

REDACTED

STATE OF NEW HAMPSHIRE
BEFORE THE
PUBLIC UTILITIES COMMISSION

Northern Utilities Inc., New Hampshire Division
Petition for Expedited Approval of
Empress Capacity Agreements

Docket DG 23-087

Direct Testimony of

Marc Vatter

Director of Economics and Finance
Office of the Consumer Advocate

December 14, 2023

1 **Q. Please state your name, position, and business address.**

2 A. My name is Marc H. Vatter. I am the Director of Economics and Finance for the Office
3 of the Consumer Advocate (OCA).

4 **Q. How long have you worked for the OCA?**

5 A. I have been employed by the OCA since August 25th of this year.

6 **Q. Is a summary of your experience attached to this testimony?**

7 A. Yes. Attachment MV-1 is my resume.

8 **Q. Have you previously testified before utility regulatory commissions?**

9 A. Yes. I have sponsored testimony before the FERC, the Mississippi PSC, the Michigan
10 PSC, and the Energy Facilities Siting Board of the Rhode Island PUC, and I am currently
11 sponsoring testimony before the New Hampshire Commission in Docket DE 23-039.

12 **Q. What is the purpose of your testimony in this docket?**

13 A. The landed cost analysis reported in Table VI-8 on page 5 of Exhibit Northern-FXW-2
14 10.5.23 CONFIDENTIAL runs through 2028, though the Empress contracts extend to 2054. The
15 main purpose of my testimony is to examine the commodity price risk associated with the
16 contracts using a long term forecast of fuel prices, with particular attention to the effect of
17 construction of liquefaction trains on the Pacific Coast in British Columbia. The distinguishing
18 feature of the forecasting model I use is that it forecasts the general pattern of global fuel price
19 shocks, based on the history of such shocks, and their profitability to the Organization of
20 Petroleum Exporting Countries (OPEC). The model draws heavily on research I published in

Vatter (2017)¹, Vatter (2019)², and Vatter (2022)³. Implementation of the model is done in the Excel file Attachment 1 MHV DG 23 087 CONFIDENTIAL.xlsb. Documentation and Excel files implementing the forecasting model, without reference to the Empress contracts, are available here: <http://www.appliedecon.net/long-term-fuel-price-forecast.html>.

I also discuss the benefits of the Empress contracts to residential electric ratepayers, as they will lower both the cost of electric commodity and the price of Regional Greenhouse Gas Initiative (RGGI) emissions allowances, which are passed through to residential ratepayers.

Q. Please summarize the OCA's position regarding whether The Commission should deem the Empress contracts "prudent".

A. The OCA supports approval of the contracts, but The Commission should require Northern to evaluate available strategies for hedging natural gas commodity price risk, including, but not necessarily limited to, purchasing Japan Korea Marker LNG on the futures market, and signing long term contracts for purchase of pipeline gas in Alberta, or additional LNG on the coast in New England.

Q. Will LNG be available for import in New England going forward?

A. The declining volume of deliveries of LNG to New England in recent years indicates that import capacity should be available to support such contracts. The declining volume in Figure

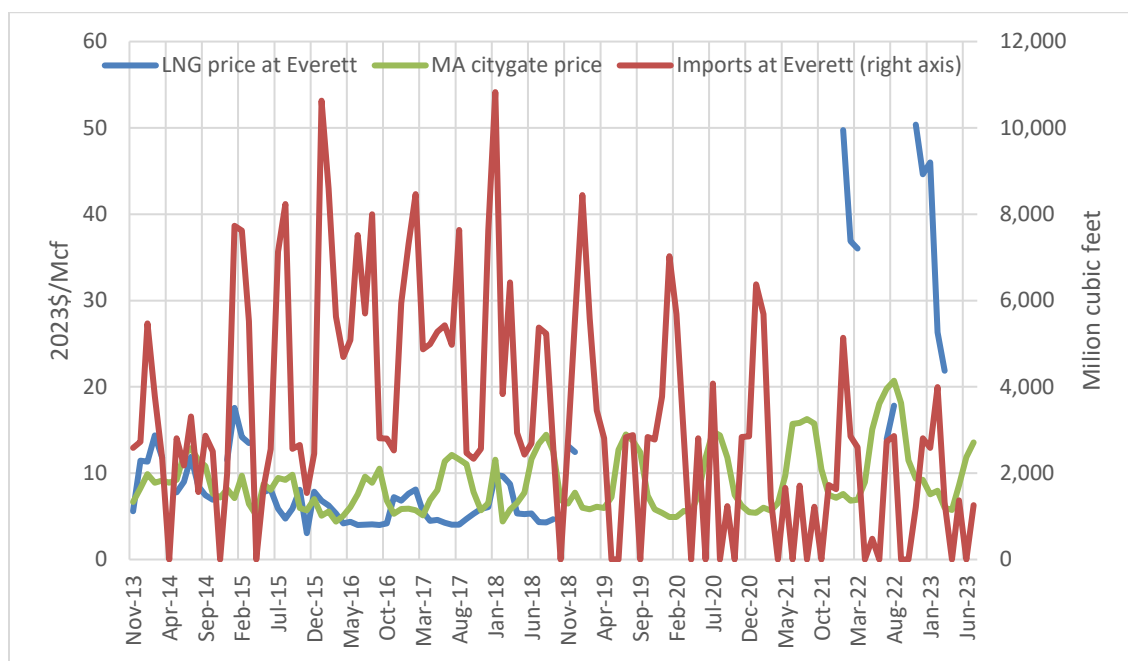
¹ Vatter, M. (2017). OPEC's kinked demand curve. *Energy Economics* 63. <https://doi.org/10.1016/j.eneco.2017.02.010>. Slides available at https://www.usaee.org/aws/USAEE/asset_manager/get_file/526528?ver=0, with voiceover under "OPEC as a Destabilizing Influence - 7/20/2020" at <https://www.usaee.org/aws/USAEE/pt/sp/podcasts>.

² Vatter, M. (2019). OPEC's risk premia and volatility in oil prices. *International Advances in Economic Research* 25:2. DOI: 10.1007/s11294-019-09734-7. Video available at <https://www.youtube.com/watch?v=IU5zqH4X0FI>, accessed April 10, 2023.

³ Vatter, M. (2022). Pricing global warming as a mortal threat. USAEE Working Paper No. 21-491, Available at SSRN: <https://ssrn.com/abstract=3821603> or <http://dx.doi.org/10.2139/ssrn.3821603>. An earlier version was also presented at a virtual conference of the International Association for Energy Economics, June 7-9, 2021, <https://www.iaee.org/proceedings/article/17059>. Video available at <https://www.youtube.com/watch?v=G5of9Qgrdsc&t=1448s>.

II-6 on page 24 of Exhibit Northern-FXW-2 10.5.23 CONFIDENTIAL is substantially driven by prices of both LNG and pipeline gas. Using the data shown in Figure 1, I estimate the price elasticity of demand for imports at the Everett LNG import terminal to be -0.35 with respect to the price of the imports themselves, and 0.28 with respect to the Massachusetts citygate price. Data and calculations are shown in the Excel file Attachment 2 MHV DG 23 087.xlsb.

Figure 1: Price and volume of imports at Everett LNG terminal, and MA citygate price



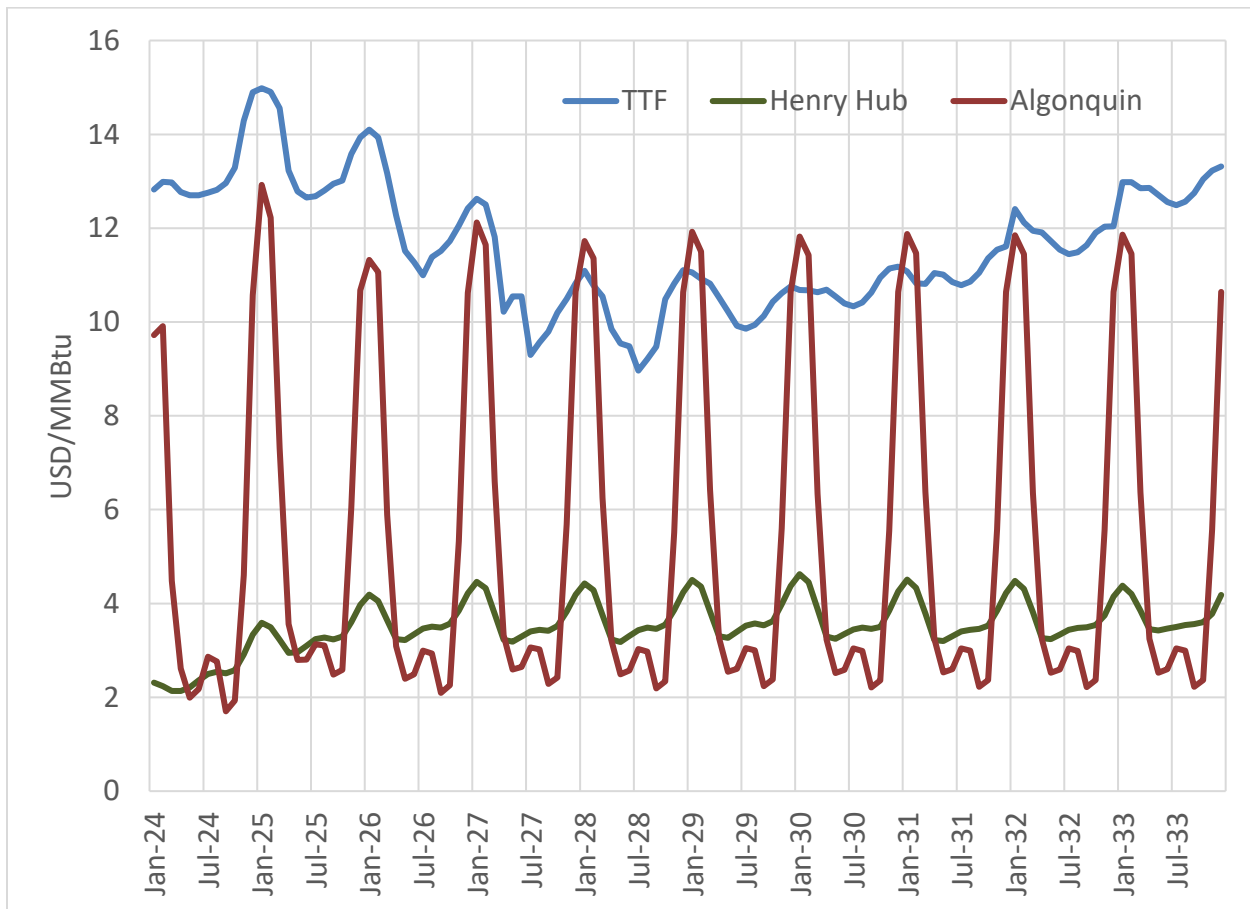
Source: Energy Information Administration (EIA)

There is a tension between arguing that gas is dear in New England and suggesting that owners of infrastructure capable of providing gas here would retire that infrastructure, as Northern does. Figure 2 shows recent futures strips for European LNG (TTF) and American pipeline gas (Henry Hub, Algonquin citygate).⁴ To July 2028, the former is in backwardation,

⁴ <https://www.cmegroup.com/markets/energy/natural-gas/dutch-ttf-natural-gas-calendar-month.settlements.html#tradeDate=10%2F26%2F2023>, accessed December 13, 2023;

and the latter are in mild contango. Given the estimated elasticities at Everett, inasmuch as these futures prices are good predictors of spot prices, volumes at Everett should rise. The present time, then, may be a good opportunity to contract for future deliveries of additional LNG to New England, while import capacity is plentiful.

Figure 2: TTF, Henry Hub, and Algonquin futures strips



<https://www.cmegroup.com/markets/energy/natural-gas/natural-gas.settlements.html#tradeDate=10%2F26%2F2023>, accessed December 13, 2023;
<https://www.ice.com/report/142>, accessed December 13, 2023

1 Unless volumes rise too much, a reasonable assumption is that the excess import capacity
2 allows one to focus on a global forecast of LNG prices without adding a congestion premium at
3 the importation and regasification facilities locally.

4 **Q. Please describe the risk associated with expanded liquefaction capacity in**
5 **British Columbia.**

6 A. According to the Canadian Association of Petroleum Producers (CAPP), four new or
7 expanded liquefaction facilities are set to come online in British Columbia between 2025 and
8 2028, fed by natural gas sourced in British Columbia and Alberta.⁵ The currently low prices in
9 Alberta could be raised substantially by competing Asian buyers because a congestion premium,
10 in the price they would pay for that gas, could be lowered significantly when the new
11 liquefaction capacity begins operations. This type of phenomenon is occurring elsewhere as the
12 natural gas industry becomes better linked globally. A stark example is the sometimes negative
13 prices at the Waha Hub for associated gas from the Permian Basin in 2019 and 2020, to which
14 additional takeaway capacity put a stop.⁶ As the industry globalizes, it will better resemble, and
15 compete with, the petroleum industry, which has been globalized for decades.

16 Asia already accounts for 70 percent of global LNG demand, and several analysts are
17 bullish about future growth.⁷ “Pointing to some 200 scenarios devised by the Intergovernmental
18 Panel on Climate Change that are Paris-compliant, Woodside CEO Meg O’Neill said gas would
19 be needed under most outcomes.

⁵ <https://www.capp.ca/explore/natural-gas-and-the-lng-opportunity-in-british-columbia/>, accessed December 11, 2023.

⁶ EIA; https://www.eia.gov/naturalgas/weekly/archivenew_ngwu/2022/09_08/, accessed December 11, 2023.

⁷ Tan, C. (2023). Industry stays bullish on Asian LNG demand. <https://www.energyintel.com/0000018b-61ee-d826-a3cb-e9fe32b50000#:~:text=Asian%20LNG%20players%20are%20not,of%20a%20peak%20before%202030.>, accessed December 11, 2023.

1 If you look at the economic growth projections of China, South Asia and Southeast Asia
2 that are likely to happen and the decarbonization objectives they have set, we absolutely
3 believe LNG will be an important part of the mix,
4 she said. O'Neill stressed the need for more LNG supplies to ensure affordable prices for
5 emerging markets like Pakistan and Bangladesh in South Asia.

6 We need to get them on LNG and off coal,
7 she said."

8 **Q. Briefly describe your forecast of global fuel price shocks.**

9 A. Figure 3 shows a long term history and forecast of global benchmark fuel prices. The
10 EIA defines the cost of imported crude oil to U.S. refiners as the "world price". Louisiana's
11 Henry Hub is the thickest market for pipeline gas worldwide. Japan Korea Marker (JKM) is
12 used to represent the price of Asian LNG, and Dutch Title Transfer Facility (TTF) is used to
13 represent the price of LNG in Europe.

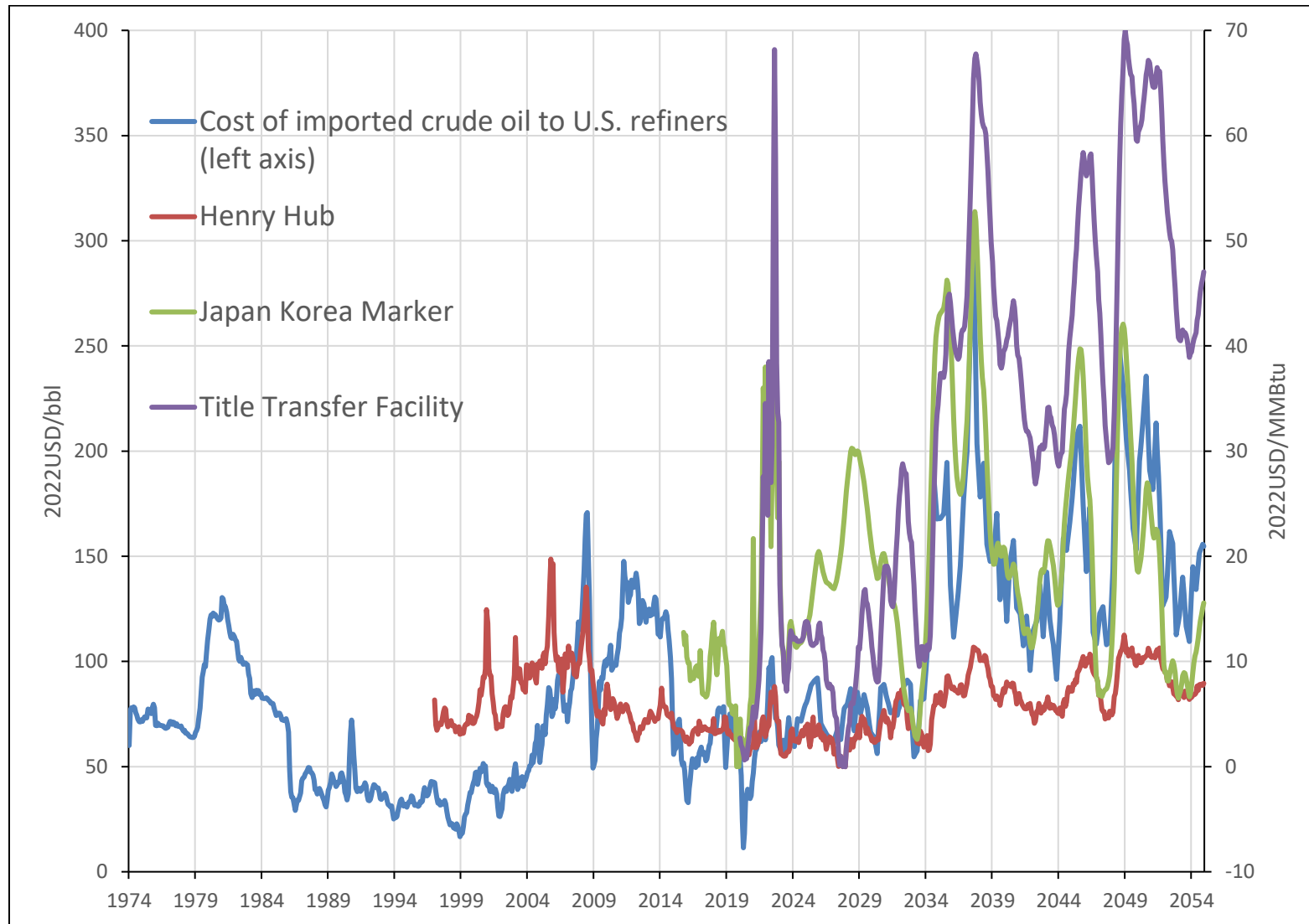
14 Equations for each of the lines shown, along with other equations, such as world demand
15 for crude oil, non-OPEC supply, world GDP, and global greenhouse gas damages, were
16 estimated econometrically. The unexplained components of the main equations in the fuel price
17 modules were used to parameterize normal probability distributions, from which numerous
18 random draws were taken. The random draw most profitable to OPEC, on a present value basis,
19 was selected as the base case, shown in Figure 3. This draw was significantly more profitable to
20 OPEC than any other draw taken, and significantly more profitable than a deterministic forecast,
21 in which the random components were "zeroed out". The reasons why OPEC profits from
22 volatility are explained in the research referenced and the documentation of the forecast, also
23 referenced. To maximize this profitability, shocks to price should come as a surprise to both

1 consumers and non-OPEC producers. According to Saudi Energy Minister Prince Abdulaziz bin
2 Salman,

3 We will never leave this market unattended. I want the guys in the trading floors to be as
4 jumpy as possible. I'm going to make sure whoever gambles on this market will be
5 ouching like hell.

6 Axes in Figure 3 are scaled so that the heights of the oil and gas lines are comparable,
7 assuming each barrel of crude oil contains 5.8 MMBtu of energy. Because of the cost of
8 liquefaction and cold transport, LNG is more expensive than crude oil, before the social cost of
9 emissions is included. Though oil and gas are both substitutes in consumption and complements
10 in production, the substitutability governs the relationship between their prices far more often, so
11 oil price shocks cause shocks to the price of LNG, as in 2022 after the Russian invasion of
12 Ukraine. Europe's LNG import capacity is expanding rapidly, so a recent futures curve for TTF
13 is used as the forecast through October 2025. Despite this, the forecast for TTF is more
14 sensitive to oil shocks than is the forecast for JKM, possibly because TTF's history as the major
15 pricing point for European gas, rather than National Balancing Point in Britain, is short and
16 encompasses the shock associated with the war in Ukraine. The analysis of the Empress
17 contracts does not refer to the forecast for TTF, only to the forecast for JKM, though a forecast
18 for TTF would be germane to evaluation of a contract for LNG delivered to New England.

1 Figure 3: Long term history and forecast of global benchmark fuel prices



2

Q. How would global fuel price shocks affect the value of the Empress contracts in New Hampshire?

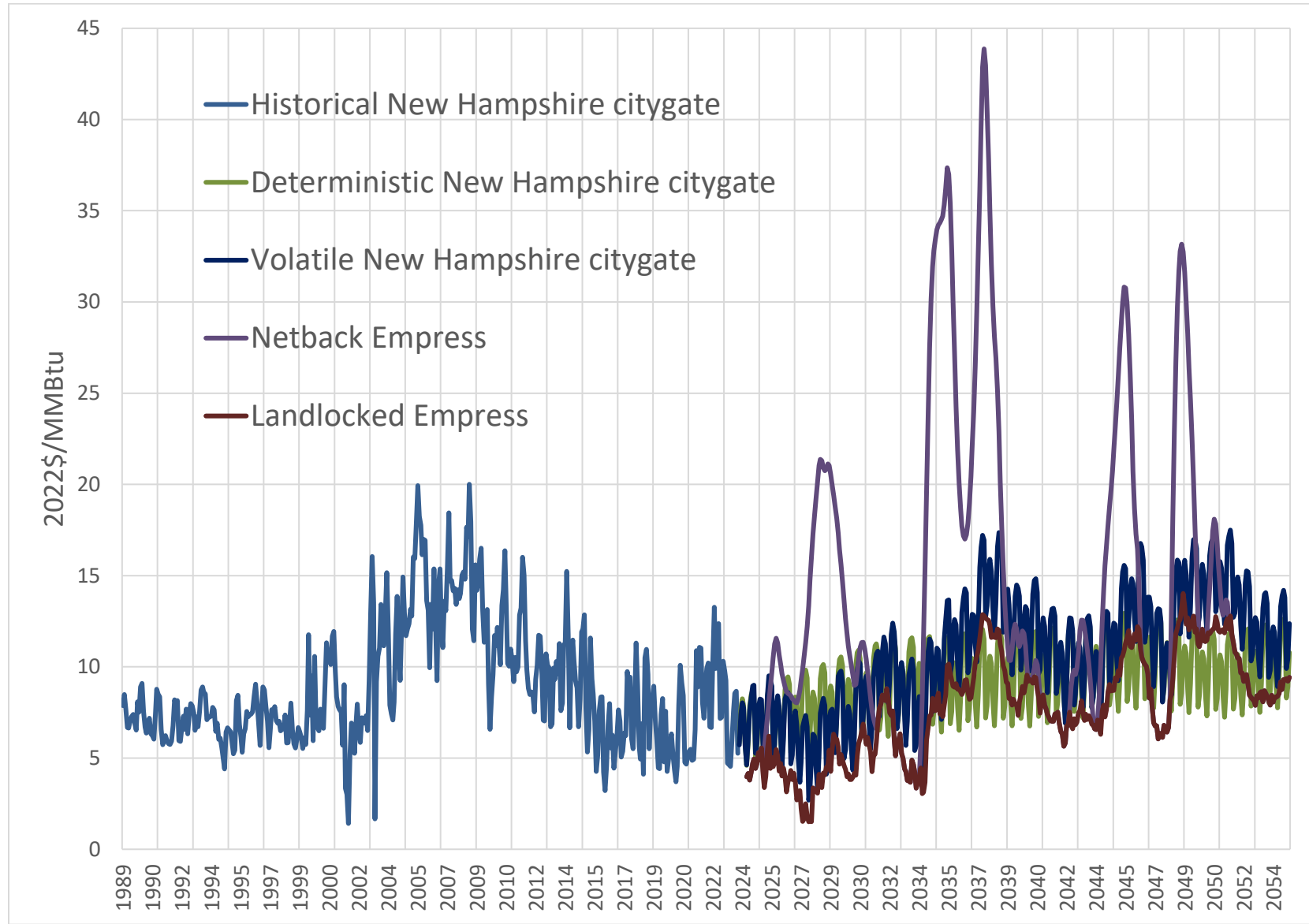
A. Using data to 1997 from the EIA , an equation for the price (USD/MMBtu) of natural gas at the New Hampshire citygate (NHCG), where wholesale gas is delivered to retail distributors, is estimated as a function of the price at Henry Hub and separate deterministic trends for each month, to reflect the changing seasonality of emergent congestion on pipelines entering New England, shown in Table 1.

Table 1: Regression equation estimating New Hampshire citygate price

	<u>Coefficient</u>	<u>Standard Error</u>
H_t	0.391	0.056
JanTime	0.005	0.001
FebTime	0.003	0.002
MarTime	-0.001	0.001
AprTime	-0.001	0.001
MayTime	0.005	0.001
JunTime	0.009	0.002
JulTime	0.006	0.002
AugTime	0.006	0.002
SepTime	0.004	0.001
OctTime	-0.005	0.001
NovTime	0.002	0.001
DecTime	0.006	0.002
$NHCG_{t-1}$	0.504	0.059
$NHCG_{t-2}$	0.149	0.036
Constant	0.272	0.217

Figure 4 shows historical and forecast prices for natural gas at the New Hampshire citygate. The forecast line labeled “volatile New Hampshire citygate” in Figure 4 uses the forecast for Henry Hub shown in Figure 3 in the equation reported in Table 1. It reflects the impacts of global fuel price shocks. The magnitude, long cycles, and seasonality of this forecast

1 Figure 4: New Hampshire citygate and Empress contract prices; 2022\$/MMBtu



1 echo those of the historical series.

2 The forecast line labeled “deterministic New Hampshire citygate” in Figure 4 uses a
3 forecast for Henry Hub with the random components “zeroed out”. It does not reflect the
4 impacts of global fuel price shocks, but it extends the long cycle and seasonality of the historical
5 series.

6 The line labeled “landlocked Empress” equals the price at Henry Hub shown in Figure 3
7 plus basis from there to Alberta of -1.15 USD/MMBtu in 2023 reported by the Alberta Energy
8 Regulator , plus [REDACTED]
9 [REDACTED], plus 25¢ to account for the markup from
10 delivery points along the Granite pipeline to Northern’s distribution system, making it
11 comparable to the New Hampshire citygate price. This price is consistently below the volatile
12 New Hampshire citygate price, showing the good economics of the Empress contracts
13 highlighted in that exhibit. However, that the basis to Henry Hub is so negative highlights the
14 temporary geographic isolation of the market for natural gas in Alberta.

15 The line labeled “netback Empress” is actually the greater of landlocked Empress and a
16 netback from JKM to Alberta. The netback is the price of JKM from Figure 3 minus the cost of
17 transportation to Asia, the cost of liquefaction, and the cost of pipeline transport from Alberta to
18 the Pacific Coast, plus [REDACTED], plus 25¢ to account
19 for the markup from delivery points along the Granite pipeline to Northern’s distribution system.
20 The costs of transportation to Asia, liquefaction, and pipeline transportation from Alberta to the
21 Pacific Coast are based on estimates from Zou et. al (2021; Table 2, page 4). The authors report
22 these costs as percentages of the price of regasified LNG, but I fix their real levels calculated at
23 2021 prices throughout the forecast because LNG prices are volatile, and these components of

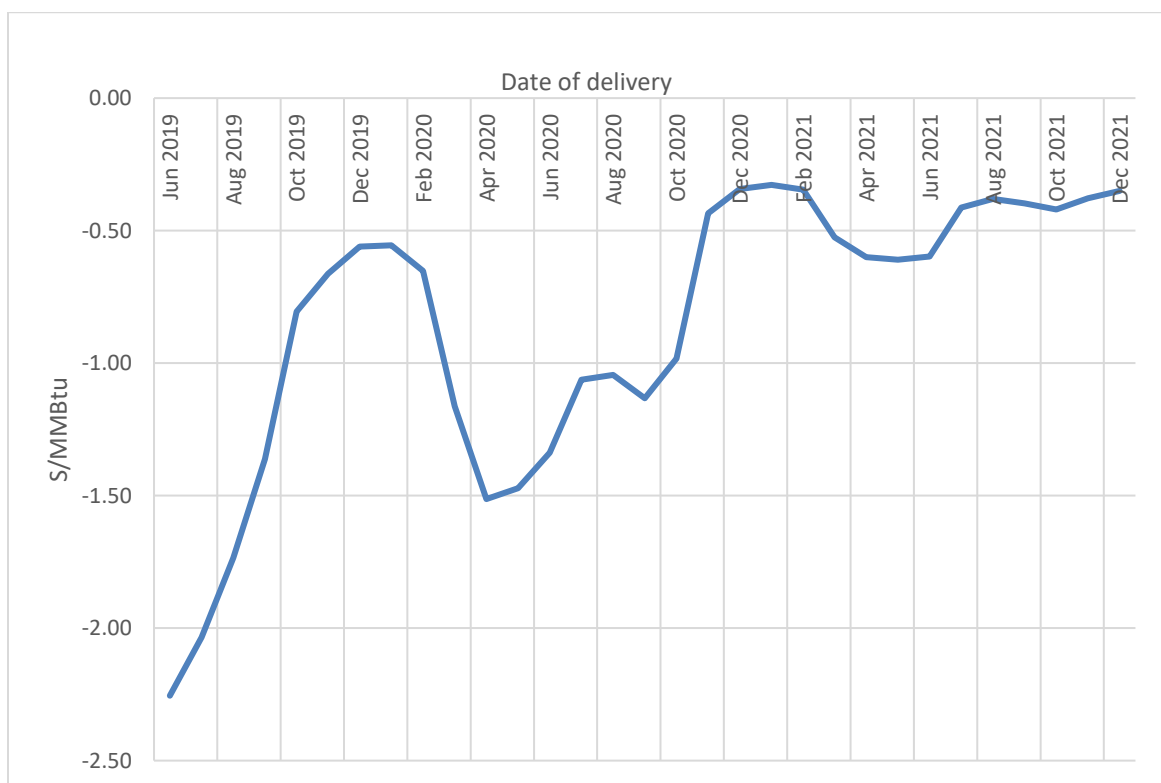
1 costs cannot be expected to vary nearly as much. The cost of liquefaction in British Columbia
2 may be lower than along the U.S. Gulf Coast because of lower ambient temperatures in
3 British Columbia.

4 Netback Empress, though lower than the volatile New Hampshire citygate price line
5 during much of the contract term, far exceeds the New Hampshire price during fuel price shocks.
6 It is for this reason that I recommend that The Commission require Northern to evaluate hedging
7 strategies for commodity price risk long term. To 2054, the end of the contract term, the real
8 levelized (@3% p.a.) New Hampshire citygate price is \$10.20/MMBtu, while the levelized
9 landlocked Empress price is \$7.23, but the levelized netback Empress price is \$14.01. Futures
10 curves typically do not factor in global fuel price shocks in advance, as intended by OPEC, only
11 regular seasonal variation and trends, so hedging that risk by buying futures before OPEC
12 surprises the market, and waiting to buy again until price comes back down, could make the
13 difference between the Empress contracts being an improvement on spot gas in New England,
14 and not. Buying three years in advance, except during upward shocks to price, should suffice:
15 OPEC has not visited a *long* price shock on the market since the price collapse of 1986. Given
16 the duration of the JKM futures strip, this could be done by buying in advance in that market.
17 Those positions, of course, could be resolved close to delivery dates and gas purchased spot.

18 Long term bilateral contracts are also a possibility, including for delivery in Alberta or
19 for additional LNG in New England. Either could help manage shocks, but perhaps not lower
20 overall price levels for Empress gas, as sellers in Alberta should be expecting higher prices
21 overall once they have better access to the global market for LNG. Again, the first new
22 liquefaction project is expected to come online in 2025, and the last in 2028.

This was the case at Waha. “In 2021, additional pipeline capacity to transport natural gas out of the Permian production region was put in service, and the price differential between Waha Hub and Henry Hub narrowed.”⁸ Figure 5 shows the basis future from Waha to Henry Hub in May of 2019. It trended up and stabilized when congestion on outgoing pipelines was going to be relieved by new capacity.

Figure 5: Waha basis future to Henry Hub; May 2019



Source: Intercontinental Exchange; <https://www.theice.com/marketdata/reports/142>

The contango in the futures strip on the Natural Gas Exchange (NGX) in Alberta now roughly matches that at Henry Hub, where prices will be lifted by increasing global demand for

⁸ https://www.eia.gov/naturalgas/weekly/archivenew_ngwu/2022/09_08/, accessed December 13, 2023.

1 LNG.⁹ As markets for natural gas become increasingly linked globally, geographic
2 diversification of spot purchasing points will become a less effective way to manage price risk.

3 It is also worth noting that gas will be extracted in Alberta where the marginal cost of
4 doing so equals the spot price, and shipped to Asia when spot prices are high enough, displacing
5 coal-fired electric generation there, whether or not Northern locks in the price it pays for
6 Empress gas ahead of time.

7 **Q. How would the Empress contracts lower the cost of residential electric service?**

8 A. Though DG 23-087 is a gas docket, residential electric customers have a stake in it: Any
9 reduction in the cost of energy in New England, including both the cost of gas-fired generation
10 and the cost of RGGI allowances, which are passed through to residential electric customers, will
11 help them. Gas continues to be the marginal fuel much of the time for electric generation.
12 Because the Empress contracts fund construction of additional pipeline capacity between the
13 source of gas and New England, they will lower both the LMPs ultimately paid by residential
14 electric customers and the price of retail gas to residential customers. Diversion of gas to electric
15 generation from gas service will mitigate, but not nullify, the downward impact of additional
16 pipeline capacity on the price of retail gas. Through RGGI, residential electric customers pay
17 external costs of emissions of CO₂. The effect thereon of the Empress contracts will be
18 incremental, but that is how cost-minimizing choices are made, “at the margin”.

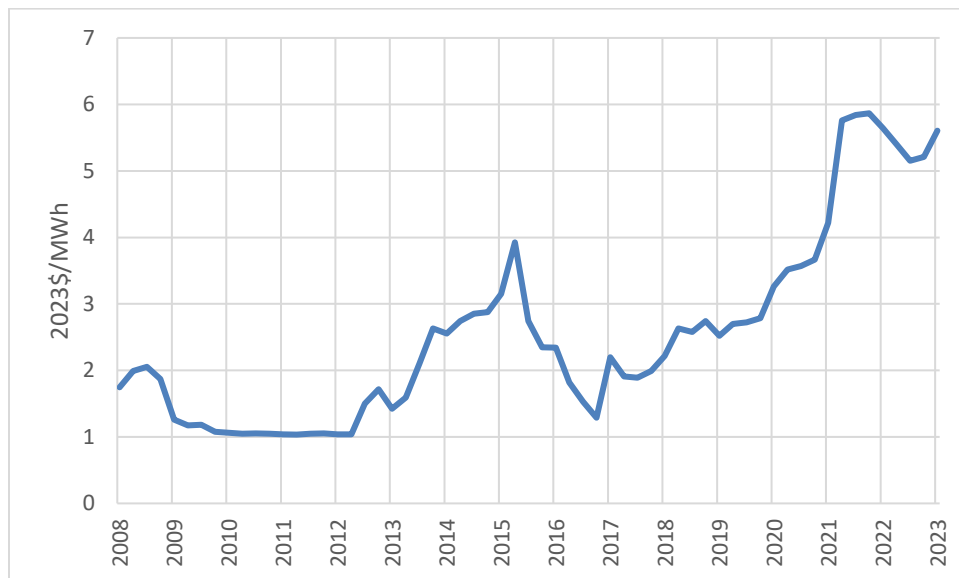
19 The normal process of decarbonization involves a phase in which natural gas is
20 substituted for coal in the generation of electricity, and most of the reductions in emissions
21 New England has achieved have come through substitution of gas for coal or oil. While this
22 process transpired, it contained the price of RGGI allowances to low levels by lowering the

⁹ <https://www.gasalberta.com/gas-market/market-prices>, accessed December 13, 2023.

demand for them, because fewer allowances are required to produce a MWh using gas than coal. This process is not quite complete, and may not be for some time, but substitution of natural gas-fired generation for coal-fired generation from Merrimack Station will lower the price of RGGI allowances in the future. The Empress contracts will bring more natural gas to New England, incrementally lowering the cost of gas-fired generation and extending the substitution of gas for the coal burned at Merrimack Station, lowering the price of RGGI allowances.

The RGGI price has risen considerably in recent years, as shown in Figure 6, assuming 0.058 tCO₂/MMBtu for gas and a heat rate of 7.0 MMBtu/MWh.

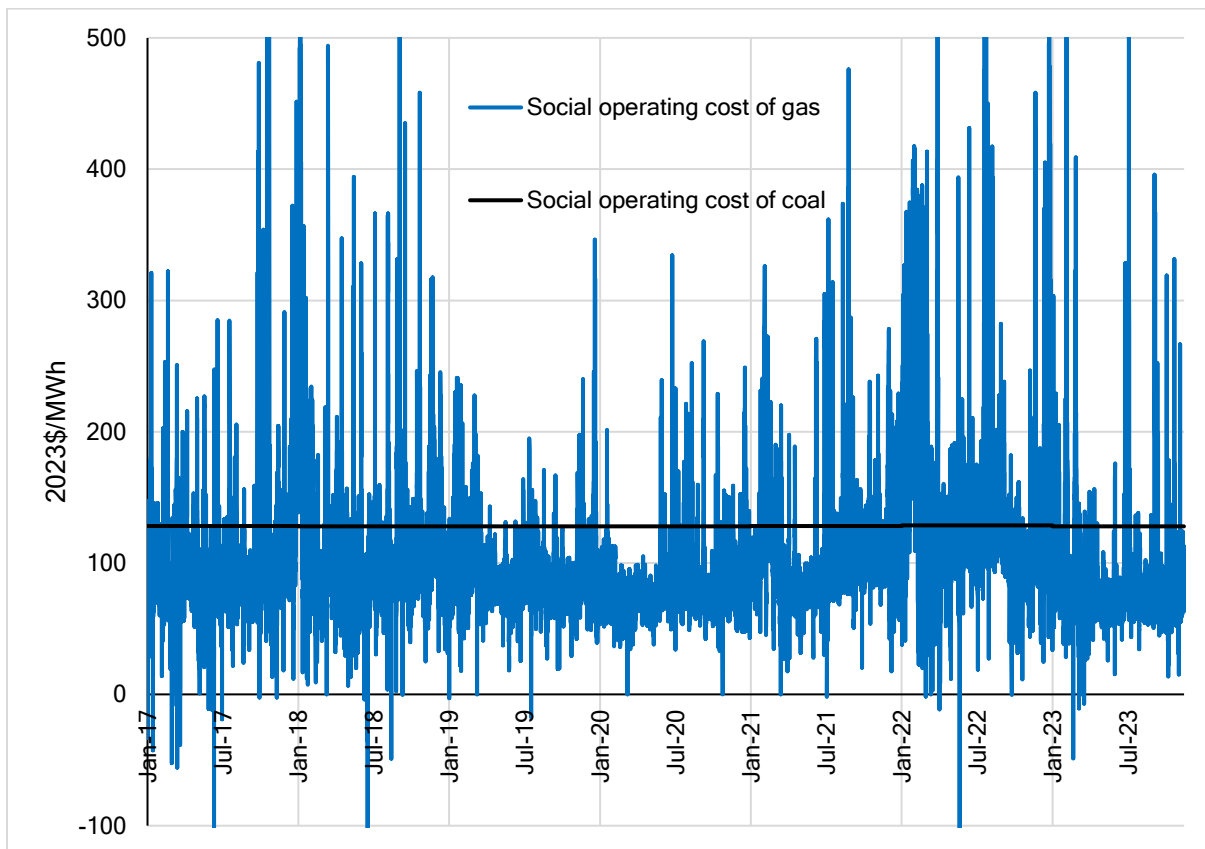
Figure 6: Real price of RGGI allowances



Q. Would the Empress contracts and similar arrangements lead to the closure of Merrimack Station?

A. Not likely. Figure 7 compares the full social operating costs of a combined cycle gas-fired plant and those of Merrimack Station from 2017 to November 15, 2023, assuming the gas fired plant sets the LMP at the Merrimack Station ISO-NE node. The social operating cost of gas equals the LMP, plus estimated greenhouse gas (GHG) damages shown in Table 2, less the RGGI price shown in Figure 6, since the RGGI price is reflected in the LMP and partially covers the GHG damages. The social cost of coal equals the private (internal) operating cost of Merrimack Station plus estimated CO₂ damages shown in Table 2.

Figure 7: Real social operating costs of natural gas and coal at Merrimack Station



1 Table 2: Assumptions underlying Figure 7

Heat rate of coal	MMBtu/MWh	10.5
Units	MMBtu/short ton	19.333
Price of coal	\$/short ton	¹
2017		123.81
2018		105.64
2019		93.90
2020		95.02
2021		124.39
2022		256.52
2023		101.38
Variable O&M of coal	\$/MWh	4.5 ²
Minimum up time of coal	Hours	48 ³
Emissions of coal	tCO ₂ /MWh	1.15 ⁴
CO ₂ damages of coal USA	\$/tCO ₂	107 ⁵
CO ₂ damages of coal USA	\$/MWh	123.05
GHG damages of gas USA	\$/MMBtu	6.30
Heat rate of gas	MMBtu/MWh	7.0
GHG damages of natural gas USA	\$/MWh	44.09
Capacity of Merrimack Station	MW	482

¹

<https://www.eia.gov/coal/data/browser/#/topic/45?agg=0,2,1&rank=g&geo=vvvvvvvvvvvo&freq=A&start=2001&end=2022&ctype=map<ype=pin&rtype=s&motype=0&rse=0&pin=>

accessed November 21, 2023

²

https://www.eia.gov/analysis/studies/powerplants/capitalcost/pdf/capital_cost_AEO2020.pdf

accessed November 7, 2023

³ <https://www.nrel.gov/docs/fy12osti/55433.pdf>

⁴ <https://www.eia.gov/tools/faqs/faq.php?id=74&t=11>

accessed November 7, 2023

⁵ https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3821603

accessed November 7, 2023

2

3 It would have been socially optimal to operate Merrimack Station when, and only when,
4 the social operating cost of gas exceeded the social operating cost of coal for any 48 hour period.
5 Socially optimal and actual plant factors are shown in Table 3. They are reasonably close,
6 except in 2018 and, especially, in 2022, when high fuel prices caused by the Russian invasion of
7 Ukraine drove LMPs to very high levels, but Merrimack Station did not respond by operating

more. The price of coal rose, but that internal cost is swamped by the external cost of emissions from coal, and that is why variation in full social cost for the plant is hardly visible in Figure 7, though it is present. Consequently, most of the net social benefits of operating Merrimack Station socially optimally shown in the lower section of Table 3 were foregone in 2022.

Table 3: Plant factors and net social benefits of operating Merrimack Station, and FCM prices, 2017-23

Plant factor of Merrimack Station			
	<u>Socially optimal</u>	<u>Actual</u>	
2017	0.07	0.06	
2018	0.14	0.03	
2019	0.04	0.07	
2020	0.01	0.03	
2021	0.09	0.07	
2022	0.31	0.07	
2023 through August	0.05	0.04	

<u>Net social benefits of operating Merrimack Station if run optimally</u>			<u>FCA price</u>
	<u>2023\$</u>	<u>2023\$/kW</u>	<u>2023\$/kW</u>
2017	13,391,950	27.78	3.50
2018	27,038,477	56.10	17.73
2019	4,177,334	8.67	8.77
2020	802,435	1.66	12.18
2021	7,424,695	15.40	9.08
2022	77,015,802	159.78	6.94

Sources: EIA-923 and EIA-860 Reports; <https://www.eia.gov/electricity/data/eia923/>, accessed November 22, 2023

This is at prices for emissions well in excess of the RGGI price, and even at those higher prices for emissions, it was, or would have been, socially optimal to operate the plant, and the net social benefits per kW of doing so generally exceeded the prices in the forward capacity market for the contemporaneous commitment years. Merrimack Station did not receive a capacity supply obligation in the most recent ISO-NE forward capacity auction (FCA), but it does not

1 need one. Profitable socially, without a capacity obligation, it is much more profitable privately,
2 given the lower RGGI prices. However, given the upward trajectory of the RGGI price, it is
3 possible that it will approach the true social damages during the term of the Empress contracts, to
4 2054, so I use my estimates of those damages from Table 2 in Figure 7. Even then, it will be
5 socially economic to operate Merrimack Station for some time if the kind of spikes in LMPs
6 shown in Figure 7 persist, especially during fuel price shocks, but those spikes will be smaller if
7 arrangements like the Empress contracts go forward.

8 When the social cost of gas did exceed that of coal in Figure 7, it was largely when those
9 spikes in LMPs occurred, because of sometimes high prices for natural gas in New Hampshire.
10 In the regression reported in Table 1, 19 percent of the variation in the New Hampshire citygate
11 price was unpredictable variation in basis to Henry Hub, and surely represents congestion premia
12 on pipeline capacity entering New England. The changes predicted by the monthly time trends
13 further include such congestion premia. Whether new pipelines enter from the southwest, like
14 Project Maple, or the north, like the Empress capacity, they will lower these congestion premia,
15 making it less economic, both socially and privately, to operate Merrimack Station, thus
16 lowering LMPs and the price of RGGI allowances that are ultimately paid by residential and
17 other retail customers for electric service.

18 Looking at the plant factors in Table 3, it is likely that substantially greater incoming
19 pipeline capacity would have rendered it not socially economic to operate Merrimack Station in
20 2017, 2019, 2020, 2021, and 2023, though it would likely still have been economic to operate it
21 at some, lower, plant factor in 2022, during the global fuel price shock. Arrangements like the
22 Empress contracts may not lead to the shutdown of Merrimack Station, but should lead to its

operating less often, emitting less CO₂, and lowering the RGGI price ultimately paid by residential and other electric customers.

Q. What is the OCA's position on the conditions under which The Commission should approve the Empress contracts?

A. If The Commission is to rule on these contracts, the OCA supports approval. Additional incoming natural gas pipeline capacity is badly needed in New England, and the Empress contracts fund such expansion, at least for a large part of the path between New England and the source of gas. They will not only lower the price of retail gas for Northern's residential customers, but, by reducing congestion on incoming pipelines generally, they will lower the price of natural gas for all residential customers in New Hampshire. Because gas is still the marginal fuel for electric generation, they will lower the cost of commodity for residential electric ratepayers, and, by helping to displace coal-fired generation at Merrimack Station, they will lower the price of RGGI allowances, further lowering residential electric rates.

Our single caveat is that global fuel price shocks will have a larger effect on the price of natural gas in Alberta once new liquefaction facilities are completed in British Columbia, better connecting Alberta to global markets, and The Commission should require Northern to evaluate available hedging strategies, including, but not necessarily limited to, purchasing Japan Korea Marker LNG on the futures market and signing long term contracts for purchase of pipeline gas in Alberta, or additional LNG on the coast in New England.

Q. Does this conclude your testimony?

A. Yes.

EDUCATION

Ph.D. in Economics, Brown University, Providence, RI, 2007

M.A. in Economics, Brown University, Providence, RI, 1999

B.A. in Economics with departmental honors, University of Oregon, Eugene, OR, 1986

EXPERIENCE

New Hampshire Office of the Consumer Advocate, Concord, NH, August 2023 – present

- Expert testimony and analysis in regulatory proceedings on behalf of residential customers of public utilities in New Hampshire
- Education of customers

Rivier University, Nashua, NH, January 2020 – present

- Teach business economics and macroeconomics

The Economic Utility Group, Nashua, NH, February 2021 – June 2021, July 2022 – July 2023

- Forecasted wages and employment in the skilled trades with Senior Economist at Construction Industry Resources
- Forecasted volatile upstream fuel prices and climate damages
- Forecasted electric vehicle and non-EV electrification load for Hitachi Energy USA

Hitachi Energy USA, Nashua, NH, June 2021 – June 2022

- Analysis, modeling, forecasting, and reporting on wholesale power markets, especially in Mexico, using PROMOD® (a production cost model)

Elevation Direct Corporation, Nashua, NH, July 2015 – January 2021

- Jointly sponsored testimony before the Rhode Island PUC on the employment impacts of Clear River Energy Center (CREC) for the Rhode Island Building and Construction Trades Council; individually sponsored rebuttal testimony on the need for CREC
- Used Aurora® (a capacity expansion and production cost model) to evaluate potential purchase of Termoelectrica de Mexicali, a combined cycle natural gas-fired generator
- Used Aurora to forecast wholesale electric prices in Michigan and sponsored testimony on behalf of Michigan Public Service Commission staff in a case regarding a purchased power agreement for the output of the Palisades nuclear plant
- Work in restructured wholesale power market in Mexico
 - Provided forecasts of gross state product, loads, and fuel, energy, congestion, loss, ancillary service, and capacity prices, as well as prices of clean energy certificates and social costs of emissions in evaluations of pumped storage, combined-cycle gas, internal combustion, and wind and solar facilities; co-authored market studies done using Aurora, Plexos, and Encompass (capacity expansion and production cost models)
 - Assembled Mexican database and used Aurora to model expansion and operation of power grid for several independent generators
 - Co-authored a report on the economics of introducing liquefied natural gas to southern Baja California
 - Estimated a weighted average cost of capital to Comisión Federal de Electricidad (CFE)
 - Trained employees of CFE in load forecasting
 - Estimated Herfindahl-Hirschman indices of market concentration following breakup of CFE under Mexican energy reform

Universidad del Pacifico, Jesús María, Lima, Peru, September 2014

- Taught topical graduate course in energy economics.

Economic Insight, Portland, OR, January 2010 – March 2013

- Used Aurora to model electric resource planning in the Pacific Northwest
- Used Aurora to estimate trade benefits of Entergy and South Mississippi Electric Power Association joining regional transmission organizations, sponsored testimony before the Mississippi Public Service Commission (MPSC)
- Assessed application to install pollution controls on a coal plant; jointly testified with Sam Van Vactor before the MPSC
- Estimated dollars of spending per employee by generating technology
- Analyzed issues regarding pricing and royalties in geothermal and natural gas leases in California and Texas;
- Analyzed pricing and alleged use of market power in California power crisis
- Estimated lost earnings in a wrongful death lawsuit and testified to report
- Editor of scholarly research written by non-native speakers of English (intermittent)

Pacific University, Forest Grove, OR, August 2008 - May 2009

- Taught principles of microeconomics, environmental economics, and international trade

New York Department of Public Service, Albany, NY, August 2006 - December 2007

Eastern Connecticut State University, Willimantic, CT, August 2005 - May 2006

- Taught principles of microeconomics

Allan M. Feldman, Ph.D., Providence, RI, 2002-2003

- Worklife evaluation for litigation related to personal injury or wrongful death

Brown University, Providence, RI, 1999-2002

- Research and teaching assistance in valuation of individual earning capacity, industrial location in Indonesia, and principles of microeconomics and macroeconomics

Synapse Energy Economics, Cambridge, MA, July 1998 - February 1999

- Evaluated forecasts of electricity prices submitted in “stranded-cost” claim by four Maryland utilities

Bonneville Power Administration, Portland, OR, September 1988 - June 1997

- Authored and testified to marginal cost analysis in 1996 rate case before FERC
 - Helped prepare inputs to and interpreted and applied results of Power Marketing Decision Analysis Model (PMDAM) to rate design and to planning and evaluation of resources
 - Prepared and conducted public meetings on analysis and its implications for rate design
 - Fielded and incorporated comments from a variety of participants
 - Authored rate case study, documentation, and testimony
- Research on marginal costs of generating and marketing hydropower on the West Coast
- Prepared workshop briefing material, rate case studies, and documentation supporting marginal cost analysis and other rate-related issues as assigned
- Evaluated contracts for disposition of wholesale power

Economic Insight, Portland, OR, May 1988 - September 1988

- Surveyed forecasts of electricity prices and estimates of demand elasticities related to litigation over Washington Public Power Supply System bond defaults

ECO Northwest, Eugene, OR, July 1986 - August 1987

- Worklife evaluation for litigation related to personal injury and wrongful death; wrote company training manual on the subject

Changsha Normal University of Water Resources and Electric Power, Changsha, Hunan, PRC, August 1987 - January 1988; Brown University, Providence, RI, Summer 2001

- Taught English as a second language

RESEARCH

Vatter, M. (2022). Pricing global warming as a mortal threat. United States Association for Energy Economics (USAEE) Working Paper No. 21-491, <http://ssrn.com/abstract=3821603>, and IAEE Conference Proceedings, online, June 7-9, 2021, <https://www.iaee.org/proceedings/article/17059>

Vatter, M., Van Vactor, S., and Coburn, T. (2022). Price responsiveness of shale oil: a Bakken case study. *Natural Resources Research*, 31:1, <https://doi.org/10.1007/s11053-021-09972-9>, and IAEE Conference Proceedings, Montreal, May 29-Jun 1, 2019, <https://www.iaee.org/proceedings/article/16313>

Vatter, M. (2020). Stratified zoning in central cities. *Journal of Housing Economics*, 50, <https://doi.org/10.1016/j.jhe.2020.101716>

Vatter, M. (2019). OPEC's risk premia and volatility in oil prices. *International Advances in Economic Research*, 25:2, DOI: [10.1007/s11294-019-09734-7](https://doi.org/10.1007/s11294-019-09734-7)

Vatter, M., Suurkask, D. (2018). The impact of trade with the United States on electric loads in Mexico. *Heliyon*, 4:8, <https://doi.org/10.1016/j.heliyon.2018.e00717>, and *IAEE Energy Forum*, 2nd quarter 2017, <https://www.iaee.org/en/publications/newsletterdl.aspx?id=406>

Vatter, M. (2017). OPEC's kinked demand curve. *Energy Economics*, 63, <https://doi.org/10.1016/j.eneco.2017.02.010>

Vatter, M. (2017). Stockpiling to contain OPEC. USAEE Working Paper No. 17-136, <http://ssrn.com/abstract=912311>, and USAEE Conference Proceedings, New Orleans, December, 2008, <https://www.iaee.org/proceedings/article/17512>

Vatter, M. (2017). Social discounting with diminishing returns on investment, <http://ssrn.com/abstract=1078502>

Vatter, M., Barney, F. (2016). Macroeconomic risk and residential rate design. USAEE Working Paper No. 15-208, <http://ssrn.com/abstract=2596258>

Vatter, M. (2008). OPEC's demand curve, <http://ssrn.com/abstract=1127642>, reviewed at <http://knowledgeproblem.com/2008/05/14/>

Peer Reviewer for *Land Economics*: effects of endowments of petroleum resources on corruption, 2008; hedging in coal contracts under the acid rain program, 2010-11; suburban agriculture as an amenity, 2012; prorationing versus unitization in the U.S. petroleum industry in the 20th century, 2013

STREAMING MEDIA

International Atlantic Economic Society video: Nice world economy you have there; be a shame if something should happen to it, temporarily available at <https://www.iaes.org/>, accessed June 15, 2022

IAEE webinar: Is another oil price shock possible, and would it matter? January 11, 2021,
https://www.iaee.org/en/webinars/webinar_vatter.aspx

USAEE podcast: OPEC as a destabilizing influence, July 21, 2020,
<https://www.usaee.org/podcasts.aspx>

Video: **Discussing transmission costs with New Hampshire Senate Energy and Natural Resources Chair Kevin Avar**,
https://www.youtube.com/watch?v=QRkLdLplz9Y&feature=youtu.be&fbclid=IwAR2Euva286vNRa5Lit0RstjHwtPuV5a_t439Cml4Z8S2WHYptXNdJ40vkZs

Video: **Discussing manufacturing, net metering rate design, and transmission costs on Perspectives with David Schoneman**, <https://youtu.be/m9YRY3U-DzM>

AWARDS

Twelve monetary awards for job performance at Bonneville Power Administration
Award for best undergraduate research project in economics at University of Oregon; examined deregulation of U.S. airline industry

OTHER ACTIVITIES

Monitored the House Science, Technology, and Energy Committee in Concord, NH for the Northeast Energy and Commerce Association
Founded and managed "Micro Lunch" seminar, Brown University, 2001-2002
Role of expert witness in Lewis & Clark Law School's mock personal-injury litigation, 1996
Peer Advisor, Department of Economics, University of Oregon, 1984-1986

MEMBERSHIPS

International and United States Associations for Energy Economics; Northeast Energy and Commerce Association; Northeast Energy and Commerce Association; New Hampshire Business and Industry Association, Manufacturing and End Users Policy Committee

TESTIMONIALS

"We asked Marc to provide us with a forecast of future locational marginal prices under two different scenarios, which he managed very well. He provided us with testimony that was on point and met our needs." Lauren Donofrio, Assistant Attorney General, Public Service Division, State of Michigan

"Marc Vatter provided joint testimony with Sam Van Vactor on behalf of Staff in 2010 regarding Mississippi Power's application to install pollution controls on the Victor J. Daniel coal-fired generator. He brought to light critical issues regarding uncertainty over natural gas prices that bore on the decision to install scrubbers. We hired the two again in 2012 in a proceeding on integrating Entergy's transmission assets into a regional transmission organization. Marc added significant detail representing the state of Mississippi to a production cost and capacity expansion model that he used to quantify the effects of integration. A number of consultants engaged in similar efforts, and Marc's analysis was of superior quality." Dr. Christopher Garbacz, Director, Economics and Planning Division, Mississippi Public Utilities Staff