MATTER 24-00515

COMMENTS OF THE NEW YORK STATE ENERGY RESEARCH AND DEVELOPMENT AUTHORITY (NYSERDA) UTEN PERFORMANCE METRICS October 11, 2024

Introduction/Background

In July 2022, the Utility Thermal Energy Network Jobs Act (the Act) was enacted into law. The Act required "[E]ach of the seven largest gas, electric, or combination gas and electric corporations to submit to the Commission for review and approval at least one and as many as five proposed pilot thermal energy network projects, with at least one pilot project in each utility territory . . . proposed in a Disadvantaged Community."[1] The Act also required the Public Service Commission (Commission) to take action to foster the development of thermal energy networks (TENs), generally, and utility thermal energy networks (UTENs), specifically. As part of this effort, the Act gave the Commission broad authority to direct the utilities to provide information related to their pilot projects.

Following the passage of the Act, the Commission issued an Order Providing Guidance on Development of Utility Thermal Energy Networks (Guidance Order), in which Staff was directed to convene one or more technical conferences on UTEN performance metrics. Accordingly, Staff has convened several technical conferences to discuss performance metrics across technical, financial, customer and societal categories, in addition to developing and releasing draft performance metrics for comment.

The New York State Energy Research and Development Authority (NYSERDA) submits these comments to provide its perspectives on the proposed performance metrics for UTENs developed by Staff. As Staff clarified at the technical conferences, the term "performance metrics" is used in this context broadly and refers to data points to be collected from the utility pilots, which could be used at a later date to develop metrics that measure the utilities' performance under the Act.

NYSERDA agrees with Staff that the data points proposed to be collected are necessary given the variety of UTENs proposed by the utilities, the fact that details of each project are not yet known, and the general nascency of this industry. It is appropriate that Staff's proposed performance metrics encompass the development of baseline information, inputs used in the development and design of the projects, expected outcomes based on the project designs, and actual and regular performance results from the projects once they become operational. NYSERDA notes it is possible that data requirements could be refined and modified over time as the utilities proceed with the design, development, construction,

[1] For details on how Disadvantaged Communities are defined by New York State, please refer to https://climate.ny.gov/Resources/Disadvantaged-Communities-Criteria

and operation of their pilot projects. Accordingly, NYSERDA recommends that Staff have sufficient flexibility to allow for adjustments to the list as appropriate.

NYSERDA's Involvement with Thermal Energy Networks (TENs)

Since 2021, NYSERDA has actively supported the development of low-carbon thermal energy networks as an important tool in New York State's toolkit to upgrade and decarbonize buildings. UTEN pilot projects provide a unique platform and opportunity to move beyond building-by-building solutions to explore solutions that can work block-by-block and community-by-community. Through its Community Heat Pump Systems Program (PON 4614), NYSERDA has provided funding for planning, design and engineering, and construction support to ~50 potential TENs sites across New York State. Reports from each of these efforts are shared publicly to help disseminate lesson learned and best practices.[2] To help identify prospective TENs opportunities and understand the potential of different thermal resources, NYSERDA supports a variety of market research and technical studies, in addition to hosting outreach and education activities to develop stakeholder networks, support potential pipeline development, and engage with local governments. NYSERDA is also engaged in supporting the development of codes and standards that could apply to TENs.[3]

Based on its involvement with studies, design and engineering plans, and construction activity for TENs to date, NYSERDA submits the following comments on the proposed revised draft performance metrics for UTENs.

1. ***There is significant value and benefit to collecting and transparently sharing the collected project data***

NYSERDA believes there is significant value in collecting data points across each of the proposed UTEN pilots to understand how they are being designed to perform and how

[2] https://www.nyserda.ny.gov/All-Programs/Large-Scale-Thermal/Winners provides information about projects funded through NYSERDA, including any final reports/studies associated with the projects.

[3] Relevant codes and standards for thermal networks are currently being developed and may help inform this proceeding once finalized. The Intl Association of Plumbing and Mechanical Officials (IAPMO) recently released Chapter 17 of the UMC (Geothermal Energy Systems and Ambient Temperature Loops) – as a code. There are also two standards, which are currently being revised and/or newly-developed, including *IAPMO Z1381 "District Ambient Temperature Loops (ATLs)"* which is out for public review (https://www.iapmo.org/newsroom/press-releases/iapmo-pace-to-publish-umc-chapter-17-as-standalone-document-for-geothermal-energy-systems-and-ambient-temperature-loops-atl/). There is also the *ANSI/CSA C448 "Design And Installation Of Ground Source Heat Pump Systems For Commercial And Residential Buildings*" standard, which is working on a new section on "District Systems" that addresses large district or community ground loop systems. A draft of this district section has undergone public review and is on track to be published in late 2024/early 2025.

designed parameters and outcomes translate into actual operational performance and outcomes.

TENs broadly can play an important role in our building decarbonization toolkit as they support community-scale approaches, can help reduce costs and future grid impacts relative to other approaches, and help retain high quality jobs. However, they are not necessarily a one-size fits all solution, and ongoing research, planning and piloting is needed to understand how they can be best designed and built in ways that provide sustainability, equity and affordability and other benefits.

Given the nascent nature of low-carbon TENs projects and TENs deployment in New York, the importance of sharing critical project design and performance data is essential to help disseminate critical learnings and expertise, attract interest in TENs among developers, contractors and equipment vendors, and encourage public participation and interest. The data collection, sharing, and analysis aspects of the UTEN pilot projects are underscored in the Act and their importance is reinforced in the Guidance Order. While this specific discussion does not focus on how the data is to be shared, NYSERDA notes that data from the pilots should be made available via a publicly accessible platform that is easy to use and understand.[4]

2. ***The metrics presented for feedback in the 9/9 filing may be better termed "key project design and operational data" to be collected by the pilot projects, with the intent of using this data to then establish performance metrics at a later date.***

As discussed at the September 30, 2024 technical conference, NYSERDA notes it would be helpful to make a distinction between data that should be collected and shared to help increase understanding of how TENS project are designed and operated and their benefits, and data that should be collected to measure utility performance in operating UTENs and serving UTEN customers. NYSERDA agrees with comments made by other parties at the recent technical conference that the focus now should be on data collection. NYSERDA notes the collection of design and operational data over time can help inform the development of future performance metrics that should represent a threshold of performance to which a UTEN system may be held.[5] It may also be the case that specific performance metrics/thresholds may need to differ depending on the type of system design.

[4] NYSERDA for example, currently tracks and reports on performance data associated with distributed energy resource projects through this website. https://der.nyserda.ny.gov/data/performance/

[5] *As an illustrative example,* it makes sense to collect and report out on how many hours the loop supply temperature of the heat transfer medium is outside of design-specified range, and then potentially use that information collected to set a future performance metric that states a UTEN in normal operating conditions should not be operating a loop that is outside of design-specified range more than X hours per year.

3. ***To understand the potential approaches to effective data collection and monitoring, NYSERDA suggests that each utility should submit as part of its Stage 2 design a sub-section that lays out its data collection and monitoring plan***

As discussed during the September 30 technical conference, NYSERDA proposes each utility should provide as part of its final Stage 2 design a sub-section that lays out how it plans to monitor and collect the data points that are required and its rationale for its monitoring approach, including any proposals for alternatives to empirical collections, such as selective sampling, drawing inferences, or modeling. This proposal should be reviewed to verify that that the appropriate energy inputs and outputs will be monitored and collected for each respective component of each pilot project.[6] Additionally, each utility should provide estimates of costs to monitor/collect data as proposed relative to total project cost.

4. **With respect to the specific data points proposed, NYSERDA submits the following targeted comments**

Where feasible, key design data and costs should be included at the end of the Stage 2 filing to provide insights and information on the evolution of the pilot projects as they move from the design stage to the operational stage. NYSERDA has noted in the template what data points it believes, based upon its experience with design and engineering studies for TENs, could be available as part of the Stage 2 design, but this is not intended to be complete and exhaustive, as there may be additional metrics listed in the template that could be available to report as part of the Stage 2 design, depending on the project.[7] Similarly, it would be helpful to include key cost categories as part of the Stage 2 design. Below, NYSERDA provides an example of the type of costs that are included in a design and engineering study completed for its PON 4614 program.[8] As designs change and there is significant deviation from the initial data points, then updated data points should be submitted.

Below, NYSERDA provides an example of the type of costs that are included in a design and engineering study completed for its PON 4614 program. These costs may not all be applicable, depending on the specific system design and associated thermal resources. As

[6] NYSERDA's PON 4614 program takes this approach with respect to construction projects it supports and their monitoring, verification, and evaluation plans.

[7] NYSERDA recognizes that some data points, especially in relation to the customer or customer-side of the project, may be challenging to report out at the end of Stage 2, although it is assumed the engineering design made some assumptions about customer load and equipment for example.

[8] Not all of these costs may be applicable, depending on the specific system design

designs change and there is significant deviation from the initial data points, then updated data points should be submitted.

Table 1: Example of cost categories for a TEN project, based upon design and engineering studies submitted to NYSERDA's PON 4614.

ITEM	***COST, $***
Borehole Installation	
Heat Pumps	
Peaking/Backup (Electric) Boilers	
Central Plant Building	
Manifolds and Valves	
Motor Control Centers	
Power Meters	
Data Monitoring and Logging Package	
SCADA System	
Initial Supply of Glycol	
Initial Supply of Water	
Interconnection to Electric Utility	
Transformers	
BTU Meters and Sensors	
Diesel Generator and Connection	
Electric Cables and Fiber Optic	
Hot Water Storage Tank	
Hot Water Circulating Pumps	
Underground Hot Water Piping and Valves	
Fire Protection, Water and Sewer Connection	
Heat Exchangers	

Transportation of Equipment to the Site		
Installation of all Equipment and Instruments		
Management and Engineering Cost		
Contingency		

NYSERDA also notes that:

- Some standardization of utility approaches toward customer-side data collection should be applied so that customer-side data can be properly compared across systems. For example, there should be a standardized customer survey that is used statewide for all UTENs.
- Data from the UTEN pilot projects should be reported in both btu and kwh to help with interpreting the data.
- One additional set of data points that could be helpful to collect are internal building temperatures, as they can provide an important data point in understanding UTEN performance from the customer perspective. For example, the New York City Housing Authority (NYCHA) collected internal building temperatures to monitor the performance of their newly installed window heat pumps, which also enabled a comparison against pre-retrofit internal temperature baselines.
- With respect to emissions factors to estimate greenhouse gas emissions from and potential emissions benefits of UTENs, NYSERDA notes that the emissions factors applied should align with the CLCPA.
- To support lifecycle emissions calculations that may require forecasted emissions factors, NYSERDA notes that it publishes and regularly updates publicly available references for electric grid and fuel-based emissions factors.
    - For electricity: NYSERDA will revise the *Projected Emission Factors for New York State Grid Electricity* concurrently with the State Energy Plan process to incorporate an updated understanding of renewables deployment over time. This source provides the option of "Month-Hour Outputs" values if electricity consumption data is captured on an hourly basis (metered or estimated by applying end-use load shapes).
    - For fuels: NYSERDA's *Fossil and Biogenic Fuel Greenhouse Gas Emission Factors* (May 2023 or as updated) provides relevant fuel-specific gross emission factors for the Residential and Commercial Buildings sector (summed to CO_2e in Appendix A, Table A-1). These emission factors are consistent with the accounting methods used under the CLCPA and sum

together upstream and out-of-state emissions, the emissions from in-state distribution of fuels, and the emissions from fuel combustion.

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Technical Metrics

Data in the Technical Metrics table may contribute to the formulation of data in other performance metrics tables. Data may also be inter-related within this table.

Overall Framing Question 1	**What metrics should be tracked to compare the relative strengths and weaknesses of different system configurations (e.g., 1-pipe, 2-pipe, 4-pipe, ambient vs. fully centralized)?**						
Performance Metric(s)	Each pilot project will qualitatively describe features and characteristics that informed decisions related to the thermal energy network configuration selected for the pilot. This will include perceived pros/cons and trade-offs related to the various configurations and the specifics of the individual pilot Many of the data points identified below will provide operational data relevant to the various configurations. To the extent the data to be collected identified below is not applicable to certain configurations, data collection would not be required.						
Overall Framing Question 2	**What are the load profiles, at design stage, and actual load, during operation, for the collective buildings being served?**						
Performance Metric	**Provide data necessary to calculate actual load profiles during operation**						
	Customer-Side (Connected Building)[1]	**Unit of Measurement**	**Frequency of Collection/Data Interval**	**Frequency of Reporting[2]**	**Agree**	**Disagree**	**Justification (must be completed if disagree)**
Data Collected to Assess the Metric	Building use/occupancy, type/vintage, sector, and sq. ft. of conditioned space	Various Units	At Stage 3 and when updated or revised		X, with clarification		Design stage load profiles could be reported out at end of Stage 2
	Nameplate capacity and rating condition of installed space conditioning, and domestic hot water (DHW) equipment	BTU/h	At Stage 3 and when updated or revised		X, with clarification		This comment with respect to this metric is related to the Framing Question intent of comparing design load to actual load: - Is this section intended to quantify "as-designed" system performance to compare to future "as-built" system performance (COPs)? so, additional design parameters (e.g. flow rates, operating temperatures, system

[1] Customer-Side used in this context represents the usage at the customer site, regardless of who owns or paid for the equipment. It may include the customer of record as well as an end-use participant of the pilot, e.g., tenant of a building.

[2] Frequency of Reporting refers to the utilities' reporting requirements to the Department of Public Service. Staff is exploring data collection and management services to reduce administrative burden imposed on the utilities related to the preparation of information and to enable the pilot project data to be made publicly available to facilitate broader knowledge exchange as required by the Commission.

Technical Metrics

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							operating procedures/sequence of operations) would be needed to estimate system performance at the design phase (to then compare design vs. operating. This would be important to be responsive to Framing Question 5. It may be that some of this data may be captured in Overall Framing Question 4, metric 1) Where feasible, design stage parameters should be shared at the end of Stage 2
	Nameplate capacity and rating condition of other equipment served by the Utility Distribution System (UDS) (e.g., heat rejection from refrigeration systems)	BTU/h	At Stage 3 and when updated or revised		X		
	Electricity consumption of installed space conditioning, and DHW equipment	kWh	Hour	Quarterly	X		
	Electricity consumption of other equipment served by the UDS	kWh	Hour	Quarterly	X, with clarifying question		It would be helpful to have electricity consumption listed for each end use (e.g., space conditioning, DHW, process loads)

(continued)	Customer-Side (Connected Building)	Unit of Measurement	Frequency of Collection/Data Interval	Frequency of Reporting	Agree	Disagree	Justification (must be completed if disagree)
Data Collected to Assess the Metric	Heat pump startups	Number of	Hour	Quarterly	X		
	Heat exchanger inlet temperature, UDS side	^{o}F	Hour	Quarterly	X, with clarification		If the intent is to calculate BTUs, it would be helpful to also collect flow rate (which may be included in Overall Framing Question 4, Metric 1)
	Heat exchanger outlet temperature, UDS side	^{o}F	Hour	Quarterly	X		

Technical Metrics

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	Heat exchanger inlet temperature, customer side	°F	Hour	Quarterly	X		
	Heat exchanger outlet temperature, customer side	°F	Hour	Quarterly	X		
Overall Framing Question 3	**What is the thermal energy capacity and output of each thermal energy resource, and in total?**						
Performance Metric	**Peak and annual energy input and output from each thermal energy resource and of the combined total resources**						
	Thermal Energy Resource(s) (Utility or Third Party Owned[3])	**Unit of Measurement**	**Frequency of Collection/Data Interval**	**Frequency of Reporting**	**Agree**	**Disagree**	**Justification (must be completed if disagree)**
Data Collected to Assess the Metric	Design capacity and rating condition of each thermal energy resource (including peaking, backup, and borehole balancing equipment)	BTU/h	At Stage 3 and when updated or revised		X, with Caveats		Design stage parameters could be reported out at end of Stage 2; report in kW too
	Design anticipated annual thermal energy (heating and cooling), provided by each thermal energy resource	BTU	At Stage 3 and when updated or revised		X		Could be reported out at end of Stage 2; report in kWh too
	Thermal energy extracted from each thermal source to UDS[4]	BTU	Hour	Quarterly	X		Could be reported out at end of Stage 2; report in kWh too
	Thermal energy rejected to each thermal sink from UDS[5]	BTU	Hour	Quarterly	X		Could be reported out at end of Stage 2; report in kWh too
	Inlet temperature to each thermal source/sink	°F	Hour	Quarterly	X		Could be reported out at end of Stage 2
	Outlet temperature from each thermal source/sink	°F	Hour	Quarterly	X		Could be reported out at end of Stage 2

[3] This metric includes data associated with the thermal energy resource, regardless of ownership. It does not include usage associated with customer-side equipment.

[4] Data includes thermal energy from third-party thermal energy supplier(s).

Technical Metrics

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	Electricity consumption of circulation pump(s)	kWh	Hour	Quarterly	X		Could be reported out at end of Stage 2 as a nameplate or designed condition

(continued)	Thermal Energy Resource(s) (Utility or Third Party Owned)	Unit of Measurement	Frequency of Collection/Data Interval	Frequency of Reporting	Agree	Disagree	Justification (must be completed if disagree)
Data Collected to Assess the Metric	Electricity consumption of heat pump(s)	kWh	Hour	Quarterly	X		
	Electricity consumption for borehole balancing equipment	kWh	Hour	Quarterly	X		
	Electricity consumption for each thermal energy resource (excluding borehole balancing equipment)	kWh	Hour	Quarterly	X		Could be reported out as a designed input at end of Stage 2
	Other fuel[4] consumption for peaking operation	BTU	Hour	Quarterly	X, with clarifying question		Is this intended to be the operational output of the other fuel (e.g., output of fuel, based upon system efficiency). If so, perhaps the metric name could be changed to reflect this (e.g., thermal energy delivered by the system – btu/hour). Otherwise, it may be misconstrued as overall fuel consumed (e.g., input) by the system, prior to any impact from conversion efficiency
	Other fuel consumption for backup operation	BTU	Hour	Quarterly	X, with clarifying question		Is this intended to be the operational output of the other fuel (e.g., output of fuel, based upon system efficiency). If so, perhaps the metric name could be changed to reflect this (e.g., thermal energy delivered by the system).

[4] Other fuel includes natural gas, propane, distillate fuel oil #2, #4, etc. The data should be classified by fuel type.

Technical Metrics

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							Otherwise, it may be misconstrued as overall fuel consumed (e.g., input) by the system, prior to any impact from conversion efficiency
	Borehole balancing heat into the borefield	BTU	Hour	Quarterly	X		Report in kWh too
	Borehole balancing heat out of the borefield	BTU	Hour	Quarterly	X		Report in kWh too
	Startups for each borehole balancing equipment	Number of	Per Incident	Quarterly	X		
	Hours in operation for each borehole balancing equipment	Hour	Hour	Quarterly	X		
	Thermal energy for heating from each peaking/backup equipment	BTU	Hour	Quarterly	X, with questions/Caveats		NYSERDA understands this metric as drafted as one that is capturing the thermal energy generated in an hour. However, it would be helpful to also report out on the peak thermal demand that is being met by the peaking resource (e.g., peak BTUs/hour of the peak load demand) to show how much instantaneous load is provided by each thermal resource (to understand appropriate sizing) Report in kWh too
	Thermal energy for cooling from each peaking/backup equipment	BTU	Hour	Quarterly	X, with questions/caveats		NYSERDA understands this metric as drafted as one that is capturing the thermal energy generated in an hour. However, it would be helpful to also report out on the peak thermal demand

Technical Metrics

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							that is being met by the peaking resource (e.g., peak BTUs/hour of the peak load demand) to show how much instantaneous load is provided by each thermal resource (to understand appropriate sizing) Report in kWh too
	Inlet temperature from each peaking or backup equipment	°F	Hour	Quarterly	X		
	Startups for each peaking/backup equipment	Number of	Per Incident	Quarterly	X, with Caveats		Include time of day that peaking/backup was started (this may be captured in the metric below if it tracks what hours the resource specifically operated)
	Hours in operation for each peaking/backup equipment	Hour	Hour	Quarterly	X		
	Outlet temperature from each peaking or backup equipment	°F	Hour	Quarterly	X		
	Thermal energy for heating into thermal energy storage	BTU	Hour	Quarterly	X		Report in kWh too
	Thermal energy for heating out from thermal energy storage	BTU	Hour	Quarterly	X		Report in kWh too
	Inlet temperature, thermal storage	°F	Hour	Quarterly	X		
	Outlet temperature, thermal storage	°F	Hour	Quarterly	X		

(continued)	Thermal Energy Resource(s) (Utility or Third Party Owned)	Unit of Measurement	Frequency of Collection/Data Interval	Frequency of Reporting	Agree	Disagree	Justification (must be completed if disagree)

Technical Metrics

Data in the Technical Metrics table may contribute to the formulation of data in other performance metrics tables. Data may also be inter-related within this table.

Data Collected to Assess the Metric	Array of thermal storage tank temperatures at varying levels to gauge remaining storage capacity		°F	Hour	Quarterly	X		
	Thermal energy for cooling into thermal energy storage		BTU	Hour	Quarterly	X		Report in kWh too
	Thermal energy for cooling out from thermal energy storage		BTU	Hour	Quarterly	X		Report in kWh too
	These data points apply to central plant configurations	Nameplate capacity and rating condition of installed heat pump equipment	BTU/h	At Stage 3 and when updated or revised		X		Report in kW too
		Operating capacity and condition of heat pump equipment	BTU/h	At Stage 3 and when updated or revised		X		Report in kW too
		Electricity consumption for heat pumps	kWh	Hour	Quarterly	X		
		Startups for each heat pump	Number of	Per Incident	Quarterly	X		
		Hours in operation for each heat pump	Hour	Hour	Quarterly	X		
		Heat pump evaporator inlet temperature	°F	Hour	Quarterly	X, with Caveats		It would be helpful to also report flow rate to help better understand system operating parameters (unless this is already captured elsewhere)
		Heat pump evaporator outlet temperature	°F	Hour	Quarterly	X		
		Heat pump condenser inlet temperature	°F	Hour	Quarterly	X with Caveats		It would be helpful to also report flow rate to help better understand system operating parameters (unless this is already captured elsewhere)
		Heat pump condenser outlet temperature	°F	Hour	Quarterly	X		

Technical Metrics

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Overall Framing Question 4	**What is the thermal energy being delivered to and from customer site?**						
Performance Metric	**Provide data to measure total energy delivery to customers and other operational characteristics of the UDS**						
	Utility Distribution System (UDS)	**Unit of Measurement**	**Frequency of Collection/Data Interval**	**Frequency of Reporting**	**Agree**	**Disagree**	**Justification (must be completed if disagree)**
Data Collected to Assess the Metric	Design capacity and rating condition of the UDS including flow rates and temperature ranges	Various Units	At Stage 3 and when updated or revised		X		If applicable, include details on electric capacity upgrades needed (for central plant or locations along UDS) as part of the Design component If applicable, provide details at the end of Stage 2
	Hours thermal energy is provided by the UDS for heating	BTU	Hour	Quarterly	X, with clarifications		*Clarification on how simultaneous heating and cooling hours are calculated, since central plant systems can distribute heating and cooling simultaneously, and ambient loop systems can be used for heating or cooling by buildings on the distribution loop *Clarification may be needed as to what the right unit of measurement should be (e.g, total energy delivered or hours of energy being delivered) .

Technical Metrics

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	Hours thermal energy is provided by the UDS for cooling	BTU	Hour	Quarterly	X		*Clarification on how simultaneous heating and cooling hours are calculated, since central plant systems can distribute heating and cooling simultaneously, and ambient loop systems can be used for heating or cooling by buildings on the distribution loop *Clarification may be needed as to what the right unit of measurement should be (e.g, total energy delivered or hours of energy being delivered)
	Hours the loop supply temperature of the heat transfer medium is outside of design-specified range	Hour	Hour	Quarterly	X		
	UDS electricity consumption	kWh	Hour	Quarterly	X		
	Loop pressure and heat transfer medium temperature measured at various locations throughout the network	psig and °F	Hour	Quarterly	X		
	Composition of heat transfer medium in UDS		At Stage 3 and when updated or revised		X		
	Volume of heat transfer medium	Gallon	At Stage 3 and when updated or revised		X		
	Concentration of antifreeze agent, such as glycol, in the heat transfer medium	Percentage	At Stage 3 and when updated or revised		X, with clarification		*To clarify whether this is duplicative to “composition of heat transfer medium”, which could include a percent breakdown of its different components

Technical Metrics

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	Fuel type and consumption for energy center(s) operation (from Energy Center utility bills)	BTU/kWh	kWh/therm - Monthly	Quarterly	X		
	Supply temperature of heat transfer medium to customer, energy center side	°F	Hour	Quarterly	X, with Caveats		Since flow rate is being captured as a design condition in the first metric in this section, it would also be helpful to report on operational flow rate. This will also help inform data points to be responsive to Question 5
	Return temperature of heat transfer medium from customer, energy center side	°F	Hour	Quarterly	X, with Caveats		Since flow rate is being captured as a design condition in the first metric in this section, it would also be helpful to report on operational flow rate. This will also help inform data points to be responsive to Question 5

Overall Framing Question 5	**What is the network's system efficiency during normal and peak conditions?**
Performance Metric	**Provide data to characterize the efficiency of meeting the customer loads**
Data Collected to Assess the Metric	Data identified above will be utilized to assess this metric.

Financial Metrics

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Overall Framing Question 1	**What are the capital expenditures associated with the UTEN?**							
Performance Metric	**Capital Expenditures (Annual):** Where feasible, it would be helpful to have estimated costs provided at the Stage 2 engineering design							
	Customer-Side[5] (Connected Building) Costs	**Equipment**	**Labor**	**Frequency of Tracking**	**Frequency of Reporting**	**Agree**	**Disagree**	**Justification (must be completed if disagree)**
Data Collected to Assess the Metric	Necessary electrical service upgrade	X	X	Monthly	Completion of Stage 3	X		
	Existing HVAC and DHW retrofit	X	X	Monthly	Completion of Stage 3	X		
	Existing HVAC and DHW removal	N/A	X	Monthly	Completion of Stage 3	X, with clarifications		Removal costs could include cost of recycling/disposing of removed equipment.
	Heat pump	X	X	Monthly	Completion of Stage 3	X, with clarifications		Could include space conditioning heat pump and DWH heat pump?
	Heat exchanger, piping, and valving	X	X	Monthly	Completion of Stage 3	X		
	Instrumentation	X	X	Monthly	Completion of Stage 3	X		
	Equipment and facility improvements	X	X	Monthly	Completion of Stage 3	X		
	Efficiency upgrades (if applicable)	X	X	Monthly	Completion of Stage 3	X, with Caveats		It would be helpful to clarify the boundary of what costs should be counted here and reported, especially if building owners view the connection to the network as an opportunity to implement other home/building upgrades. It may also be

[5] Customer-Side used in this context represents costs of the equipment at the customer site, regardless of who owns or paid for the equipment.

Financial Metrics

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								helpful to categorize in-scope upgrades into buckets – for example building envelope work, electric efficiency, other upgrades
	Other	X	X	Monthly	Completion of Stage 3	X		
	Customer-Side (Connected Building) Costs (Counterfactual)	**Equipment**	**Labor**	**Frequency of Tracking**	**Frequency of Reporting**	**Agree**	**Disagree**	**Justification (must be completed if disagree)**
Data Collected to Assess the Metric	Other necessary information	Source TBD[6]						

	Utility Distribution System (UDS) Costs	**Equipment**	**Labor**	**Frequency of Tracking**	**Frequency of Reporting**	**Agree**	**Disagree**	**Justification (must be completed if disagree)**
Data Collected to Assess the Metric	Design and inspection	X	X	Monthly	Completion of Stage 3	X		
	Necessary electrical infrastructure upgrades	X	X	Monthly	Completion of Stage 3	X, with clarifications		Estimated cost could be made available as part of Stage 2 design
	Equipment and facilities	X	X	Monthly	Completion of Stage 3	X, with caveats		It would be helpful to break this out into specific cost categories, for example (trenching/piping; cost of UDS pumps/equipment) Estimated cost could be made available as part of Stage 2 design

[6] In instances where Source TBD is indicated, Staff will work with the utilities to identify the data source(s) to calculate the counterfactual.

Financial Metrics

Data in the Financial Metrics table may be derived from data in other performance metrics tables. Data may also be inter-related within this table.

	Land and land rights	X	X	Monthly	Completion of Stage 3	X, with clarifications		Estimated cost could be made available as part of Stage 2 design
	Permitting	N/A	X	Monthly	Completion of Stage 3	X		
	Software/Intangibles	X	X	Monthly	Completion of Stage 3	X		
	Metering	X	X	Monthly	Completion of Stage 3	X, with clarifications		Estimated cost could be made available as part of Stage 2 design
	Other	X	X	Monthly	Completion of Stage 3	X		
	Utility Distribution System (UDS) (Counterfactual)	**Equipment**	**Labor**	**Frequency of Tracking**	**Frequency of Reporting**	**Agree**	**Disagree**	**Justification (must be completed if disagree)**
Data Collected to Assess the Metric	Other necessary information	Source TBD						
	Thermal Energy Resource(s) Costs (Utility or Third Party Owned)	**Equipment**	**Labor**	**Frequency of Tracking**	**Frequency of Reporting[7]**	**Agree**	**Disagree**	**Justification (must be completed if disagree)**
Data Collected to Assess the Metric	Acquisition cost	X	X	Monthly	Completion of Stage 3	X, with clarifications		Estimated cost could be made available as part of Stage 2 design
	Equipment and facilities	X	X	Monthly	Completion of Stage 3	X, with clarifications		Drilling costs have been identified as a cost-compression opportunity and it could be useful to have those separated out if feasible Estimated cost could be made available as part of Stage 2 design

[7] In instances where re-occurring payments are made, the Frequency of Reporting should be annually.

Financial Metrics

Data in the Financial Metrics table may be derived from data in other performance metrics tables. Data may also be inter-related within this table.

	Permitting	X	X	Monthly	Completion of Stage 3	X		

(continued)	Thermal Energy Resource(s) Costs (Utility or Third Party Owned)	Equipment	Labor	Frequency of Tracking	Frequency of Reporting[8]	Agree	Disagree	Justification (must be completed if disagree)
Data Collected to Assess the Metric	Land and land rights	X	X	Monthly	Completion of Stage 3	X		
	Software/Intangibles	X	X	Monthly	Completion of Stage 3	X		
	Thermal Energy Resource(s) Costs (Utility or Third Party Owned) (Counterfactual)	**Operate**	**Maintain**	**Frequency of Tracking**	**Frequency of Reporting**	**Agree**	**Disagree**	**Justification (must be completed if disagree)**
Data Collected to Assess the Metric	Other necessary information	Source TBD						
Overall Framing Question 2	**What are the operational costs associated with the UTEN?**							
Performance Metric	**Operational Expenditures (Annual)**							
	Customer-Side (Connected Building)	**Operate**	**Maintain**	**Frequency of Tracking**	**Frequency of Reporting**	**Agree**	**Disagree**	**Justification (must be completed if disagree)**
Data Collected to Assess the Metric	Electricity costs of installed space conditioning, and DHW equipment	X	N/A	Monthly	Annually	X		
	Electricity costs of other equipment served by the UDS	X	N/A	Monthly	Annually	X		
	DHW equipment maintenance	N/A	X	Monthly	Annually	X		

[8] In instances where re-occurring payments are made, the Frequency of Reporting should be annually.

Financial Metrics

Data in the Financial Metrics table may be derived from data in other performance metrics tables. Data may also be inter-related within this table.

	Space conditioning equipment maintenance	N/A	X	Monthly	Annually	X		
	Peak and super peak electricity consumption	X	N/A	Monthly	Annually	X		
	Instrumentation (including metering)	X	X	Monthly	Annually	X		
	Other	X	X	Monthly	Annually	X		
	Customer-Side (Connected Building) (Counterfactual)	**Operate**	**Maintain**	**Frequency of Tracking**	**Frequency of Reporting**	**Agree**	**Disagree**	**Justification (must be completed if disagree)**
Data Collected to Assess the Metric	Other necessary information	Source TBD						

	Utility Distribution System (UDS) Costs	**Operate**	**Maintain**	**Frequency of Tracking**	**Frequency of Reporting**	**Agree**	**Disagree**	**Justification (must be completed if disagree)**
Data Collected to Assess the Metric	Necessary electrical infrastructure upgrade maintenance	N/A	X	Monthly	Annually	X		
	Necessary electrical infrastructure upgrade operation labor	X	N/A	Monthly	Annually	X		
	Equipment and facilities maintenance	N/A	X	Monthly	Annually	X		
	Equipment and facilities energy	X	N/A	Monthly	Annually	X, with clarifications		Estimated cost could be made available as part of Stage 2 design
	Equipment and facilities operations labor	X	N/A	Monthly	Annually	X with clarifications		Estimated cost could be made available as part of Stage 2 design
	Land and land rights property taxes	X	N/A	Monthly	Annually	X, with clarifications		Estimated cost could be made available as part of Stage 2 design
	Customer-related equipment and facilities	X	X	Monthly	Annually	X		
	Customer-related labor	X	X	Monthly	Annually	X		

Financial Metrics

Data in the Financial Metrics table may be derived from data in other performance metrics tables. Data may also be inter-related within this table.

	Other	X	X	Monthly	Annually	X		
	Utility Distribution System (UDS) (Counterfactual)	**Operate**	**Maintain**	**Frequency of Tracking**	**Frequency of Reporting**	**Agree**	**Disagree**	**Justification (must be completed if disagree)**
Data Collected to Assess the Metric	Other necessary information	Source TBD						
	Thermal Energy Resource(s) (Utility or Third Party Owned)	**Operate**	**Maintain**	**Frequency of Tracking**	**Frequency of Reporting**	**Agree**	**Disagree**	**Justification (must be completed if disagree)**
Data Collected to Assess the Metric	Equipment and facilities maintenance	X	X	Monthly	Annually	X		
	Equipment and facilities energy	X	N/A	Monthly	Annually	X		
	Equipment and facilities operation labor	X	X	Monthly	Annually	X, with clarifications		Clarification would be helpful on how facilities maintenance (item above) and facilities operation are distinct.
	Land and land rights – property taxes	X	N/A	Monthly	Annually	X, with clarifications		Estimated cost could be made available as part of Stage 2 design
	Other	X	X	Monthly	Annually	X		
	Thermal Energy Resource(s) Operator (Counterfactual)	**Operate**	**Maintain**	**Frequency of Tracking**	**Frequency of Reporting**	**Agree**	**Disagree**	**Justification (must be completed if disagree)**
Data Collected to Assess the Metric	Other necessary information	Source TBD						

Customer Metrics

Customer includes the customer of record as well as an end-use participant of the pilot, e.g., tenant of a building.

Overall Framing Question 1	**What are the participation rates of customers eligible to take service from the UTEN?**									
Performance Metric	**Percentage of customers electing to take service from the UTEN**									
		Unit of Measurement	**During Design**	**During Construction**	**During Operation**	**Frequency of Tracking**	**Frequency of Reporting**	**Agree**	**Disagree**	**Justification (must be completed if disagree)**
Data Collected to Assess the Metric	Total number of customers offered the opportunity to take UTEN service	Customer Count	X	X	X	Monthly	Quarterly	X		
	Total number of customers taking UTEN service	Customer Count	X	X	X	Monthly	Quarterly	X		
	Total number of customers opting out of UTEN service[9]	Customer Count	X	X	X	Monthly	Quarterly	X		
	Total number of customers electing to remain taking UTEN service at the term of the pilot	Customer Count	N/A	N/A	N/A	N/A	At the term of the pilot	X		
	Other Necessary Information	**Unit of Measurement**	**During Design**	**During Construction**	**During Operation**	**Frequency of Tracking**	**Frequency of Reporting**	**Agree**	**Disagree**	**Justification (must be completed if disagree)**
Data Collected to Assess the Metric	Additional root-cause analysis to be conducted to determine why the customers chose not to enroll, to opt out during the pilot and chose not to remain taking service from the UTEN	N/A	X	X	X	On-going	Quarterly and at the term of the pilot	X		

[9] This data point is referring to customers that opted out of UTEN service after either agreeing to take service or were previously taking service from the UTEN.

Customer Metrics

Customer includes the customer of record as well as an end-use participant of the pilot, e.g., tenant of a building.

Overall Framing Question 2	What are customers' awareness levels?									
Performance Metric	**Customer awareness levels associated with UTEN activity[10]**									
		Unit of Measurement	**During Design**	**During Construction**	**During Operation**	**Frequency of Tracking**	**Frequency of Reporting**	**Agree**	**Disagree**	**Justification (must be completed if disagree)**
Data Collected to Assess the Metric	Number of customers aware of pilot project details[11]	Customer count by awareness level	N/A	N/A	X	Quarterly	Quarterly	X		
	Number of customers aware of pilot project construction impacts[12]	Customer count by awareness level	N/A	N/A	X	Quarterly	Quarterly	X		

[10] The utilities, in consultation with Staff, should develop a standardized set of survey questions to be administered to customers of all active pilots throughout the duration of the project period to allow for commonality in data collection across the projects.

[11] This data point includes the purpose of the pilot project, equipment, and construction schedule. Equipment in this context refers to the customers' awareness of equipment installed at the customer premises, which may impact property value, home aesthetics, or require instructions to operate.

[12] This data point refers to noise, dust, traffic, accessibility, and service disruptions.

Customer Metrics

Customer includes the customer of record as well as an end-use participant of the pilot, e.g., tenant of a building.

	Number of customers that have an understanding of the Customer Agreement[13]	Customer count by awareness level	N/A	N/A	X	Quarterly	Quarterly	X		
	Other necessary information	**Unit of Measurement**	**During Design**	**During Construction**	**During Operation**	**Frequency of Tracking**	**Frequency of Reporting**	**Agree**	**Disagree**	**Justification (must be completed if disagree)**
Data Collected to Assess the Metric	Customer communication preference	N/A	X	X	X	On-going	Annually	X		

Overall Framing Question 3	**Are the customers satisfied with the UTEN?**									
Performance Metric	**Customer satisfaction levels associated with UTEN activity[14]**									
		Unit of Measurement	**During Design**	**During Construction**	**During Operation**	**Frequency of Tracking**	**Frequency of Reporting**	**Agree**	**Disagree**	**Justification (must be completed if disagree)**
Data Collected to Assess the	Customer experience with the UTEN pre-construction process[15]	Customer count by satisfaction level	N/A	N/A	X	Annually	Annually	X		

[13] This data point refers to awareness of customer rights and protections, utility responsibilities, the complaint process, and billing changes/format included in the Customer Agreement.

[14] The utilities, in consultation with Staff, should work to develop a standardized set of survey questions to be administered to customers throughout the duration of the pilot project.

[15] This data point includes the recruitment process, information shared about the pilot project and potential impacts, the Customer Agreement, and utility contact details.

Customer Metrics

Customer includes the customer of record as well as an end-use participant of the pilot, e.g., tenant of a building.

Metric	Customer experience with UTEN service quality and reliability	Customer count by satisfaction level	N/A	N/A	X	Annually	Annually	X		
	Customer experience with the UTEN complaint and resolution process[16]	Customer count by satisfaction level	N/A	N/A	X	Annually	Annually	X		
	Customer experience with the UTEN post-construction process[17]	Customer count by satisfaction level	N/A	N/A	X	Annually	Annually	X		

Overall Framing Question 4	**Why do customers contact the utility?[18]**									
Performance Metric	**Number and type of customer contact associated with the UTEN**									
		Unit of Measurement	**During Design**	**During Construction**	**During Operation**	**Frequency of Tracking**	**Frequency of Reporting**	**Agree**	**Disagree**	**Justification (must be completed if disagree)**

[16] This data point should also include whether the customer issue was resolved.
[17] This data point includes the customer service response rate, billing process, complaint resolution, and maintenance.
[18] The utilities should also track, and report customer contact made directly to the Department of Public Service Call Center.

Customer Metrics

Customer includes the customer of record as well as an end-use participant of the pilot, e.g., tenant of a building.

Data Collected to Assess the Metric	Contact related to billing issues	Number of customers	N/A	N/A	X	Monthly	Quarterly	X		
	Contact related to quality of service and customer operation of the UTEN	Number of customers	N/A	N/A	X	Monthly	Quarterly	X		
	Contact related to service contractor performing work on-site	Number of customers	N/A	X	X	Monthly	Quarterly	X		
	Contact related to utility customer service	Number of customers	N/A	X	X	Monthly	Quarterly	X		
	Other[19]	Number of customers	X	X	X	Monthly	Quarterly	X		
	Customers that have made contact more than once	Number of customers	X	X	X	Monthly	Quarterly	X		
	Contact that has been addressed on first resolution attempt	Number of customers	X	X	X	Monthly	Quarterly	X		
	Other necessary information	**Unit of Measurement**	**During Design**	**During Construction**	**During Operation**	**Frequency of Tracking**	**Frequency of Reporting**	**Agree**	**Disagree**	**Justification (must be completed if disagree)**
Data Collected to Assess the Metric	Targeted Sampling: Root cause analysis to be conducted on a representative sample of contacts (e.g., billing or service quality issues).	N/A	X	X	N/A	On-going	Quarterly and at the term of the pilot	X		

[19] The utility should include the reason(s) for contact.

Customer Metrics

Customer includes the customer of record as well as an end-use participant of the pilot, e.g., tenant of a building.

(continued)	Other necessary information	Unit of Measurement	During Design	During Construction	During Operation	Frequency of Tracking	Frequency of Reporting	Agree	Disagree	Justification (must be completed if disagree)
Data Collected to Assess the Metric	Prevalence-Driven Focus: Root cause analysis to be prioritized for highfrequency or high-impact contact types (e.g., unresolved issues after first contact, contractor performance).	N/A	X	X	N/A	On-going	Quarterly and at the term of the pilot	X		
Data Collected to Assess the Metric	Trigger-Based Investigation: Root cause analysis to be initiated based on specific criteria, such as unresolved issues after the first contact or repeated customer follow-ups.	N/A	X	X	N/A	On-going	Quarterly and at the term of the pilot	X		

Societal Metrics

Data in the Societal Metrics table may be derived from data in other performance metrics tables. Data may also be inter-related within this table.

Overall Framing Question 1	**What are the overall emission reductions associated with the UTEN pilot?**						
Performance Metric(s)	**Emission Reductions (Annual)** **Emission Reductions (Lifetime)**						
	Customer-Side[20] (Connected Building)	**Unit of Measurement**	**Frequency of Collection/Data Interval**	**Frequency of Reporting**	**Agree**	**Disagree**	**Justification (must be completed if disagree)**
Data Collected to Assess the Metric	Customer pre- & post-UTEN electricity consumption	kWh	Monthly	Annually	X, with clarification		It would be helpful to clarify what is counted in the customer's post-UTEN electricity consumption
	Customer pre- & post-UTEN electric demand	kW	Monthly	Annually	X, with clarification		It would be helpful to clarify what is counted in the customer's post-UTEN electricity demand
	Customer pre- & post-UTEN other fuel[21] consumption	BTU	Monthly	Annually	X, with clarification		It would be helpful to clarify what is counted in the customer's post-UTEN electricity consumption
	Customer-Side (Connected Building) (Counterfactual)	**Unit of Measurement**	**Frequency of Collection/Data Interval**	**Frequency of Reporting**	**Agree**	**Disagree**	**Justification (must be completed if disagree)**
Data Collected to Assess the Metric	Individual ASHP or GSHP customer electricity consumption	kWh	TBD	Annually	X, with clarification		Would be helpful to clarify approach to identifying an appropriate counterfactual – is this a modeled approach and/or identifying/selection of control group approach to conduct counterfactual comparison. NYSERDA is OK with a modeled approach at this time.

[20] Customer-Side used in this context represents the usage at the customer site, regardless of who owns or paid for the equipment. It may include the customer of record as well as an end-use participant of the pilot, e.g., tenant of a building.

[21] Other fuel includes natural gas, propane, distillate fuel oil #2, #4, etc. The data should be classified by fuel type.

Societal Metrics

Data in the Societal Metrics table may be derived from data in other performance metrics tables. Data may also be inter-related within this table.

	Individual ASHP or GSHP customer electric demand	kW	TBD	Annually	X		Same comment as above
	Thermal Energy Resource(s) (Utility or Third Party Owned)	**Unit of Measurement**	**Frequency of Collection/Data Interval**	**Frequency of Reporting**	**Agree**	**Disagree**	**Justification (must be completed if disagree)**
Data Collected to Assess the Metric	Thermal Energy Resource electric demand	kW	Monthly	Quarterly	x		
	Thermal Energy Resource other fuel consumption	BTU	Monthly	Quarterly	x		
	Utility Distribution System (UDS) (Utility-Side)	**Unit of Measurement**	**Frequency of Collection/Data Interval**	**Frequency of Reporting**	**Agree**	**Disagree**	**Justification (must be completed if disagree)**
Data Collected to Assess the Metric	UDS electricity consumption	kWh	Hourly	Monthly	x		
	UDS electric demand	kW	Monthly	Quarterly	x		
	UDS other fuel consumption	BTU	Monthly	Quarterly	x		

	Other Information Necessary:	**Unit of Measurement**	**Frequency of Collection/Data Interval**	**Frequency of Reporting**	**Agree**	**Disagree**	**Justification (must be completed if disagree)**
Data Collected to Assess the Metric	Emission Factor per on-site fuel consumption type (CO_2 equivalent)	Metric Ton	Source TBD[22]	TBD	X, with clarification		Suggest annual reporting frequency
	Electric Generation Mix/Hourly Grid Emission Factors	TBD	Source TBD	TBD	X, with clarification		Suggest annual reporting frequency
Overall Framing Question 2	**What are other societal benefits associated with the UTEN pilot?**						
Performance Metric(s)	**Cost Savings per Customer** **Criteria Air Pollutant Reductions**						

[22] In instances where Source TBD is indicated, Staff will work with the utilities to identify the data source(s) to calculate the counterfactual.

Societal Metrics

Data in the Societal Metrics table may be derived from data in other performance metrics tables. Data may also be inter-related within this table.

	Aggregate Electric Demand Reduction						
	Customer-Side (Connected Building)	**Unit of Measurement**	**Frequency of Collection/Data Interval**	**Frequency of Reporting**	**Agree**	**Disagree**	**Justification (must be completed if disagree)**
Data Collected to Assess the Metric	Customer pre- & post-UTEN electricity costs	Monetary value	Monthly	Quarterly	x		
	Customer pre- & post-UTEN other fuel costs	Monetary value	Monthly	Quarterly	x		
	Customer pre- & post-UTEN electric demand	kW	Monthly	Quarterly	x		
	Customer pre- & post-UTEN consumption from onsite combustion of other fuel	BTU	Monthly	Quarterly	x		
	Customer-Side (Connected Building) (Counterfactual)	**Unit of Measurement**	**Frequency of Collection/Data Interval**	**Frequency of Reporting**	**Agree**	**Disagree**	**Justification (must be completed if disagree)**
Data Collected to Assess the Metric	Individual ASHP or GSHP customer electricity cost	Monetary value	TBD	Annually	X, with clarification		Would be helpful to clarify approach to identifying an appropriate counterfactual – is this a modeled approach and/or identifying/selection of control group approach to conduct counterfactual comparison. NYSERDA is OK with a modeled approach at this time. It could be helpful to provide this modeled information at the end of Stage 2, including with a comparison to the projected electricity costs associated with connecting to the UTEN

Societal Metrics

Data in the Societal Metrics table may be derived from data in other performance metrics tables. Data may also be inter-related within this table.

	Individual ASHP or GSHP customer electric demand	kW	TBD	Annually	X, with clarification		Would be helpful to clarify approach to identifying an appropriate counterfactual – is this a modeled approach and/or identifying/selection of control group approach to conduct counterfactual comparison. NYSERDA is OK with a modeled approach at this time. It could be helpful to provide this modeled information at the end of Stage 2, including with a comparison to the projected electricity costs associated with connecting to the UTEN

	Thermal Energy Resource(s)	**Unit of Measurement**	**Frequency of Collection/Data Interval**	**Frequency of Reporting**	**Agree**	**Disagree**	**Justification (must be completed if disagree)**
Data Collected to Assess the Metric	Thermal Energy Resource electricity costs	Monetary value	Monthly	Quarterly	X		
	Thermal Energy Resource electric demand	kW	Monthly	Quarterly	X		
	Thermal Energy Resource other fuel costs	Monetary value	Monthly	Quarterly	X		
	Utility Distribution System (UDS) (Utility-Side)	**Unit of Measurement**	**Frequency of Collection/Data Interval**	**Frequency of Reporting**	**Agree**	**Disagree**	**Justification (must be completed if disagree)**

Societal Metrics

Data in the Societal Metrics table may be derived from data in other performance metrics tables. Data may also be inter-related within this table.

Data Collected to Assess the Metric	UDS electricity costs	Monetary value	Monthly	Quarterly	X		
	UDS other fuel costs	Monetary value	Monthly	Quarterly	X		
	UDS electric demand	kW	Monthly	Quarterly	X		
	Other Information Necessary	**Unit of Measurement**	**Frequency of Collection/Data Interval**	**Frequency of Reporting**	**Agree**	**Disagree**	**Justification (must be completed if disagree)**
Data Collected to Assess the Metric	Criteria air pollutant factors per fuel type	Metric Ton	TBD	TBD	X		
Overall Framing Question 3	**What type and level of jobs and skilled trades work is needed to design, construct, and operate the UTEN pilot project(s)?**						
Performance Metric(s)	**Total number of Jobs (Temporary and Permanent)** **Specific skills, licenses, certifications, apprenticeships required**						
	Other Information Necessary	**Unit of Measurement**	**Frequency of Tracking**	**Frequency of Reporting**	**Agree**	**Disagree**	**Justification (must be completed if disagree)**
Data Collected to Access the Metric	Categorical list of jobs (temporary and permanent), specific skills, license categories, certifications and apprenticeships during design, construction, and operation of the pilot project[23]	N/A	Monthly	Annually	X		

(continued)	**Other Information Necessary**	**Unit of Measurement**	**Frequency of Tracking**	**Frequency of Reporting**	**Agree**	**Disagree**	**Justification (must be completed if disagree)**

[23] The utilities, in consultation with Staff, should work to develop standardized lists and categories of the type and level of jobs and skilled trades work needed to design, construct, and operate the UTEN pilot projects.

Societal Metrics

Data in the Societal Metrics table may be derived from data in other performance metrics tables. Data may also be inter-related within this table.

Data Collected to Access the Metric	Number of jobs (temporary and permanent) during design, construction, and operation of the pilot project	Number of	Monthly	Annually	X		

Safety and Reliability Metrics

Data in the Safety and Reliability Metrics table may be derived from data in other performance metrics tables. Data may also be inter-related within this table.

Overall Framing Question 1	**Is the UTEN pilot operating safely and reliably?**						
Performance Metric	**Safety and Reliability**						
	Customer-Side @ Site (Actual)	**Unit of Measurement**	**Frequency of Tracking**	**Frequency of Reporting**	**Agree**	**Disagree**	**Justification (must be completed if disagree)**
Data Collected to Assess the Metric	Curtailment[24]	Number of customers	Per Incident	Quarterly	x		
	Duration of curtailment period	Hour	Per Incident	Quarterly	x		
	Cause of curtailment	Description of event[25]	Per Incident	Quarterly	x		
	Asset[26] failure	Number of	Per Incident	Quarterly	X, with clarifications		If not included in event description, this should include the detail of what types of assets failed
	Duration of asset failure	Hour	Per Incident	Quarterly	X		
	Cause of asset failure	Description of event	Per Incident	Quarterly	X		
	Leak of thermal transfer medium	Number of	Per Incident	Quarterly	X		
	Location of leak of thermal transfer medium	Location	Per Incident	Quarterly	X		
	Cause of leak of thermal transfer medium	Description of event	Per Incident	Quarterly	X		
	Utility-Side	**Unit of Measurement**	**Frequency of Tracking**	**Frequency of Reporting**	**Agree**	**Disagree**	**Justification (must be completed if disagree)**

[24] Curtailment in this context refers to the loss of substantial or complete thermal energy to a customer. It can be either planned or unplanned.

[25] Description of event used throughout this table should include a concise and informative description of the event (e.g., curtailment, asset failure, leak, shut down, etc.) including, as applicable, how the event was discovered, such as through instrument, public notification, or other means).

[26] Customer-side asset refers to equipment on the customer-side of the demarcation point (e.g., HVAC equipment, pumps, piping, meter, appurtenances, monitoring devices, etc.).

Safety and Reliability Metrics

Data in the Safety and Reliability Metrics table may be derived from data in other performance metrics tables. Data may also be inter-related within this table.

Data Collected to Assess the Metric	Asset[27] failure	Number of	Per Incident	Quarterly	X		
	Duration of asset failure	Hour	Per Incident	Quarterly	X		
	Cause of asset failure	Description of event	Per Incident	Quarterly	X		
	Leak of thermal transfer medium	Number of	Per Incident	Quarterly	X		
	Location of leak of thermal transfer medium	Location	Per Incident	Quarterly	X		

(continued)	Utility-Side	Unit of Measurement	Frequency of Tracking	Frequency of Reporting	Agree	Disagree	Justification (must be completed if disagree)
Data Collected to Assess the Metric	Cause of leak of thermal transfer medium	Description of event	Per Incident	Quarterly	X		
	Shut down of all, or a portion of the UTEN	Number of	Per Incident	Quarterly	X		
	Duration of shut down	Hour	Per Incident	Quarterly	X		
	Cause of shut down	Description of event	Per Incident	Quarterly	X		
	Response time to customer outage/trouble calls	Minutes	Per Incident	Quarterly	X		
	Concentration of antifreeze agent, such as glycol, in the heat transfer medium[28]	Percentage	Initial, unless changed		X, with clarifications		The frequency of this reporting is not clear – is this supposed to be for each incident reported, the concentration of the antifreeze agent would need be reported? If so, then the frequency may need to be per incident. It is also not clear what "initial" frequency means
	Other Information Necessary	**Unit of Measurement**	**Frequency of Tracking**	**Frequency of Reporting[29]**	**Agree**	**Disagree**	**Justification (must be completed if disagree)**

[27] Utility-side asset refers to equipment on the utility-side of the demarcation point (e.g., pumps, piping, metering, back-up power, thermal energy storage, valves, SCADA, thermal energy resource, etc.).

[28] This data point is duplicative of data to be collected on the Technical Metrics table and is listed here as this information would be necessary in the event of leaks.

[29] The utility may be required to report safety- and environmental impact-related incidents more frequently if such incidents are immediate threats or hazards.

Safety and Reliability Metrics

Data in the Safety and Reliability Metrics table may be derived from data in other performance metrics tables. Data may also be inter-related within this table.

Data Collected to Assess the Metric	Maintenance tasks and /or inspections[30]	Description of event	Per Incident	Annually	**x**		
Overall Framing Question 2	**What adverse environmental impacts are associated with safety and reliability issues experienced by the UTEN pilot?**						
Performance Metric	**Adverse impact to life, property, environment**						
	Customer-Side @ Site	**Unit of Measurement**	**Frequency of Tracking**	**Frequency of Reporting[31]**	**Agree**	**Disagree**	**Justification (must be completed if disagree)**
Data Collected to Assess the Metric	Property damage due to asset failure	Monetary value	Per Incident	Quarterly	X, with clarification		Would consider adding "description of damage/event" to the unit of measurement (unless appropriately covered by the metric below)
	Environmental impact due to leak of thermal transfer medium	Description of event	Per Incident	Quarterly	X		
	Volume of thermal transfer medium loss	Gallon	Per Incident	Quarterly	x		

[30] Maintenance tasks, inspections and associated intervals would be contained within the utility's respective operating procedures, emergency plans and damage prevention programs.

[31] The utility may be required to report safety- and environmental impact-related incidents more frequently if such incidents are immediate threats or hazards.

Safety and Reliability Metrics

Data in the Safety and Reliability Metrics table may be derived from data in other performance metrics tables. Data may also be inter-related within this table.

(continued)	Customer-Side @ Site	Unit of Measurement	Frequency of Tracking	Frequency of Reporting[32]	Agree	Disagree	Justification (must be completed if disagree)
Data Collected to Assess the Metric	Injuries or fatalities[34]	Number of	Per Incident	Quarterly	x		
	Theft of thermal energy from the UDS	Number of	Monthly	Quarterly	X, with clarification		Quantity or magnitude of the theft could be important to understand and could be added as a unit of measurement (estimate of kwh / btus stolen)
	Utility-Side	**Unit of Measurement**	**Frequency of Tracking**	**Frequency of Reporting**	**Agree**	**Disagree**	**Justification (must be completed if disagree)**
Data Collected to Assess the Metric	Property damage due to asset failure	Monetary value	Per Incident	Quarterly	X, with clarification		Would consider adding "description of damage/event" to the unit of measurement (unless appropriately covered by the metric below)
	Environmental impact due to leak of thermal transfer fluid	Description of event	Per Incident	Quarterly	X		
	Volume of thermal transfer medium loss	Gallon	Per Incident	Quarterly	x		
	Excavation damages[33]	Number of	Per Incident	Quarterly	x		
	Injuries or fatalities	Number of	Per Incident	Quarterly	x		
	Concentration of antifreeze agent, such as glycol, in the heat transfer medium[36]	Percentage	Initial, unless changed		X, with caveats		The frequency of this reporting is not clear – is this supposed to be for each incident reported, the concentration of the antifreeze agent would be reported? If so, then the frequency may need to be per incident. It is also not clear what "initial" frequency means

[32] The utility may be required to report safety-and environmental impact-related incidents more frequently if such incidents are immediate threats or hazards.

[34] Accident reporting criteria similar to 16 NYCRR Part 255.801 will be required.

[33] This data point refers to excavation damages, as defined in Damage Prevention Performance Metrics in gas utility rate cases, and also presented in Case 24-G-0145, In the Matter of Staff's Analysis of Local Distribution Company (LDC) Performance Related to the Pipeline Safety Measures. Components to be reported are the number of requests to the One-Call system requesting the marking of underground facilities, number of damages due to inaccurate marking of facilities, damage by company and company contractor personnel, damages due to third-party excavators, and damages to facilities where no request for locate was made. [36] This data point is duplicative of data to be collected on the Technical Metrics table and is listed here as this information would be necessary in the event of leaks.

Safety and Reliability Metrics

Data in the Safety and Reliability Metrics table may be derived from data in other performance metrics tables. Data may also be inter-related within this table.