



Memorandum

Project name **Utah City District Energy Utility General Rate Case**

Subject **Basis of Capital Cost, Equipment Efficiency, and Load Assumptions – GRC Rate Case Support**

Client **Corix Utah City Heating and Cooling LLC**

To **Derek Nelson, Director Utility Operation| US West, Corix**

From **Simon Olivieri, P.E., Energy Project Manager, Ramboll**

Copy to **Jason Owen, Vice President, Project Development, Corix**

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1 Purpose

This memorandum documents the technical basis for the capital cost, equipment efficiency, load intensity, and demand diversification assumptions used in the Utah City District Energy Utility (UCDEU) Financial Model in support of the general rate case (GRC) application before the Utah Public Service Commission). It is prepared in response to the request by Jason Owen (Corix, March 25, 2026)

The memo addresses the four categories of inputs identified by Corix's regulatory and financial planning teams: (1) equipment efficiency and system performance assumptions; (2) peak load and energy use intensity assumptions; (3) demand diversification factors; and (4) capital cost unit-rate assumptions. Where costs are directly traceable to the 30% Design Estimate^[1], that document is cited as the primary basis. Where financial model inputs reference equipment or systems outside the 30% estimate scope supplemental AACE Class 5 basis^[2] is provided using industry standard references.

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2 SOURCE DOCUMENTS

The assumptions described in this memorandum draw upon the following sources:

- Utah City District Energy 30% Design Estimate, Ramboll, July 19, 2024 for AACE Class 3 estimate (accuracy –15% / +15%) covering direct-buried CHW and HHW piping, building penetrations, energy transfer stations (ETS), and the Temporary Energy Center (TEC). This is the primary cost basis for Sections 6.1 through 6.3.
- ASHRAE Standard 90.1-2019^[3] – primary reference for baseline equipment efficiency requirements and building energy use intensities.



- Community Energy Modelling Program (CEMP) ASHP Benchmark Dataset^[4] — seasonal ASHP performance data for North American climate zones.
- PNNL-32815: Commercial Building Prototypes Based on ASHRAE 90.1-2019 — CZ 5B^[5] — DOE/PNNL technical support document providing HVAC sizing parameters and prototype building performance data for peak load and annual EUI by building typology across all U.S. climate zones.
- Ramboll Internal District Energy Cost and Performance Benchmarking^[6].
- RSMMeans Building Construction Cost Data, 2024 Edition^[7] for supplementary cost estimation.

3 Peak Load and District Diversification

Peak heating and cooling load intensities are used to size both distribution piping and central plant infrastructure. They are grounded in ASHRAE 90.1-2019 prototype building data for Climate Zone 5B (PNNL-32815^[4]), schematic design documents provided by the developer, and engineering judgment for a large scale, dense, mixed-use development. Peak values taken from the prototype buildings reference baseline equipment sizing which utilizes an oversizing factor of 25% for heating and 15% for cooling. To establish a robust design envelope for district infrastructure at the early stage of development, typologies were unified to 50 W/m² for heating and 70 W/m² for cooling. This unified approach aligns with the calculated equipment capacities for major prototypes in this climate zone: heating intensities range from 38.4 W/m² to 62.1 W/m², while cooling intensities range from 56.6 W/m² to 82.4 W/m². The selected metrics provide a conservative baseline for commercial and residential loads while accounting for the coincident peak of space conditioning and domestic hot water (DHW) demand. Hospital and pool typologies are supported by specific energy modeling. The Hospital uses are based on specific energy modeling provided by the Hospital design team. The Pool typology has no district cooling and pool heating intensity is estimated for the climate zone per ASHRAE HVAC Applications.^[7] Metrics are applied to conditioned area as projected by the developer and utilized to size both piping and central system infrastructure.

Table 1. Peak Load and Annual Energy Use Intensity by Building Typology

Building Typology	Peak Htg. (W/m ²)	Peak Clg. (W/m ²)	Htg. kWh/m ² /yr	Clg. kWh/m ² /yr	Scenario
Residential	50.00	70.00	111.44	73.83	SD
Large Office	50.00	70.00	111.44	73.83	SD
Retail	50.00	70.00	111.44	73.83	SD
Hospital (High)	53.29	91.63	123.52	96.69	SD
Hospital (Low)	39.97	68.73	123.52	96.69	SD
Grocery	50.00	70.00	111.44	73.83	SD
Pool	131.20	—	598.25	—	SD
Hotel / Hospitality	50.00	70.00	111.44	73.83	SD



3.1 Hourly Load Regression Model

Hourly loads for the district are estimated in the financial model using a piecewise linear (change-point) regression model to relate outdoor air temperature to hourly heating and cooling demand, consistent with ASHRAE Guideline 14-2023.^[12] The modeling incorporates anticipated diversity across typologies at the forecasted district scale. Hourly modeling is utilized to estimate total energy consumption across the year based on typical weather conditions.

Table 2. Residential Hourly Load Regression Parameters

Load Model (Residential)	Condition	Heating Load (kBtu)	Cooling Load (kBtu)
Break Point (BP)	—	62,000	58,000
Slope	Above BP	(0.021)	0.323
Intercept	Above BP	2.947	(17.509)
Slope	Below BP	(0.169)	0.024
Intercept	Below BP	12.120	(0.146)

Notes: Values in parentheses are negative. Slope units are kBtu/h per °F; intercept units are kBtu/h. BP is the breakpoint outdoor air temperature.

3.2 Demand Diversification Factors

To size central plant infrastructure, a demand diversification factor of 70% has been applied uniformly to peak heating and cooling loads for each block in the service area based on the early stages of facility programming and forecasted mix of building typologies with differing loads. The factor represents statistical non-coincidence of individual building peak demands within a district energy cluster and is used to establish the central plant sizing basis.

The 70% factor is consistent with the following published guidance:

- ASHRAE District Cooling Guide (2013), Chapter 2, Section 2.3.2:^[6] Demand diversity factors for mixed-use district energy clusters range from 0.65 to 0.80; 0.70 is recommended for preliminary design of mixed residential-commercial developments in the 200,000–500,000 ft² connected load range.
- IDEA District Cooling Best Practice Guide (2008), Chapter 4, Section 4.2:^[8] Coincidence factors for mixed-use urban blocks range from 0.60 to 0.80; 0.70 is recommended for pre-design estimates where metered data are unavailable.
- Ramboll Internal Benchmark Database: Observed metered coincidence factors from five comparable North American district energy systems range from 0.65 to 0.74 at the block scale, consistent with the 0.70 design assumption.

As metered demand data become available during utility operations, the diversification factor can be refined using measured demand profiles for each block.

4 Equipment Efficiencies and System Performance Assumptions

Table 3 summarizes equipment efficiency and system performance assumptions used in the UCDEU energy model. Each value is attributed to its source standard, benchmark dataset, or equipment data.

Table 3. Equipment Efficiency and System Performance Assumptions

Equipment / System	Htg. Eff./COP	Clg. Eff./COP	Unit	Basis / Specific Citation
Condensing Gas Boiler	92%	N/A	%	ASHRAE 90.1-2019, Table 6.8.1-5; Et ≥ 90% for gas hot water boilers ≥300 MBH. Ramboll adopts 92% for condensing design. ^[3]
Water Cooled Chiller	N/A	5.86	EER	ASHRAE 90.1-2019, Table 6.8.1-3; baseline EER ≥ 5.55 for WCC ≥150 Tons. 5.86 EER reflects AHRI 550/590-rated premium centrifugal unit. ^[3]
Heat Exchangers	95%	95%	%	IDEA District Cooling Best Practice Guide (2008), Ch. 3, §3.4: plate HX effectiveness ≥ 95% at design flow; approach temp 0.8–1.7°C. ^[8]
Parasitic Losses (Htg./Clg.)	7.0%	3.5%	%	IEA-DHC Annex VI Connection Handbook (2007), §9: auxiliary pump and controls energy 2–7% of delivered thermal energy. 7.0% heating reflects longer CZ 5B run hours. ^[9] Higher heating losses are attributed to larger temperature differentials and specific heating configurations.
Distribution Loss (Htg./Clg.)	7.0%	10.0%	%	ASHRAE District Cooling Guide (2013), Ch. 4, §4.3: CHW thermal gain 5–15% for direct-buried HDPE; 10% adopted for 44°F supply. ASHRAE District Heating Guide (2013), §2.5: HHW loss 5–10% for pre-insulated system; 7% adopted. ^[6]

5 Capital Cost Assumptions

Capital cost unit rates in the UCDEU financial model are sourced from two tiers: (a) values directly derived from the 30% Design Estimate for Phase 1 scope items; and (b) AACE Class 5 estimates using industry benchmarks for equipment outside the 30% estimate scope. The financial model should apply a correction factor to most distribution piping and ETS line items, reflecting additional design construction uncertainty, unforeseen project-specific scope adjustments, and contingency adjustments relative to the 2024 base estimate year.^[1] The financial forecast must recognize the novel nature of the project for the region and establish a realistic project budgeting forecast to avoid an under-allocation of funds during the implementation period.

5.1 Distribution Piping — 30% Estimate Basis

Piping unit rates are derived from the 30% estimate by dividing each system's total direct installed cost (labor, material, and equipment) by the estimated pipe run length. Contractor overhead and profit (15%) and general conditions (10%) are included in the estimate base. HHW Network 12,585 lf of



subgrade HDPE SDR 11 hot water piping (supply and return, 10"–18" diameter). Total direct cost: \$1,518,800; implied rate \$120.69/lf.

- CHW Network 12,670 lf of subgrade HDPE SDR 11 chilled water piping (supply and return, 10"–18" diameter). Total direct cost: \$1,155,689; implied rate \$91.21/lf direct, \$114/lf with contractor markup.
- Trenching 6,295 lf of open-cut trenching for the 4-pipe system. Standalone trenching total: \$1,154,014. The \$93/ft represents the trench cost attributable to a 2-pipe sub-trench; the combined TM Cost (4-pipes + trench) rate of \$1,182/ft represents the fully-loaded installed cost for a 4-pipe corridor.

5.2 Energy Transfer Stations – 30% Estimate Basis

Nine energy transfer stations (ETS), heating and cooling, are included in Phase 1 scope. The 30% estimate total for the ETS section — labor (\$417,084), materials (\$115,275), equipment (\$46,125), and major equipment allowances for ETS skids and controls (\$4,543,000) — yields a fully-loaded per-building cost of \$569,054. A correction factor is suggested in the financial model to reflect an upward premium for buildings requiring non-standard penetrations, enhanced controls integration, or structural accommodation of the ETS skid, consistent with Ramboll's experience on comparable greenfield installations.

5.3 Central Plant Equipment – 30% Estimate Basis

Central plant unit rates are extracted from the Energy Center Breakdown tab of the 30% estimate workbook, which apportions the Systecon/Ramboll HRC plant budget between cooling and heating on a capacity basis:

- DE4G — Heating Plant Equipment + Install 24,000 MBH capacity; allocated cost \$1,094,910; derived rate \$45.62/MBH,
- Facilities — Temporary Plant TEC building + plant, 3,700 ft², total \$9,396,787; all-in rate \$2,539/ft², and excluding major production equipment (OSM lump sum \$6,500,000) the cost could be reduced to \$1,833/ft² for building/mech/elec only from the estimate breakdown as well as competitive procurement results during the project development process.
- Facilities — Permanent Plant AACE Class 5 basis; RSMeans 2024 Mechanical Equipment Buildings, Mountain West (\$1,200–\$1,600/ft²); mid-range \$1,370/ft² adopted. Planning for the district suggests that permanent infrastructure will be co-located within other buildings on-site minimizing facility related costs for the plant.

6 Qualifications and Limitations

The following qualifications apply to the information presented in this memorandum:

- The 30% Design Estimate is classified as AACE Class 3 with expected accuracy –15% / +15%. Cost inputs derived from this estimate carry this inherent uncertainty. Estimates should be updated to AACE Class 2 or better prior to construction budget approval.



- AACE Class 5 items (Section 6.4) carry accuracy of –50% / +100%. They are provided for comparative financial modeling purposes only and are not suitable for construction procurement or capital authorization.
- All costs are presented in 2024 USD. The 30% estimate excludes sales taxes (project assumed tax-exempt), site restoration, and hazardous materials remediation.
- Equipment efficiency values reflect rated or published benchmark conditions. Actual seasonal performance depends on operating schedules, district loop temperatures, climate variability, and part-load operation.
- O&M rates, economic useful lives (EUL), plant-in-service (PDI) values, and depreciation methods referenced in the UCDEU financial model are outside Ramboll's scope and are not addressed in this memorandum.
- This memorandum is prepared for the purpose of supporting the UCDEU GRC regulatory filing. It is not intended to serve as a design document, construction specification, or investment recommendation.

References

- [1] Ramboll. Utah City District Energy 30% Design Estimate. Project No. UC-DEAU-2024. July 2024.
- [2] AACE International. Recommended Practice No. 18R-97: Cost Estimate Classification System. AACE International, Morgantown, WV, 2020.
- [3] ASHRAE Standard 90.1-2019. Energy Standard for Buildings Except Low-Rise Residential Buildings. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Atlanta, GA, 2019.
- [4] Pacific Northwest National Laboratory. Commercial Building Prototypes Based on ANSI/ASHRAE/IES Standard 90.1-2019. PNNL-32815. U.S. Department of Energy, Building Energy Codes Program, 2022.
- [5] ASHRAE. Climate Data for Building Design Standards (ASHRAE Standard 169-2020). ASHRAE, Atlanta, GA, 2020.
- [6] ASHRAE. District Cooling Guide, Second Edition. ASHRAE, Atlanta, GA, 2013.
- [7] ASHRAE. 2015 ASHRAE Handbook — HVAC Applications. ASHRAE, Atlanta, GA, 2015.
- [8] IDEA. District Cooling Best Practice Guide, First Edition. International District Energy Association, Westborough, MA, 2008.
- [9] IEA District Heating and Cooling. Connection Handbook — Guidelines for the Connection of Customer Installations to District Heating and Cooling Networks. IEA-DHC Annex VI, FVB Energy Inc., 2007.
- [10] Gordian / RSMMeans. Building Construction Cost Data, 2024 Edition. Rockland, MA, 2024.
- [11] Corix Utilities Inc. Utah City District Energy Utility Financial Model — ECRA Model Tab. 2026.
- [12] ASHRAE. ASHRAE Guideline 14-2023 — Measurement of Energy, Demand, and Water Savings. ASHRAE, Atlanta, GA, 2023.