as components of equipment costs).

Unfortunately, Synapse provides very little basis for most of those input values. As I discuss in Section II, there is little real publicly available data on the costs of in-stream tidal projects, so selecting any particular value requires the exercise of judgment. Unfortunately, since Synapse has provided very little of the data on which it relied, neither the parties nor the Board can review how Synapse formed its judgments.

Q: Can you provide some examples of inputs that Synapse could have documented more effectively?

A: Yes. In particular, I would like to highlight two factors that should be amenable to qualitative, data-based analysis: capacity factor and transmission losses.

Synapse offers no data to support its estimate of a 38% capacity factor. From page 27 of Synapse's evidence, it appears that the analysis was based on water-velocity data from university research rather than proprietary corporate sources. While it may be reasonable for Synapse to protect proprietary power-curve data from specific manufacturers, that could be accomplished by averaging the power curves of the multiple options, using "typical" power curves that do not represent specific models, or by requiring a confidentiality undertaking from parties to review the computation. As it stands, Synapse's analysis is cannot be meaningfully reviewed.

Similarly, Synapse does not document the origin of its estimate of 2% transmission losses (Synapse Evidence at 27). Since the Nova Scotia system-wide transmission losses—including step-up transformers, multiple levels of substations and transmission voltages—over hundreds of kilometers from Lingan, Pt. Aconi, and Pt. Tupper to the load centers, is only 3.23% of load (or 3.1% of generation), 2% losses seems quite large for the short interconnection of the tidal plant to the system.

Q: What rate of return does Synapse assume is necessary for the construction of test and developmental units?

A: Synapse assumes that a 10% return is required for all these units.

Q: Is that 10% return target realistic?

A: No. A 10% overall return is reasonable for commercial projects, although some of that return would be debt. For example, the COMFIT rate for large wind is based on a 50/50 mix of 13% equity and 8% debt, for a total return of 10.5%. In contrast, the research, development, test and demonstration installations of any new technology would typically recover less than their full cost, resulting in negative return. Setting rates to provide any positive return would be generous for the demonstration phase of any new product. A manufacturer would be lucky to recover its full cost for demonstration projects, let alone earn a profit. Using an IRR of about 5% would reduce the required first-block array tariff from $543.50/MWh to about $459/MWh, a 15.6% reduction. That target return would bring the array prices closer to the range competitive with other potential development sites (such as Maine and the UK), offering an attractive price while allowing more tidal projects or larger projects to be developed.

V. Shaping Rates Over Time

Q: What options are there for shaping the Tidal FIT rates over time?

A: Purchased-power rates may be designed with a range of temporal patterns, including, among others, the following:

- flat in nominal terms (i.e., paying the same dollars-per-MWh rate in every year of the contract),
- partially escalating with inflation (e.g., to nominally levelized the fixed costs and roughly follow the escalation in operating costs over time),

- fully escalating with inflation (i.e., levelized in real terms).

Synapse has presented its rates in nominal terms, but acknowledges that the rates could also be escalating (Synapse Evidence at 16–17). In its draft rates, Synapse developed options for fully levelized rates and rates in which the O&M component escalates. While the differences in the first-year rates are small, escalating rates would have the following three advantages:

- Starting with lower rates in the first year may allow more Tidal FIT projects to be developed under the 1% and 2% rate-increase caps that the DOE intends to use to limit Tidal FIT contracts. In later years, escalation in labor, fuel prices, operating costs and other rate components will tend to raise average rates, leaving more room under the 2% rate-increase ceiling.
- Escalating a large portion of the rate with actual inflation will better track the costs of labor, services and materials necessary to operate the tidal plants, reducing the risks to the developers and owners of the plants.
- Reducing revenue requirements from the Tidal FIT in the near term will avoid having the highest Tidal FIT revenue requirements coincide with the highest rate effect of the Maritime Link. NSPI expects that the costs of the Maritime Link will start to flow through retail rates in late 2017, peaking in 2019 and then declining 11% through 2025 in nominal terms and 22% in constant-dollar terms.[3] In constant dollars, the Maritime Link revenue requirements fall 23% by 2030, the final year of a 15-year Tidal FIT starting in 2015. Whenever possible, the Board should attempt to minimize other costs in the expensive early years of the Maritime Link.

[3]Maritime Link Application, Appendix 4.01.

Q: Does this conclude your testimony?

A: Yes.