City of Louisville
Internal Decarbonization Plan

GOLF CLUBHOUSE & GOLF MAINTENANCE
DECARBONIZATION AUDIT REPORT

585 W DILLON RD
LOUISVILLE, COLORADO
AUGUST 18, 2023

City of Louisville
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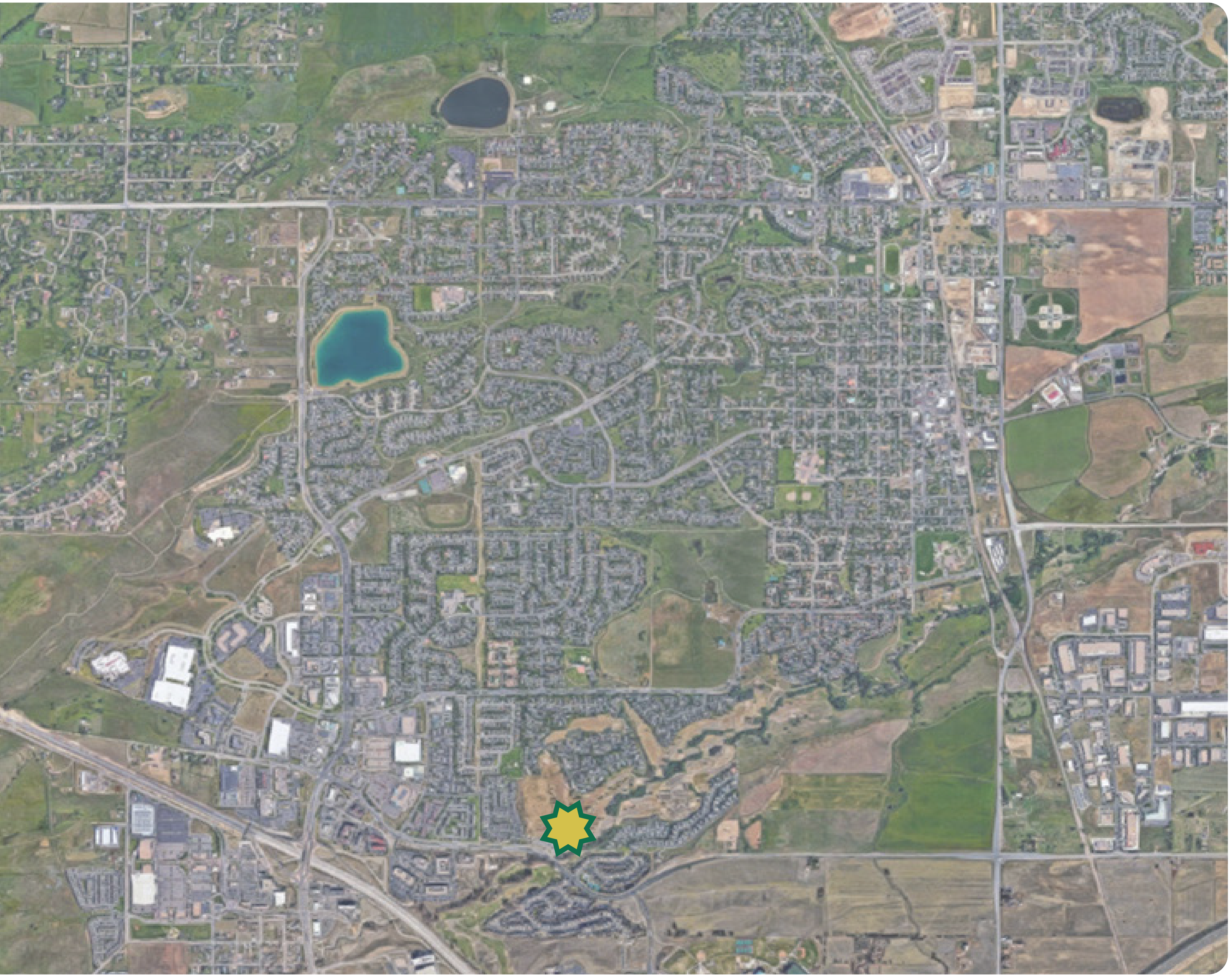


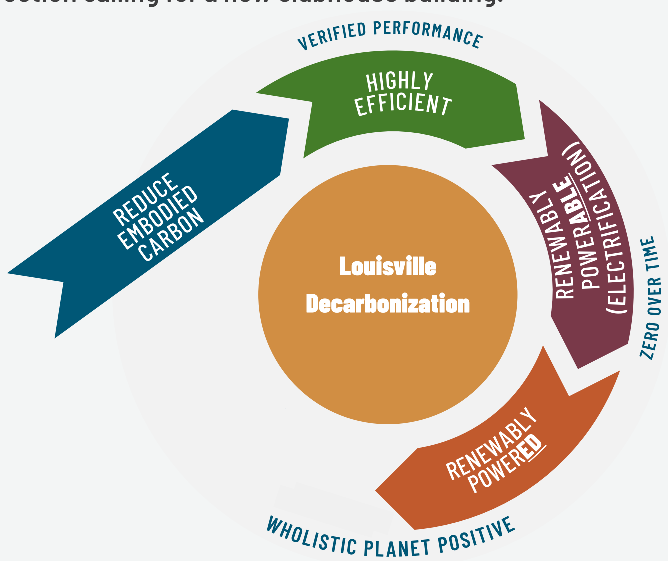
Date	Version History
8/18/2023	Version 1 - Issued to City

Background

In August of 2019, City Council passed Resolution 25, Series 2019, which set clean energy and carbon emission reduction goals for the municipality and larger community. This resolution sets goals to meet all of Louisville's municipal electric needs with 100% carbon-free sources by 2025, and to reduce core municipal greenhouse gas emissions annually below the 2016 baseline through 2025. The City of Louisville has demonstrated its commitment toward creating a healthy and sustainable environment for its residents, evident through Resolution 25-2019 (Setting Clean Energy and Carbon Emission Reduction Goals), as well as their Sustainability Action Plan (adopted in October 6, 2020). In support of these goals, McKinstry was contracted to identify a strategic roadmap for electrification and decarbonization of all City buildings, fleet, equipment and operations by 2030, and recommend an alternative target if appropriate.

This is an interim report, providing initial directions, findings, as well as a draft set of detailed decarbonization approaches for the Golf Clubhouse and the Golf Maintenance building. While it is possible the clubhouse building will be demolished to make way for a new building, this report assumes reuse of the existing clubhouse building. At time of this report and study, there was no direction calling for a new clubhouse building.

There are many possible pathways for decarbonizing Louisville. With guidance from City staff, this report focuses on identification of strategies that provide the highest value, most fiscally responsible path forward to achieve Louisville's decarbonization goals.



Decarbonization Recommendation

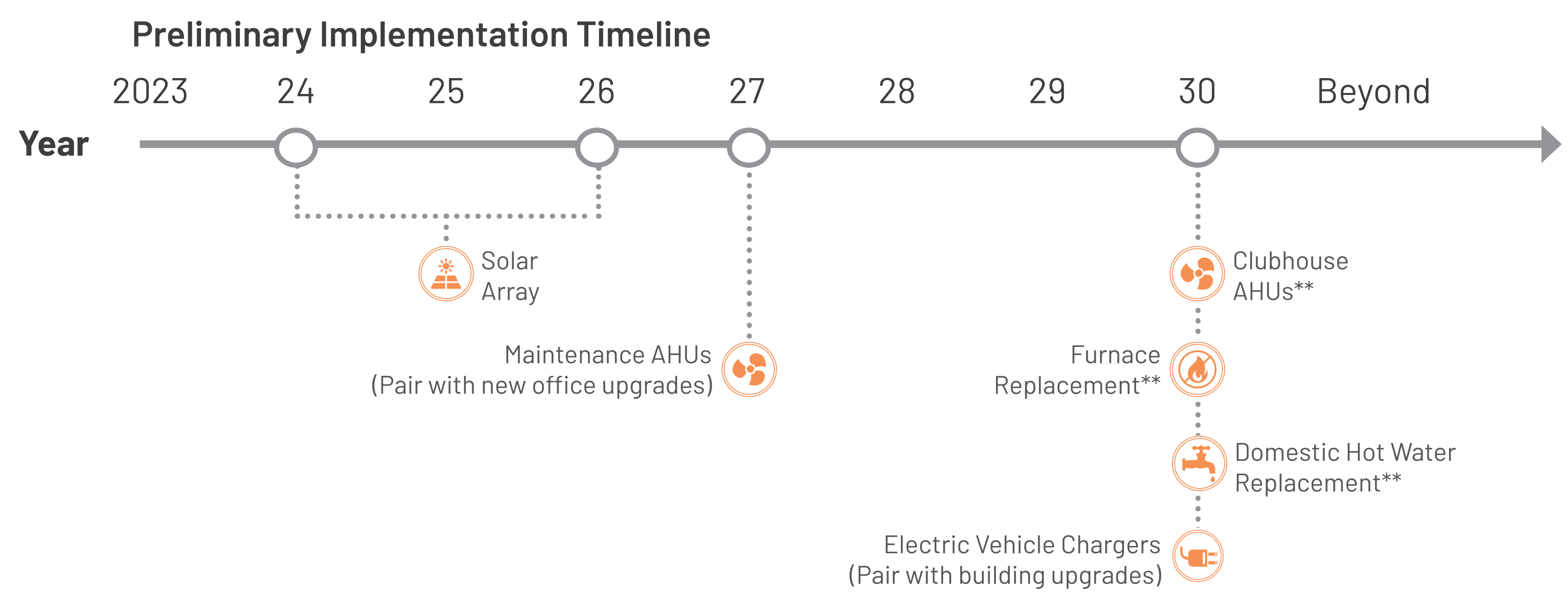
The table below outlines the findings of the study and highlights the opportunity towards a viable and cost-effective path towards carbon neutrality. The total cost is the total amount of money that will need to be allocated for budgetary purposes. The net cost is the total construction costs minus the replacement costs that would've been spent to replace the existing units with like-for-like fossil fuel units. The net cost represents the true cost of this decarbonization effort. All information included in this table is explained in greater detail in this report. **These are "all-in costs" and represent the total cost of construction. They are also Rough Order of Magnitude (ROM) numbers, with a +/-20% range.** See "Construction Pricing Context" section for more detail.

Scenario	Life Cycle Carbon Reduced	Life Cycle Carbon % Reduction	Total First Cost	Net First Cost Over Business as Usual Cost
Full Electrification	1,200 tons	100%	$1.5M	$1.0M
High Performance Electrification	1,200 tons	100%	$2.0M	$1.5M
Renewables	N/A	N/A	$1.2M*	N/A
EV Charging	N/A	N/A	$170k	N/A

Renewable costs do not account for funding from the Inflation Reduction Act (IRA).

Implementation

A preliminary implementation timeline is shown below, based on the 2023 Capital Improvement Plan (CIP).



***Existing equipment was installed in 2015. Replace at end-of-life.*

Baseline | Building Use & Energy and Carbon Analysis

Baseline Building Use

Baseline Year
2019

% of City

Building Size
8,200 ft²
3%

Building Energy
1,600 MMBtu
3%

Building Carbon
85 Tons
3%

Building Information

- Golf Clubhouse and Golf Maintenance buildings for Louisville.
- Located on southern edge of the city.
- Clubhouse open to public, maintenance not open to public.
- Originally designed in 1990. Redesigned after being destroyed in flood, reopened in 2015.
- Open year-round as long as there's no snow.

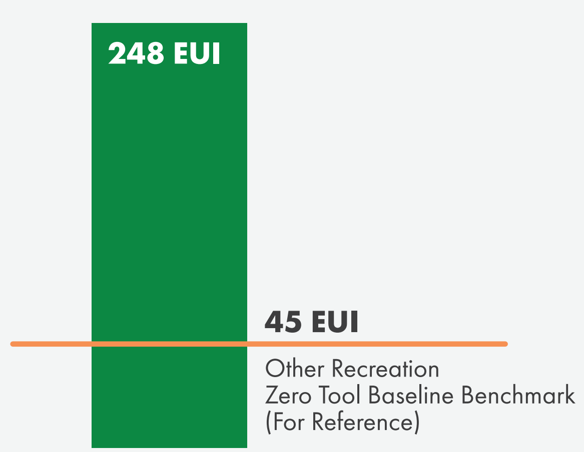
Recent Renovations and Energy Improvements

- R-49 insulation in attic space in 2022.
- Smart T-Stats in 2021.

Baseline Energy Use

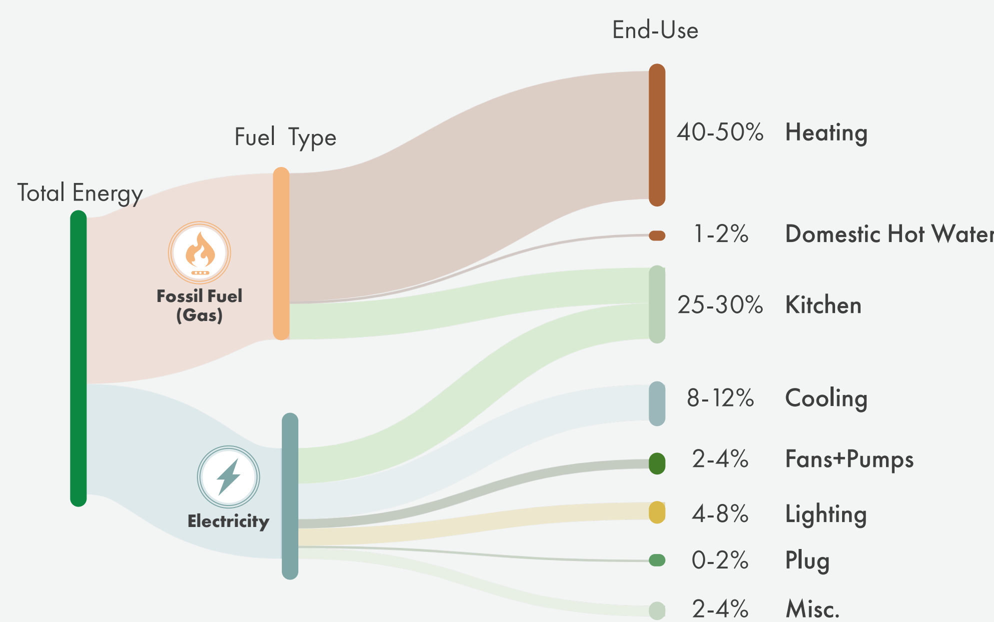
The Golf buildings perform average when compared to the Portfolio Manager Benchmark for recreation facilities.

Baseline Annual Energy Use Intensity (EUI)



Baseline Energy End-Use

Energy end-use estimates are based on most recent available 2018 Commercial Building Energy Consumption Survey (CBECS) benchmarking data and site audit information.



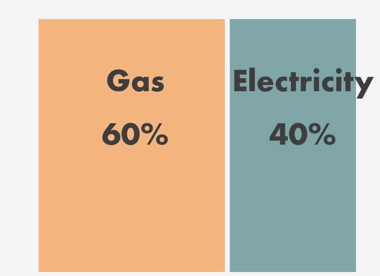
Baseline Carbon Use

The City of Louisville participates in programs to offset their existing electrical consumption with renewable sources. **Therefore, for the purposes of this study the total carbon emissions at Louisville will be solely driven by on-site fossil fuel combustion and emissions associated with electric consumption will be zero.**

The amount of electric consumption offset needed for zero carbon will be addressed in future phases of this study, and will be evaluated at the portfolio level. The offset will be a function of post-decarbonization electrical consumption considering carbon and load reduction measures, on-site renewable energy provided, and the grid emissions of Xcel Energy and zero-carbon utility subscription programs.

1 Car emits 5 tons of CO2e per year

Baseline Energy

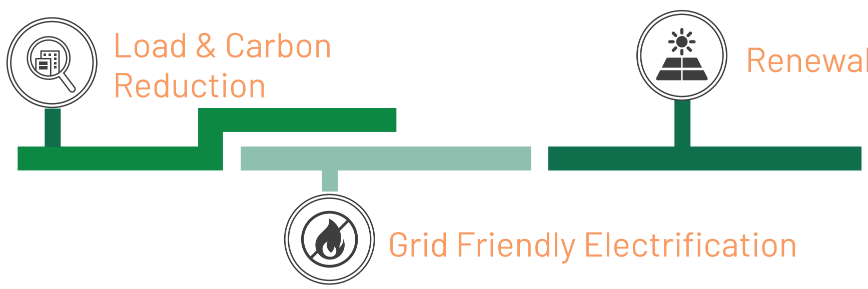


Baseline Carbon

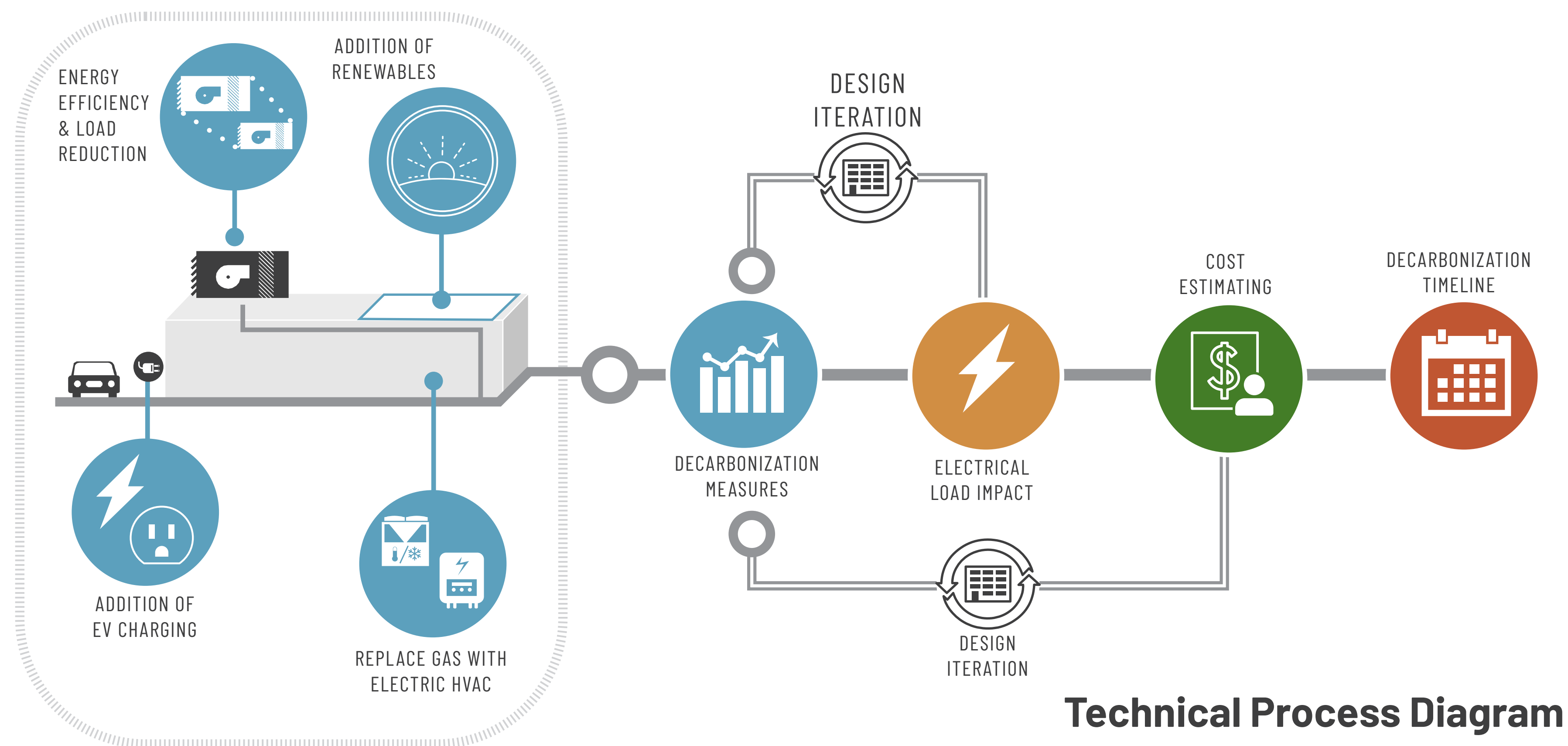
Decarbonization Measures | Decarbonization Process, Load & Carbon Reductions

Decarbonization Process

There are a host of measures to employ on the path of decarbonization, ranging from time-tested traditional energy efficiency measures to the more aggressive electrification measures. The key to decarbonization is finding the right balance between measures, as indicated by the graphic below. With this approach, Louisville will find the most cost-effective path to full decarbonization.



The decarbonization solution starts by identifying measures at the building, and continues with design iteration to arrive at the final timeline, as seen in the Technical Process Diagram.



Technical Process Diagram

Load & Carbon Reduction

The recent shift towards decarbonization still operates on the core foundation of reducing building's overall energy use. Measures can have two functions: reducing annual energy/carbon consumption and reducing peak building demand load. These measures are often incentivized by Xcel and may have shorter paybacks.

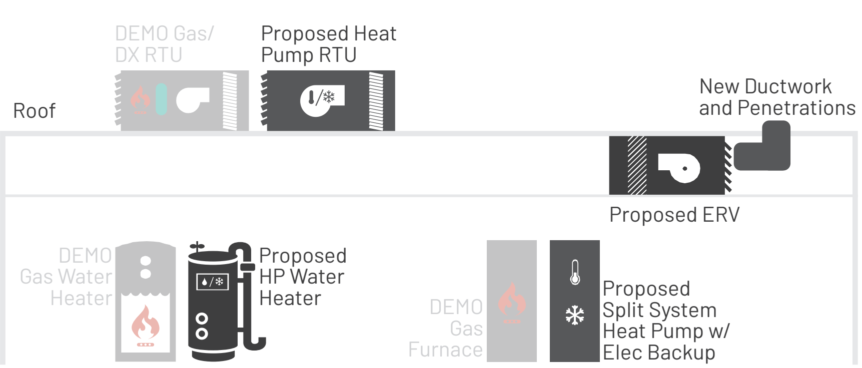
Load	Carbon	Measure	Description
■	■	ENVELOPE AIR SEALING	Buildings are often remarkably leaky – the wall/parapet junction being a frequent culprit. Ensuring a building is tight and ventilated correctly is an effective efficiency measure that also has durability benefits (condensation often occurs at air leakage points) and improves air quality (mold reduction and limiting outside air infiltration during wildfire events).
□	■	LIGHTING CONTROLS/VACANCY SENSORS	LED light replacements are typically the most cost effective way for saving electricity in the lighting arena, but adding lighting controls (which turn off lights with vacancy and vary based on available daylight) provide additional savings and better user experience.
■	■	COMPRESSED AIR LEAKS	Compressed air systems generally have numerous leaks that go unrepaired. These leaks are very costly and can result in very high utility costs. By finding and repairing these leaks the compressor lifetime will be extended and typically improve performance of the overall system.
■	■	WALL/ROOF INSULATION	Due to the age of this building, it was constructed with very little insulation. Additional wall insulation will reduce utility costs and provide better thermal comfort to the occupants of the building.
■	■	ADVANCED PLUG LOAD REDUCTION	Items that are plugged into outlets -plug loads- often make up the single largest use of electricity in buildings, after heat pump heating and cooling. A dedicated, ongoing program for ensuring plug load items are operating at maximum efficiency and/or appropriately switched is a great way to save electricity.

Decarbonization Measures | Mechanical Electrification

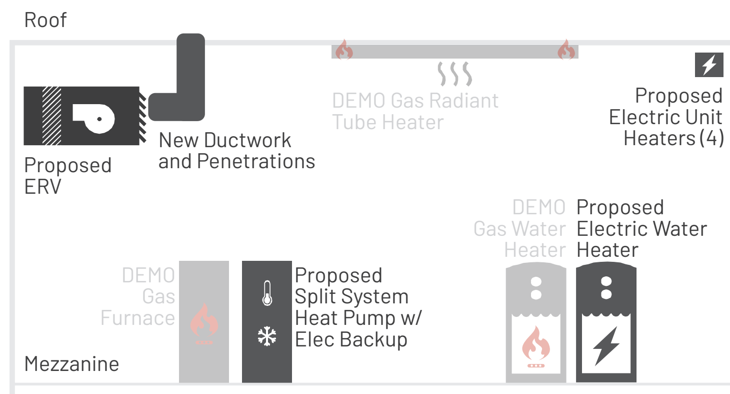
Proposed Electrification

The Golf Clubhouse's primary HVAC systems are a gas/DX rooftop unit and a gas furnace. The Golf Maintenance building's primary HVAC system is a gas furnace. Simple diagrams of these systems and their proposed electrification measures are shown below.

Golf Clubhouse Diagram



Golf Maintenance Diagram



AIRSIDE

The Golf Clubhouse contains a packaged gas/DX rooftop unit and a gas furnace for space conditioning and ventilation. The decarbonized solution would entail replacing the gas/DX rooftop unit with a heat pump RTU with heat recovery and full electric backup, as well as replacing the gas furnace with a heat pump and Energy Recovery Ventilation unit (ERV). ERVs introduce fresh outdoor air into the building and precondition/temper the air via the heat recovery coil. Electric backup heat will be utilized during extreme winter days when heat pump operation is not optimal. Swap gas stovetop burners for electric burners.

The Golf Maintenance building contains (1) gas furnace for heating. To decarbonize, replace the gas furnace with a heat pump and provide an ERV for ventilation.

DOMESTIC HOT WATER

DHW in both the Golf Clubhouse and the Golf Maintenance building is currently served by existing gas water heaters. Replace the gas water heater in the maintenance building with an electric water heater and replace the gas water heater in the clubhouse with a heat pump water heater.

HIGH PERFORMANCE MECHANICAL SYSTEM FOR CONSIDERATION

Another option would be to completely redesign the mechanical systems in the Golf Clubhouse. The Golf Clubhouse is a good candidate for a ground-source heat pump system with the expansive driving range right next to the building. GSHP systems are extremely energy efficient and would unite the building under a large condenser water loop, allowing for energy sharing between different zones. Additionally, the replacement equipment for the RTU and furnace could be water-sourced and tie into the new condenser water loop. To achieve the required capacity, drill approximately (8) boreholes and provide new distribution pumps and manifolds in the Golf Clubhouse building. In the event the clubhouse is demolished, this system would be well-suited to a new zero energy building.

All Electric vs Hybrid Systems

Based on the sizes of the mechanical equipment and the load profile of the building, there is no need for a Hybrid option for the Golf Clubhouse and Golf Maintenance buildings. Even the smallest of the proposed electrification measures would exceed the available capacity of the existing electrical service and would require an electrical service upgrade. Both the full electrification option (#1) and the ground-source heat pump option (#2) would require the same electrical service upgrade.

Beneficial Electrification

Electrification of mechanical systems provides value beyond energy and carbon savings. Additional benefits include, but are not limited to:

- Enhanced ventilation control (outside-air supply, CO_2 Control, etc.) with new RTU and ERV
- Improved thermal comfort with right-sized equipment and updated controls
- Improved resiliency of newer units
- Improved indoor air quality from electrifying kitchen equipment

Decarbonization Measures | Renewables & Electric Vehicle Chargers

Renewables

At the Coal Creek Golf Course, Louisville could install a 202kW-DC carport-mounted solar PV system.

Renewable energy plays the important role of offsetting remaining carbon emissions after building load reductions and electrification are complete. This can be handled through a variety of avenues: behind-the-meter systems, Community Solar Gardens, and utility subscriptions. Since City of Louisville already offsets its current electricity with renewable utility subscriptions, we focused on customer-owned, behind-the-meter systems that would provide more value to the City of Louisville.

When evaluating this site, the following factors were considered:

AVAILABLE SPACE & RACKING MODALITY

The first constraint on system size is the available space on the property. Since ground-mounted PV systems are typically the least expensive racking modality, we evaluate this first followed by rooftop and then parking canopies. Solar systems benefit from economies of scale – generally, the larger the system, the cheaper it is per kW. Coal Creek Golf Course has little roof capacity and no ground-mount availability. The only viable option is a Carport.

SIMPLE PAYBACK

Payback is an easy way to determine the value of a solar system. Solar PV systems last around 25-30 years. McKinstry typically only recommends systems that – including Inflation Reduction Act credits, utility incentives, and/or other funding sources – will pay back within the system lifetime. At this stage of evaluation, simple payback is used. However, if the project advances, more detailed cash flows and paybacks can be calculated.

INTERCONNECTION METHOD & INCENTIVES

Due to size and value of utility savings, the Golf Course would interconnect behind the utility meter and would qualify for Xcel's Solar*Rewards C&I incentives. Additionally, this solar project would be eligible for Inflation Reduction Act incentives, giving 25-30% of the solar cost back to City of Louisville depending on the chosen financing mechanism.

Electric Vehicle (EV) Chargers

One city fleet vehicle is kept at the golf maintenance facility for snow plowing. No fleet vehicles are stored at the golf clubhouse.

Make	Model	Qty
Chevy	Silverado	1

Existing Public Charging Stations	Existing Public Charger Level	Quantity of New Level 2 Public Chargers	Quantity of New Level 3 Public Chargers	Quantity of New Level 2 Fleet Chargers	Quantity of New Level 3 Fleet Chargers
1	2	2	0	0	0

We recommend installing 2 public-facing dual head chargers at the clubhouse. The clubhouse already has 1 level 2 public charger.

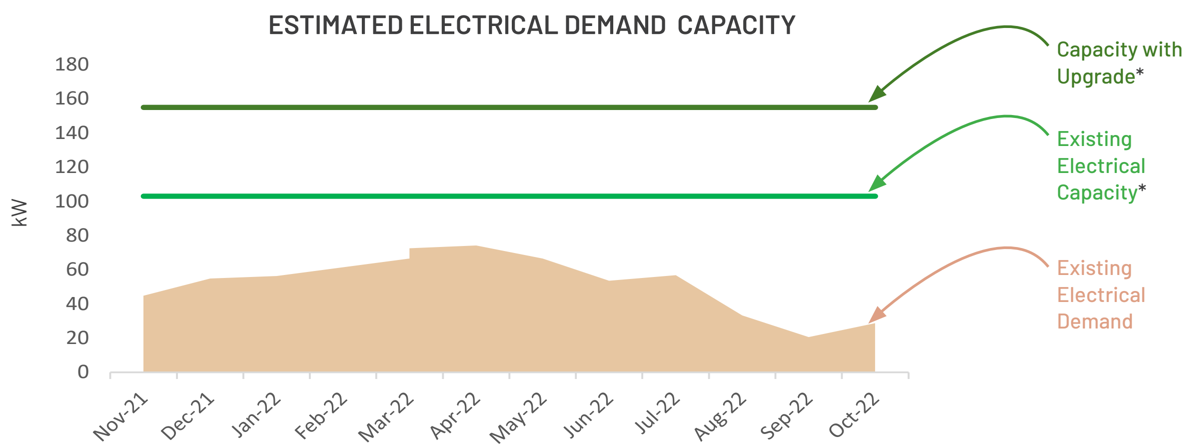
The quantity of new chargers selected for this site was based on the remaining parking spots near the existing charger and proximity to the electrical services. More or less spots could be installed or located in other areas but this will affect the cost.

Electrical Impacts

Golf Clubhouse

The existing service to the clubhouse is 208 Volts (V), 3-phase, and of inconclusive size. It is believed to be 400 Amps (A) based on the apparent conduit size shown in the photos obtained from site.

Utility data was analyzed for the date range 11/2021 – 10/2022. This data shows the existing annual maximum demand of the clubhouse is 66kW and 45kW during heating season.



*with assumed power factor, sized per electrical code requirements

A significant proportion of the load addition being considered by this project is heating so we can utilize the winter demand as the base case. It should be noted that future changes in building occupancy or consumption patterns from the date range where data was provided may impact the service demand and available capacity for electrification.

The Clubhouse does not have a generator. This project has not assessed how existing life safety load is served. Egress lighting is typically provided by battery backed fixtures in buildings that do not have a generator.

The total resultant existing, kitchen and HVAC load for the 2 mechanical options is 582 / 496 Amps at 208V, 3-phase. Both systems require the same size electrical service (600A). This load addition will require an upgrade to the existing 75kVA Xcel energy transformer. EV charging will be served by a new dedicated 208V, 3-phase, 200A separate service directly from the utility transformer, providing some capacity for additional EV chargers to be added in the future.

Golf Maintenance

The existing service to the Golf Maintenance building is 240/120 Volts (V), single-phase, 200 Amps (A).

Existing demand is approximately 10kW based on billing analysis performed by McKinstry over the 2020-2021 period. The existing load is taken at 65A, leaving approximately 135A extra capacity for new mechanical electrification and EV charging load on the existing service.

Load addition at the maintenance facility consists of HVAC electrification (electric unit heaters, furnace / ERV, domestic water heating), L2 EV charging, and allowance for electrification of maintenance equipment. Resultant total load is approximately 525A of 120V single-phase, or 345A of 208V 3-phase. This requires an upgrade to a 600A single-phase or 400A 3-phase service. Typically, a 3-phase service would be selected.

The utility primary wiring to the site is unknown, upgrading to 3-phase power may have incremental additional utility cost. 3-phase power would allow easier integration of solar PV, if desired in the future. Additional in-building power distribution equipment has been allowed for to serve the new added load.

The maintenance facility does not have a generator. This project has not assessed how existing life safety load is served. Egress lighting is typically provided by battery backed fixtures in buildings that do not have a generator.

Structural Impacts

No structural upgrade is triggered from replacement mechanical equipment. All equipment is within existing structural weight limits. No structural upgrades are anticipated with proposed mechanical equipment upgrades to be installed at first floor and mezzanine levels. All incoming mechanical equipment is relatively light, and the existing support framing is presumed adequate.

Decarbonization Measures | Proposed Electrification

Electrification Options

FULL ELECTRIFICATION – Full electrification at the golf buildings, including heat pump RTUs, electric DHW, ERVs, and split system heat pumps. EV charging costs are not included in this option. **This option requires significant electrical upgrades.**

	Load & Carbon Reduction	Grid Friendly Electrification	Renewables
	Envelope Air Sealing Lighting Controls LED Upgrades	~~Electrification High Performance~~ Electrification Full	On-Site Ground Mount PV
Total Cost	**$45k**	**$1.5M***	**$1.2M****
Base Cost	N/A	$450k	N/A
Net Cost of Electrification	**N/A**	**$1.0M***	**N/A**

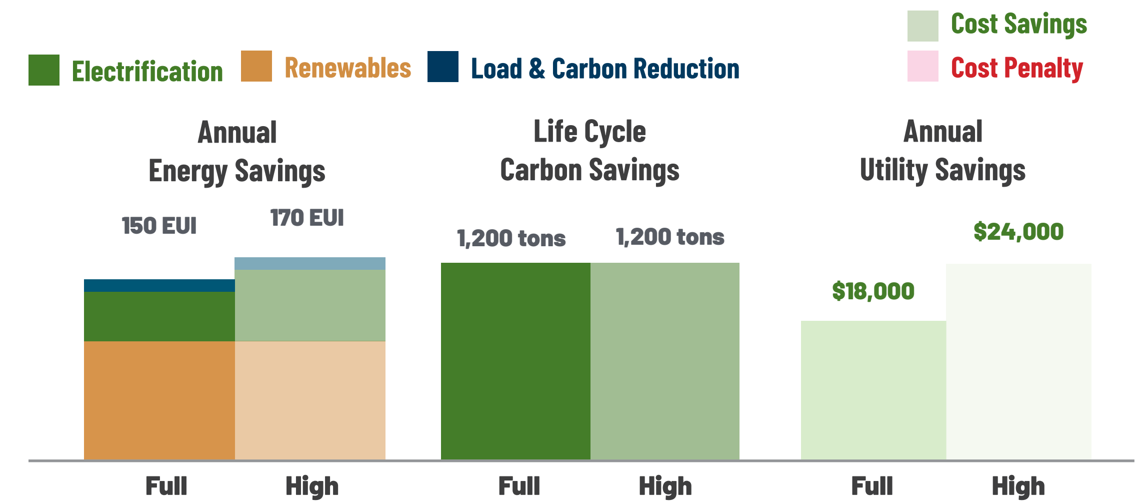
HIGH PERFORMANCE ELECTRIFICATION – High performance electrification at the golf buildings, including an HVAC redesign to a campus ground-source heat pump system. EV charging costs are not included in this option. **This option requires significant electrical upgrades.**

	Load & Carbon Reduction	Grid Friendly Electrification	Renewables
	Envelope Air Sealing Lighting Controls LED Upgrades	Electrification High Performance ~~Electrification Full~~	On-Site Ground Mount PV
Total Cost	**$45k**	**$2.0M**	**$1.2M****
Base Cost	N/A	$450k	N/A
Net Cost of Electrification	**N/A**	**$1.5M**	**N/A**

**Full electrification assumes like-like capacity replacements for unit heaters. Costs subject to further evaluation of required freeze protection and generator requirements.*
***Renewable costs do not account for funding from the Inflation Reduction Act (IRA).*

Proposed Annual Measure Savings

Energy, carbon, and utility cost savings of the proposed options are shown here. The full electrification option is roughly equivalent in energy savings. Conversion from gas to electricity does provide additional carbon savings. There is a larger utility penalty when you electrify the unit heaters, largely driven by increased demand (kW) charges.

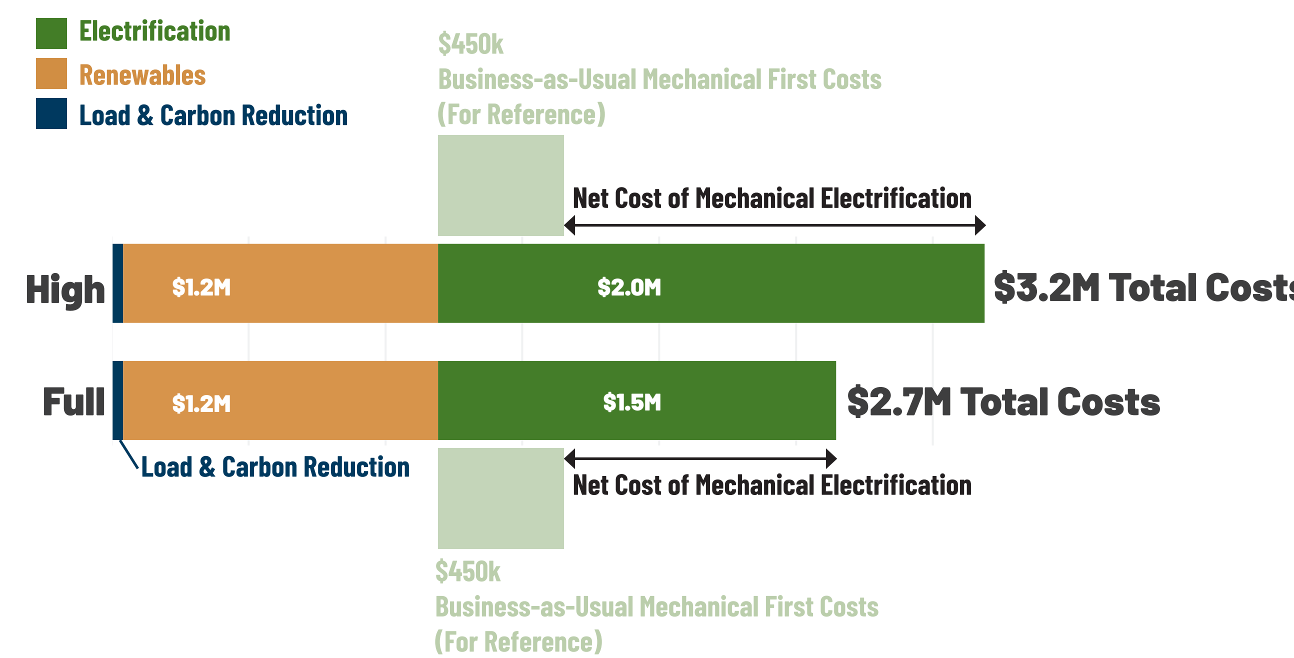


Recommended = Full Electrification

Proposed Total Measure Costs

Proposed measure costs are shown below, including any structural and electrical upgrades needed for each option. **They are also Rough Order of Magnitude (ROM) numbers, with a +/-20% range.**

The total cost is the total amount that will need to be allocated for budgetary purposes. The net cost represents the total cost minus the replacement cost that would've been spent to replace the existing units with like-for-like fossil fuel units. Note that there is a significant net cost premium for full electrification due to electrical upgrades.



Decarbonization Measures | Construction Pricing Context & Constructibility

Construction Pricing Context

The MEP scope narratives described in previous sections and included in the appendices were used by McKinstry's construction division to provide Rough Order of Magnitude (ROM) pricing. This early ROM budgeting process sought to be reasonable but conservative wherever possible. **Typically for ROM-level pricing a range of +/- 20% is applied to the total construction and start up costs.** This range can be reduced, and the pricing further refined, via a deeper understanding of existing building conditions and detailed design. Note this does not account for escalation, which is addressed separately. This pricing represents the total construction and startup cost to Louisville, including:

- General contractor markup
- Design fees
- Engineering energy analysis
- Controls
- Equipment startup, commissioning, testing, and balancing
- Placeholders for miscellaneous trades (e.g. carpentry).
- Allowances specific to each building for construction conditions (e.g. crane time)

All construction costs are in 2023 dollars unless noted otherwise.

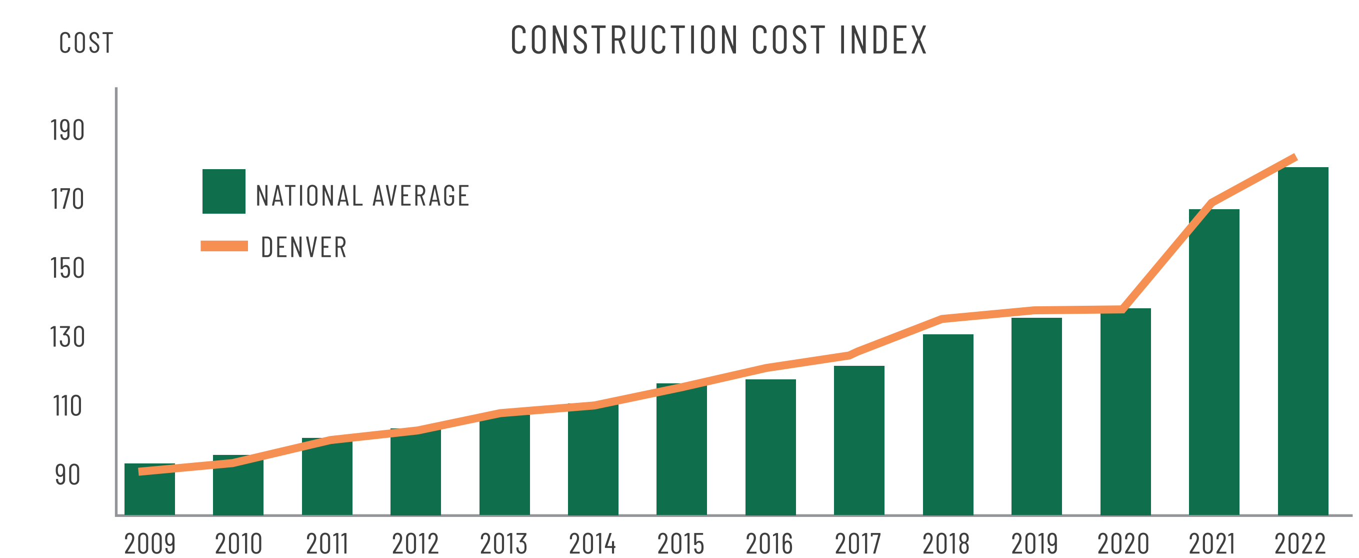
Using These Construction Costs

Throughout this report, differentiation is made between "total construction costs" and "net cost over business-as-usual fossil fuel systems"The distinction between the two is:

- Total costs: these are the total construction costs. This is the total amount of money that will need to be allocated for budgetary purposes.
- Net Cost: these are the total construction costs minus the replacement costs that would've been spent to replace the existing units with like-for-like fossil fuel units. These numbers represent the true cost of this decarbonization effort.

Note the numbers in the 2023 City Budget are budget numbers, and do not represent all costs for replacing the existing units. As such, they should not be used when determining the costs of decarbonization. In addition, the cost estimates in this report assume miscellaneous equipment (e.g. expansion tanks, domestic hot water storage tanks) need to be replaced. This assumption should be validated in detailed design, and could result in the total construction cost being lower if equipment can be reused.

As shown in the graph by the Mortenson, construction costs have been steadily rising since 2009. However, costs rose drastically from 2020 to 2022 (approximately 35%) due to global supply chain issues and unforeseen consequences of the COVID-19 pandemic.



SOURCE: MORTENSON CONSTRUCTION

Constructibility

Recent upheavals in the global supply chain and labor workforce have caused uncertainty in the construction market. Our construction teams are seeing the following trends as of March, 2023:

ELECTRICAL LEAD TIMES:

- Most commodity items, such as conduit, wire, fittings, etc. are readily available.
- Lead times for Switchboards are being quoted 50-80 weeks. Panel-boards can be 20-40 weeks depending on complexity.

MECHANICAL LEAD TIMES:

- Equipment needs to be ordered earlier in detailed design process to accommodate long lead times. Requires additional coordination earlier in design.

In order to combat these lead time challenges, design teams may need to be flexible with their specifications and the products/manufacturers they are selecting.

LABOR MARKET:

While we are seeing a general relaxing of labor shortages in other markets around the country, the contractor and labor shortages continue to persist in the Denver market.

Next Steps | Implementation

Implementation

A preliminary implementation timeline is shown below, based on the 2023 Capital Improvement Plan (CIP). Given the CIP replacement schedule, the golf buildings will likely implement measures beyond 2030, at equipment end of life. The summary below is the implementation recommendation based on age of equipment as well as additional thoughts on emerging technologies and sequence of upgrades.

AIRSIDE

- As RTU reaches end of life, replace with all-electric heat pump alternatives.

FURNACES

- As furnaces reach end of life, replace with heat pump and energy recovery ventilation units.

DOMESTIC HOT WATER

- Replace gas water heater with electric.

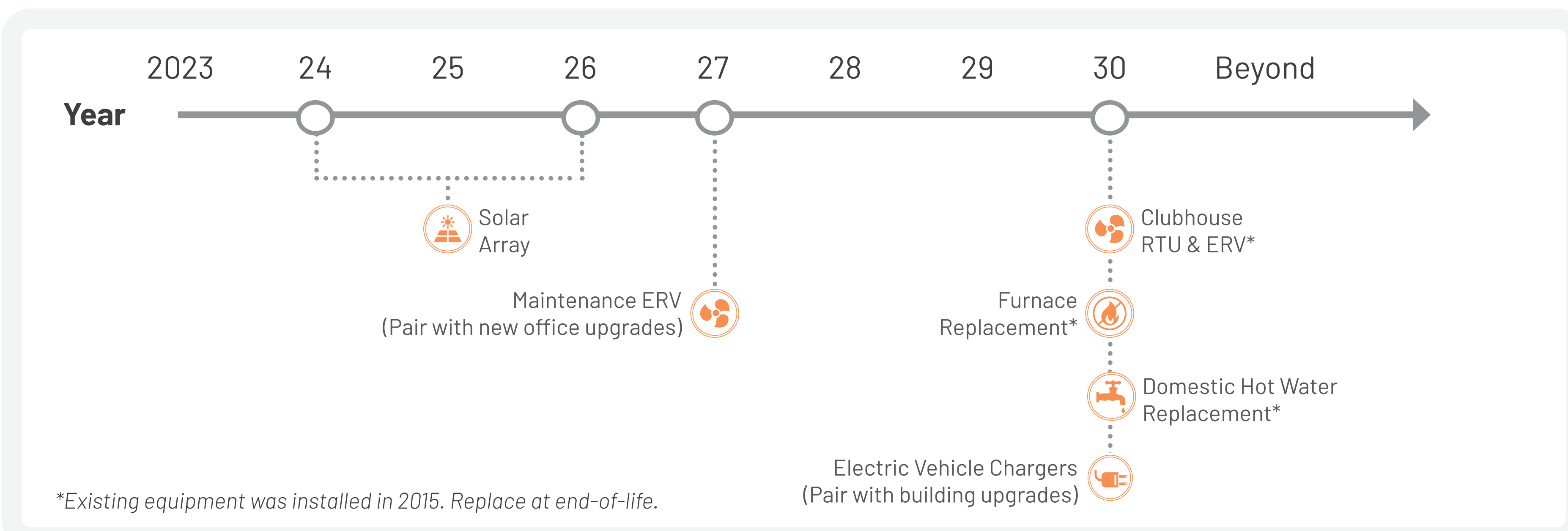
RENEWABLES

- Install a 202kW-DC carport-mounted solar PV system.

ELECTRIC VEHICLE CHARGER

- Provide 1 EV charger for fleet and 3 EV chargers for public.

Preliminary Implementation Timeline



Appendix

1. Mechanical System Matrix Options
2. Mechanical Decarbonization Scoping
3. Electrical Decarbonization Scoping
4. Structural Scoping
5. Electric Vehicle Charging Narrative
6. Renewables Scoping
7. Cost Estimating

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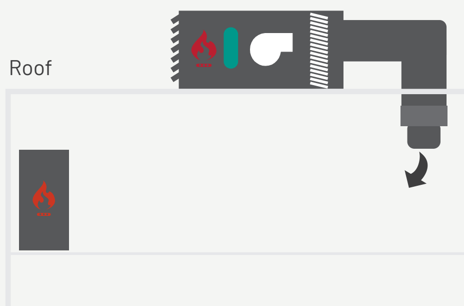
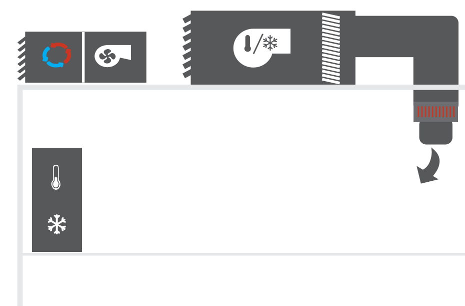
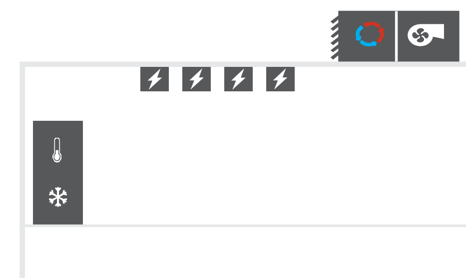
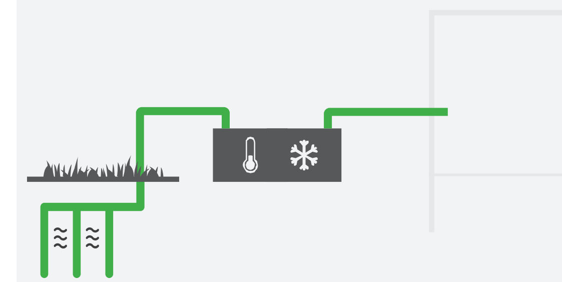
HVAC System Matrix: Golf Clubhouse & Maintenance

	Golf Clubhouse: Existing System	Golf Maintenance: Existing System	Golf Clubhouse: Recommendation	Golf Maintenance: Recommendation	Golf Clubhouse: New Construction Alternate
General	Gas Rooftop Unit, Gas Furnace	Gas Furnace, Gas Tube Heater	Rooftop Heat Pump, ERV+ASHP	ERV+ASHP, Electric Unit Heaters	Ground-source heat pumps and borefield. Full system replacement
					
Plant Equipment	-	-	None	None	See Above
			None	None	See Above
Extent of Retrofit	-	-	**Medium** Energy Recovery Ventilator (ERV) will require new ductwork and penetrations to the exterior for outdoor air and exhaust air.	**Medium** Energy Recovery Ventilator (ERV) will require new ductwork and penetrations to the exterior for outdoor air and exhaust air.	**Extensive** Significant modifications and new infrastructure required to fully redesign central system to a borefield and ground-source heat pump system.
Electrical Impacts	-	-	**Upgrade Needed** Mechanical electrification will require an electrical service upgrade. EV charging will require a new, separate electrical service.	**Upgrade Needed** Mechanical electrification will require an electrical service upgrade.	**Upgrade Needed** Mechanical electrification will require an electrical service upgrade. EV charging will require a new, separate electrical service.
Limiting Factor	-	-	**None**	**None**	**High First Cost**
Verdict	-	-	**Proceed w/ Detailed Scoping**	**Proceed w/ Detailed Scoping**	**High Level Consideration.** Recommended if new clubhouse is built.

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Golf Clubhouse - Mechanical Scope Narrative

Option 1 – Full Electrification

Demo Scope of Work:

- Includes removal and disposal of (1) 10-ton RTU
  - Assumes cut, cap and make safe gas piping from each RTU
- Includes removal and disposal of (1) 5-ton gas furnace
  - Assumes cut, cap and make safe gas piping from furnace
- Includes removal and disposal of (1) gas-fired domestic water heater
  - Includes removal of existing flues and patch and seal of roof
  - Assumes flue is accessible for demo, excludes demo/reinstalling of any shaft walls
  - Assumes cut, cap and make safe gas piping from unit

New Scope of Work:

- Includes (1) new 10-ton air to air heat pump
  - Includes new curbs
  - Assumes existing ductwork and any sound attenuation to remain and be reused
  - Assumes any condensate off RTUs may drain to existing roof receptors
- Includes (1) new 5-ton air to air heat pump
  - Located in approximately same area as existing gas furnace
- Includes (1) new 500 cfm ERV with heat wheel
  - Located in approximately same area as existing gas furnace
  - Includes new supply and exhaust ductwork to exterior
  - Includes roof penetrations for new ERV ductwork
  - Includes 2kW duct heater downstream of unit for additional capacity
- Includes (1) new 120 gallon, 45kW electric water heater
  - Assumes existing circulation pump, expansion tank, and other accessories to remain
  - Includes new relief piping

Option 2 – High Performance Electrification

Demo Scope of Work:

- Includes removal and disposal of (1) 10-ton RTU
  - Assumes cut, cap and make safe gas piping from each RTU
- Includes removal and disposal of (1) 5-ton gas furnace
  - Assumes cut, cap and make safe gas piping from furnace
- Includes removal and disposal of (1) gas-fired domestic water heater
  - Includes removal of existing flues and patch and seal of roof
  - Assumes flues are accessible for demo, excludes demo/reinstalling of any shaft walls
  - Assumes cut, cap and make safe gas piping from unit

New Scope of Work:

- Includes new ground-source condenser water loop running through building
  - Includes borefield located beneath the driving range
  - Includes (8) new vertical bores
  - Includes new associated pumps, manifolds, and water treatment
- Includes (1) new 10-ton water-source RTU

- Assumes piping and valves to tie into new ground-source condenser water loop
- Includes (1) new 5-ton water-source heat pump
  - Assumes piping and valves to tie into new ground-source condenser water loop
- Includes (1) new 500 cfm ERV with heat wheel
  - Located in approximately same area as existing gas furnace
  - Includes new supply and exhaust ductwork to exterior
  - Includes roof penetrations for new ERV ductwork
  - Includes 2kW duct heater downstream of unit for additional capacity
- Includes (1) new 120 gallon, 45kW electric water heater
  - Assumes existing circulation pump, expansion tank, and other accessories to remain
  - Includes new relief piping

Mechanical General Inclusions, Clarifications, & Exclusions

- Includes allowance for crane/rigging
- Includes allowance for permits
- Includes allowance for carpentry
- Carrying Seattle labor rates
- Pricing in today's dollars
- Excludes temp HVAC and plumbing
- Excludes overtime work
- Excludes parking
- Excludes any new sound attenuation scope. Assumes ductwork and existing sound attenuation to remain.
- Excludes duct smoke detectors and wiring
- Excludes any heat tracing
- Excludes good faith survey
- Excludes demolishing gas distribution lines/piping back to meter
- Excludes condensate drain piping to roof drains. Assumes piping directly down onto roof.

Golf Maintenance - Mechanical Scope Narrative

Option 1 – Full Electrification

Demo Scope of Work:

- Includes removal and disposal of (1) gas furnace
  - Assumes cut, cap and make safe gas piping from furnace
- Includes removal and disposal of (1) gas-fired domestic water heater
  - Includes removal of existing flues and patch and seal of roof
  - Assumes flue is accessible for demo, excludes demo/reinstalling of any shaft walls
  - Assumes cut, cap and make safe gas piping from unit
- Includes removal of (1) gas infrared tube heater
  - Assumes cut, cap and make safe gas piping from unit

New Scope of Work:

- Includes (1) new 4-ton residential-style air-source heat pump
  - Located in basement in approximately same area as existing gas furnace
  - Includes auxiliary 10kW electric coil for 100% electric backup capabilities
- Includes (1) new 200 cfm ERV with heat wheel
  - Located in basement in approximately same area as existing gas furnace
  - Includes new supply and exhaust ductwork to exterior
  - Includes roof penetrations for new ERV ductwork
  - Includes 5kW duct heater downstream of unit for additional capacity
- Includes (1) new 40 gallon, 4.5kW hybrid heat pump/electric water heater
  - Assumes existing circulation pump, expansion tank, and other accessories to remain
- Includes (4) new 10kW electric unit heaters

Mechanical General Inclusions, Clarifications, & Exclusions

- Includes allowance for crane/rigging
- Includes allowance for permits
- Includes allowance for carpentry
- Carrying Seattle labor rates
- Pricing in today's dollars
- Excludes temp HVAC and plumbing
- Excludes overtime work
- Excludes parking
- Excludes any new sound attenuation scope. Assumes ductwork and existing sound attenuation to remain.
- Excludes duct smoke detectors and wiring
- Excludes any heat tracing
- Excludes good faith survey
- Excludes demolishing gas distribution lines/piping back to meter
- Excludes condensate drain piping to roof drains. Assumes piping directly down onto roof.

CURRENT GOLF CLUBHOUSE MECHANICAL DESIGN INCLUDES:
- (1) 10-TON GAS DX ROOFTOP UNIT
- (1) 5-TON GAS-FIRED FURNACE
- (1) GAS WATER HEATER

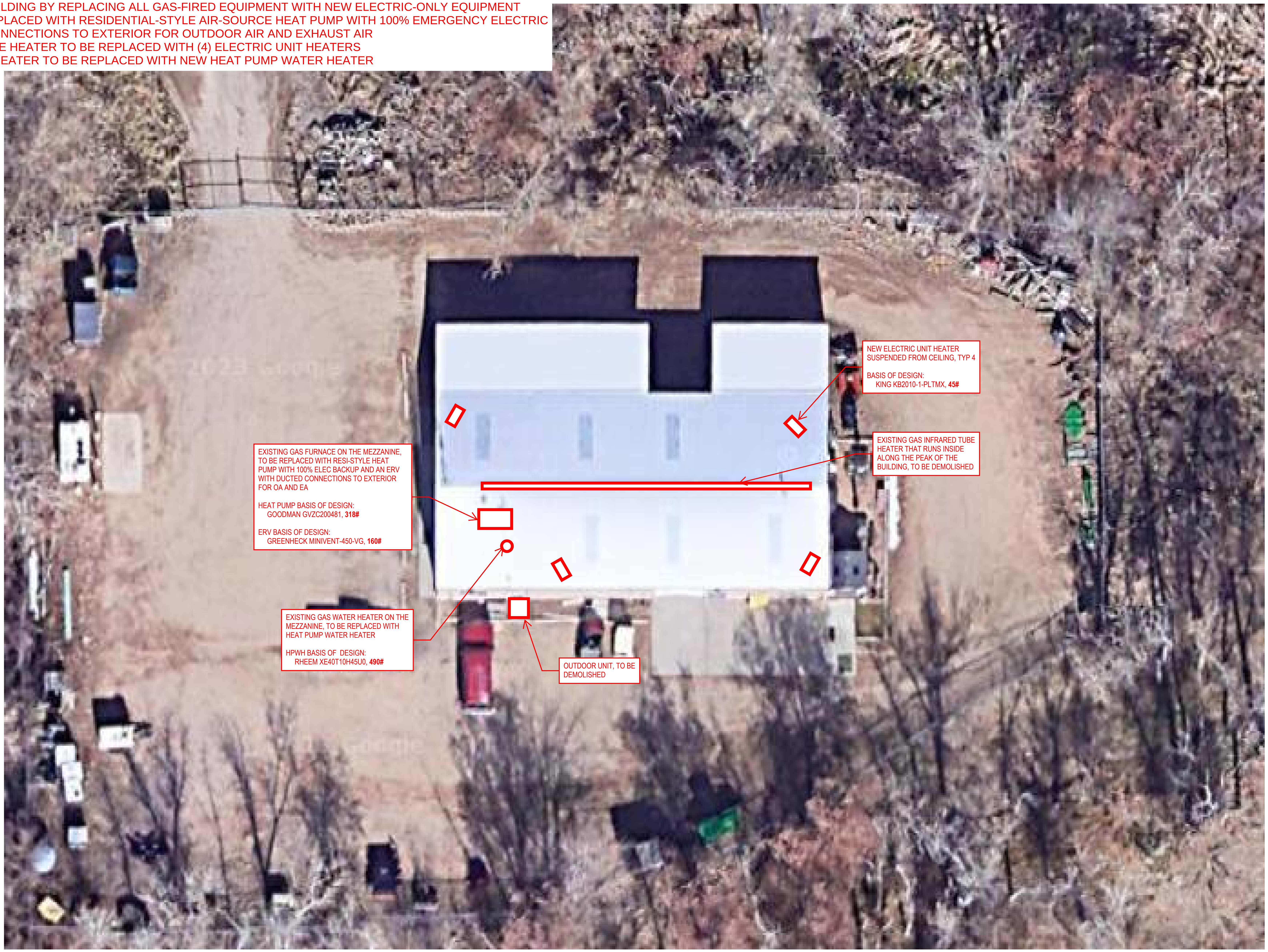
BASE REPLACEMENT OPTION:
- RTU REPLACED WITH PACKAGED HEAT PUMP RTU WITH HEAT RECOVERY WHEEL AND 100% ELECTRIC BACKUP
  - aRTU BASIS OF DESIGN:
    DAIKIN DPS007A
- GAS FURNACE REPLACED WITH NEW AIR-SOURCE HEAT PUMP AND ERV WITH ELECTRIC BACKUP AND NEW DUCTWORK FOR OA
  - ASHP BASIS OF DESIGN:
    GOODMAN GVZC200601
  - ERV BASIS OF DESIGN:
    GREENHECK MINIVENT-450-VG
- GAS WATER HEATER REPLACED WITH A NEW ELECTRIC WATER HEATER
  - EWH BASIS OF DESIGN:
    LOCHINVAR LCA120X45

ALT REPLACEMENT OPTION:
- GROUND-SOURCE CONDENSER WATER LOOP WITH 8 BOREHOLES BENEATH THE DRIVING RANGE FOR 16 TONS OF TOTAL CAPACITY. CONDENSER WATER ROUTED TO CLUBHOUSE. NEED DEDICATED SPACE FOR WATER TREATMENT AND PUMPS/MANIFOLDS
- 10-TON RTU REPLACED WITH 10-TON WATER-SOURCED RTU
  - wRTU BASIS OF DESIGN:
    CLIMATEMASTER TRE-120
- 5-TON GAS FURNACE REPLACED WITH 5-TON WATER-SOURCE HEAT PUMP
  - WSHP BASIS OF DESIGN:
    CLIMATEMASTER TC-096
  - ERV BASIS OF DESIGN:
    SAME AS BASE REPLACEMENT OPTION
- GAS WATER HEATER REPLACED WITH A NEW WATER-SOURCE HEAT PUMP WATER HEATER
  - EWH BASIS OF DESIGN:
    SAME AS BASE REPLACEMENT OPTION

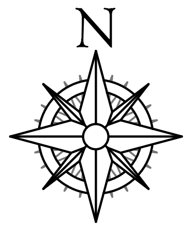
1 Site Plan
Scale: 1" = 10'-0"

LOUISVILLE GOLF MAINTENANCE - MECHANICAL PRICING DOCUMENT
BASE OPTION - FULL ELECTRIFICATION

NARRATIVE:
-FULL ELECTRIFICATION OF THE BUILDING BY REPLACING ALL GAS-FIRED EQUIPMENT WITH NEW ELECTRIC-ONLY EQUIPMENT
-EXISTING GAS FURNACE TO BE REPLACED WITH RESIDENTIAL-STYLE AIR-SOURCE HEAT PUMP WITH 100% EMERGENCY ELECTRIC REHEAT AND ERV WITH DUCTED CONNECTIONS TO EXTERIOR FOR OUTDOOR AIR AND EXHAUST AIR
-EXISTING GAS-FIRED RADIANT TUBE HEATER TO BE REPLACED WITH (4) ELECTRIC UNIT HEATERS
-EXISTING GAS DOMESTIC WATER HEATER TO BE REPLACED WITH NEW HEAT PUMP WATER HEATER



1 Main Floor Plan
Scale: NO SCALE



Appendix

1. Mechanical System Matrix Options
2. Mechanical Decarbonization Scoping
3. Electrical Decarbonization Scoping
4. Structural Scoping
5. Electric Vehicle Charging Narrative
6. Renewables Scoping
7. Cost Estimating

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Golf Clubhouse – Electrical Scope Narrative

Options 1 & 2 – Full Electrification & High Performance Electrification

- General: 600A 208V service to serve mechanical option 1 or 2 & kitchen electrification. Mechanical option 2 reduces load by about 80A, and will require the same service size and distribution system. Therefore, only a single system has been designed for estimating purposes.
- 30 Day Metering: None required. Utility data is sufficient.
- Electrical Demo:
  - Demolish existing meter base and CT enclosure
  - Demolish existing 200A and 400A service disconnect switches and feeders to panels (location unknown)
  - Demolish existing service conductors. Retain existing service conduit for future reuse.
  - Demolish existing EV service, retain existing EV charging station and circuit for reconnection. Retain service conduit, if suitable for reuse.
- Electrical New Work:
  - New utility transformer & secondary connection metering cabinet:
    - Provide pads for the transformer and SCC as required by Xcel Energy. The existing transformer pad should be sufficient for reuse. For details, refer to Xcel energy blue book.
    - Supply and install pad mount secondary connection /metering cabinet (SCC) per Xcel Energy specifications, rated for 600A. Install adjacent to transformer. For details, refer to Xcel energy blue book.

      Note: Utility provides conduit and conductors between transformer and SCC.
  - New PV supply side interconnect service equipment (adjacent to transformer, next to EV service)
    - Supply and install 600A NEMA 3R fused disconnect for PV interconnect, by others. Assume 10' of excavation and 20' of 600/4 (reduced neutral) feeder from the Secondary Connection Cabinet to the fused disconnect.
    - Install new grounding electrode.
  - New (replacement) EV service 200A 3P 208V:
    - Supply and install new 200A 3 phase 208V meter base and 200A MCB NEMA 3R load center (36kA) in location of old EV service equipment.
    - Install new 200/4 service conductors from transformer to new service equipment. Assume new conduit, however existing conduit may be reused).
    - Install new grounding electrode (may be common with PV disconnect grounding electrode).
  - New service equipment at Clubhouse:
    - Supply and install new 600A service entrance rated distribution panelboard, NEMA 3R, 36kA, with the following circuit breakers and feeders:
      - 400A/3P (existing panelboard). Assume 20' 400/4
      - 225A/3P (existing panelboard). Assume 50' 225/4

- 250A/3P (new kitchen panelboard). Assume 50’ 250/4
- 225A/3P (new mechanical panelboard). Assume 50’

- New service feeder to clubhouse:
  - Reuse existing (2) 2 ½” service conduits. Reroute existing conduits to Secondary Connection Cabinet and new service equipment.
  - Install new 600/4 service conductor (reduced neutral, 3#350, 1#250N).
  - Install new GEC and augment grounding electrode system for 600A service.
- New distribution in building:
  - Install new 250A Kitchen panelboard NEMA 1, 36kA, with the following circuits to kitchen equipment (assume all circuits 25’, neutral not required):
    - (1) 175A 3P (EWH)
    - (1) 80A 3P (induction range)
    - (1) 70A 3P (Griddle)
    - (1) 50A 3P (Fryer)
    - (2) 30A 3P (ovens)
  - Install new 225A Mechanical panelboard NEMA 3R, 36kA, with the following circuits to mechanical equipment (circuit lengths as indicated, assume neutral not required):
    - (1) 150A 3P (aRTU, assume 50’)
    - (1) 60A 3P (ASHP, assume 50’)
    - (1) 15A 3P (ERV heat, assume 30’)
    - (1) 15A 1P (ERV, assume 30’)

Level 2 EV Chargers and Supporting Infrastructure

- General: Installation of (2) dual port pedestal type EVSE’s.
- Electrical Demo: None required.
- Electrical New Work:
  - Level 2 Charging:
    - Provide (qty 5) 60/2 circuits from new EV service to location of new L2 EVSE’s (assume 40’)
    - Install (qty 2) L2 dual port 60A EVSE’s. Zefnet or approved equal.
    - Refeed existing L2 dual port EVSE.Electrical Exclusions

Electrical Exclusions

- Applicable sales, use and B&O tax
- Performance and Payment Bonds
- Utility company charges.
- Refurbishing existing lighting (cleaning, re-lamping, re-trimming, repair, restoration).
- Roof and building envelope penetrations, waterproofing.
- Moving, placing and (re)-calibrating owner equipment.
- Mechanical and plumbing control devices, including wiring, conduit, and components.
- Correcting existing code violations

- Hidden conditions.
- Removing, re-installing and replacing ceiling tiles.
- Opening and repairing walls and ceilings for electrical work.
- Patching and painting.
- Access panels.
- Temporary power and lighting
- Handling hazardous material including but not limited to asbestos, lead and PCB's.
- Overtime and shift premiums.
- Work stoppages, hindrances, multiple trim passes and out-of-sequence installation.
- Electrical engineering, calculations, drawings, peer review services.
- Structural and Seismic Engineering
- Material cost escalation.
- Plywood and specialty backing.
- Low voltage systems (telecom, CCTV, access control, audio visual, etc.).
- Any work not specifically included in this proposal.
- No thermostat relocations are included

Golf Maintenance - Electrical Scope Narrative

Option 1 – Full Electrification (600A 240V Service)

- General: Existing and added load requires 525A, of new single phase 240V service capacity, or 345A of new three phase service capacity. This requires an upgrade to 600A single phase 240V or 400A 3 phase 208V service.
- Electrical Demo:
    - Demolish existing meter base
    - Demolish main load center, 40 pole 200A NEMA 3R
        - Retain existing branch circuits and feeders for reconnection to new load center at this location
- Electrical New Work
    - Coordinate with utility to upgrade the service transformer as necessary. 112.5kVA anticipated.
    - Provide new 600A meter base.
    - Provide new 600A service conductors. (2 sets) 2 ½”- 2#350, 1#250N to utility transformer, or (1 set) 3 ½” - 4#400, 2#300.
        - Allow for 100’ of trenching (actual details unknown)
        - Allow for 20’ of concrete cutting and restoration.
    - Install new 2 section, 600A, 600A MCB NEMA 1R service panelboard at location of demolished load center.
        - Panel shall be loaded with breakers of varying sizes, including all existing (<50A) and the new equipment feeders as follows
            - (qty 6) 60A 2P
            - (qty 2) 30A 2P
            - (qty 21) 20A 2P
            - (qty 1) 20A 1P
            - (qty 10) assorted spares.
    - Allow for provision of new ground rods and GEC.
    - Refeed existing loads from new circuit breakers.
    - Provide new branch circuiting and equipment disconnects for HVAC equipment:
        - (qty 5) 60/2, allow for 50’
        - (qty 2) 30/2, allow for 50’
        - (qty 2) 20/2, allow for 30’
    - Provide new branch circuiting and duplex receptacles fed from a 2P multi wire branch circuit, as follows
        - (qty 20) 20/2, allow for 30’.

Option 2 – Full Electrification (400A 3P 208V Service)

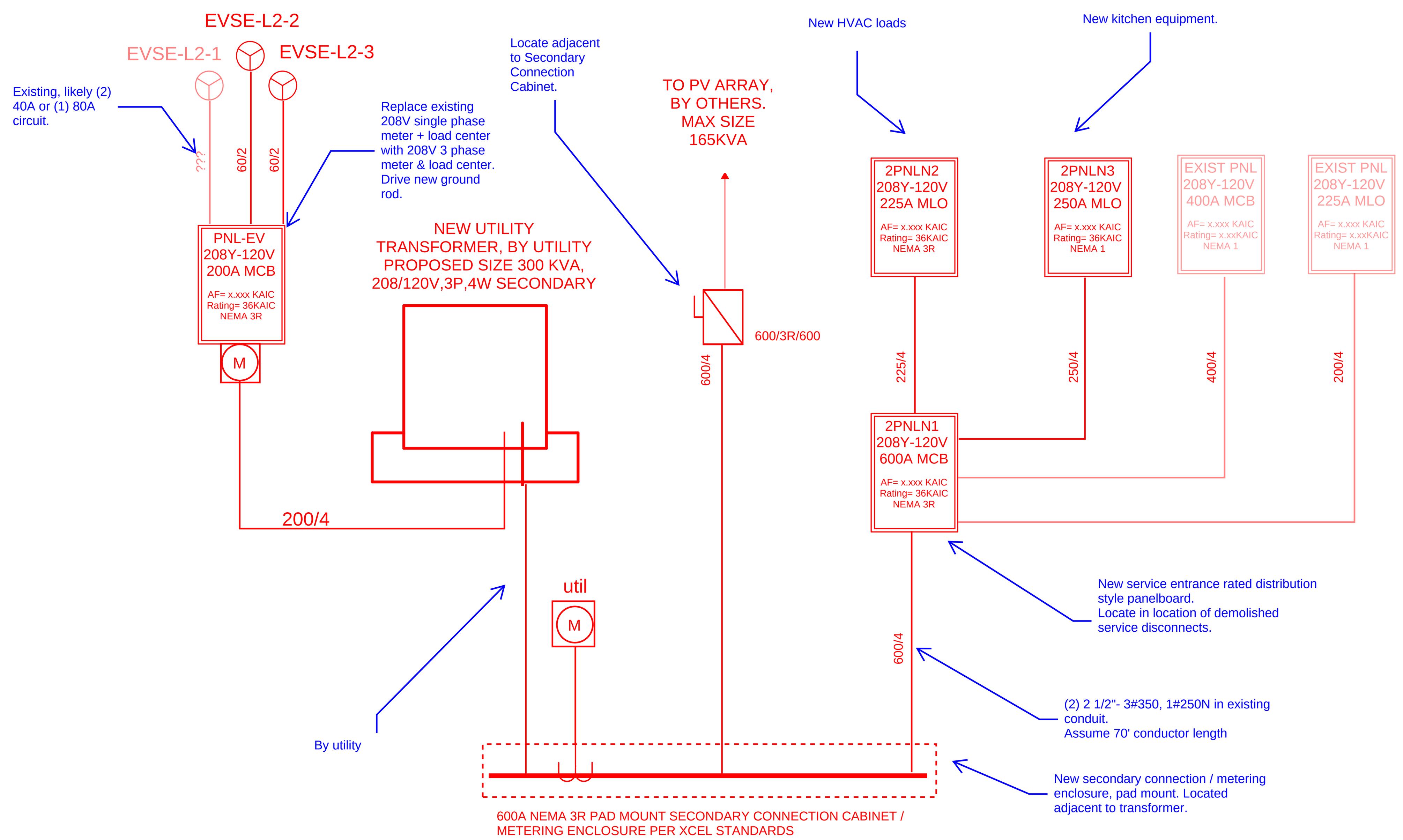
- General: Existing and added load requires 525A, of new single phase 240V service capacity, or 345A of new three phase service capacity. This requires an upgrade to 600A single phase 240V or 400A 3 phase 208V service.
- Electrical Demo:
  - Demolish existing meter base
  - Demolish main load center, 40 pole 200A NEMA 3R
    - Retain existing branch circuits and feeders for reconnection to new load center at this location
- Electrical New Work
  - Coordinate with the utility to supply 3 phase 208V transformer. 112.5kVA anticipated.
  - Provide new 400A meter base.
  - Provide new 400A service conductors to utility transformer:
    - (1 set) 3 ½"- 3#600, 1#400N, or
    - (2 sets) 2" – 3#3/0, 1#1/0
    - Allow for 100' of trenching (actual details unknown)
    - Allow for 20' of concrete cutting and restoration.
  - Install new 2 section 400A MCB NEMA 1R service panelboard at location of demolished loadcenter.
    - Panel shall be loaded with breakers of varying sizes, including all existing (<50A) and the new equipment feeders as follows
      - (qty 1) 60A 2P
      - (qty 5) 40A 3P
      - (qty 2) 30A 2P
      - (qty 14) 20A 3P
      - (qty 1) 20A 2P
      - (qty 1) 20A 1P
      - (qty 10) assorted spares.
  - Allow for provision of new ground rods and GEC.
  - Refeed existing loads from new circuit breakers.
  - Provide new branch circuiting and equipment disconnects for HVAC equipment:
    - (qty 5) 40/3, allow for 50'
    - (qty 2) 30/2, allow for 50'
    - (qty 2) 20/2, allow for 30'
  - Provide new branch circuiting and (2) duplex receptacles fed from a 3P multi wire branch circuit, as follows
    - (qty 14) 20/3, allow for 30'.

Level 2 EV Chargers and Supporting Infrastructure

- General: Installation of (1) level 2 dual port pedestal type EVSE.
- Electrical Demo: None required.
- Electrical New Work:
    - Level 2 Charging:
        - Provide (qty 1) 60/2 circuits from new EV service to location of new L2 EVSE

Electrical Exclusions

- Applicable sales, use and B&O tax
- Performance and Payment Bonds
- Utility company charges.
- Refurbishing existing lighting (cleaning, re-lamping, re-trimming, repair, restoration).
- Roof and building envelope penetrations, waterproofing.
- Moving, placing and (re)-calibrating owner equipment.
- Mechanical and plumbing control devices, including wiring, conduit, and components.
- Correcting existing code violations
- Hidden conditions.
- Removing, re-installing and replacing ceiling tiles.
- Opening and repairing walls and ceilings for electrical work.
- Patching and painting.
- Access panels.
- Temporary power and lighting
- Handling hazardous material including but not limited to asbestos, lead and PCB's.
- Overtime and shift premiums.
- Work stoppages, hindrances, multiple trim passes and out-of-sequence installation.
- Electrical engineering, calculations, drawings, peer review services.
- Structural and Seismic Engineering
- Material cost escalation.
- Plywood and specialty backing.
- Low voltage systems (telecom, CCTV, access control, audio visual, etc.).
- Any work not specifically included in this proposal.
- No thermostat relocations are included



KITCHEN + MECHANICAL 600A 208V OPTION

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MCKINSTRY CO.

SEATTLE:
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SEATTLE, WA 98134
206-762-3311

www.mckinstry.com

PROJECT:

Louisville

PROJECT ADDRESS

CONSULTANTS:

REGISTRATION:

ISSUES:

NO	DATE	DESCRIPTION

DESIGNED: NJE
DRAWN:
CHECKED:
JOB NO:

SHEET TITLE:

Golf Clubhouse one-line

SHEET NUMBER:

ESK

City of Louisville
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Appendix

1. Mechanical System Matrix Options
2. Mechanical Decarbonization Scoping
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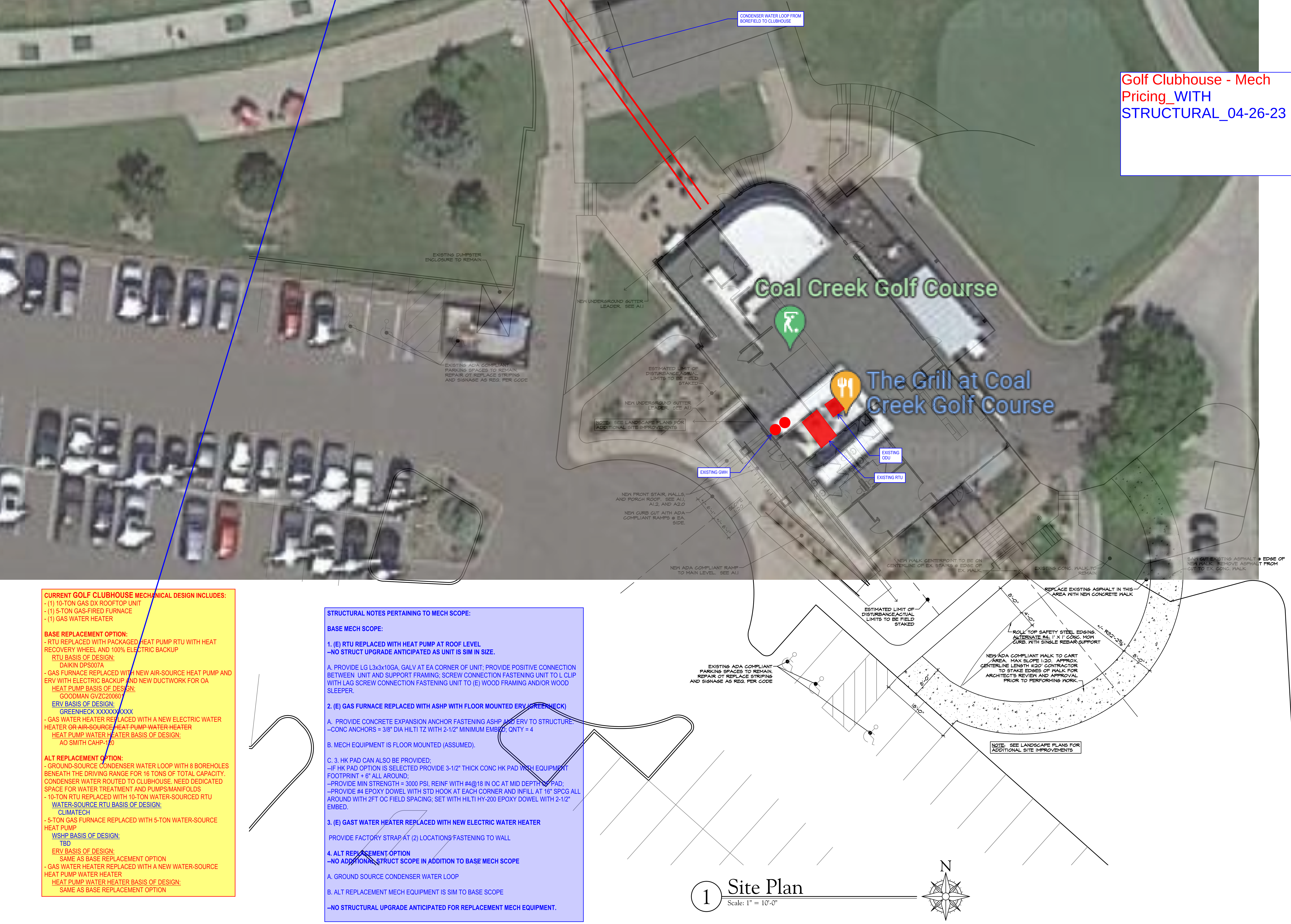
Golf Clubhouse - Mech Pricing_WITH STRUCTURAL_04-26-23



1 Site Plan
Scale: 1" = 10'-0"

CURRENT GOLF CLUBHOUSE MECHANICAL DESIGN INCLUDES:
- (1) 10-TON GAS DX ROOFTOP UNIT
- (1) 5-TON GAS-FIRED FURNACE
- (1) GAS WATER HEATER

BASE REPLACEMENT OPTION:
- RTU REPLACED WITH PACKAGED HEAT PUMP RTU WITH HEAT RECOVERY WHEEL AND 100% ELECTRIC BACKUP
  RTU BASIS OF DESIGN:
  DAIKIN DPS007A
- GAS FURNACE REPLACED WITH NEW AIR-SOURCE HEAT PUMP AND ERV WITH ELECTRIC BACKUP AND NEW DUCTWORK FOR OA
  HEAT PUMP BASIS OF DESIGN:
  GOODMAN GVZC200601
  ERV BASIS OF DESIGN:
  GREENHECK XXXXXXXXXX
- GAS WATER HEATER REPLACED WITH A NEW ELECTRIC WATER HEATER ~~OR AIR-SOURCE HEAT PUMP WATER HEATER~~
  HEAT PUMP WATER HEATER BASIS OF DESIGN:
  AO SMITH CAHP-120

ALT REPLACEMENT OPTION:
- GROUND-SOURCE CONDENSER WATER LOOP WITH 8 BOREHOLES BENEATH THE DRIVING RANGE FOR 16 TONS OF TOTAL CAPACITY. CONDENSER WATER ROUTED TO CLUBHOUSE. NEED DEDICATED SPACE FOR WATER TREATMENT AND PUMPS/MANIFOLDS
- 10-TON RTU REPLACED WITH 10-TON WATER-SOURCED RTU
  WATER-SOURCE RTU BASIS OF DESIGN:
  CLIMATECH
- 5-TON GAS FURNACE REPLACED WITH 5-TON WATER-SOURCE HEAT PUMP
  WSHP BASIS OF DESIGN:
  TBD
  ERV BASIS OF DESIGN:
  SAME AS BASE REPLACEMENT OPTION
- GAS WATER HEATER REPLACED WITH A NEW WATER-SOURCE HEAT PUMP WATER HEATER
  HEAT PUMP WATER HEATER BASIS OF DESIGN:
  SAME AS BASE REPLACEMENT OPTION

STRUCTURAL NOTES PERTAINING TO MECH SCOPE:

BASE MECH SCOPE:

1. (E) RTU REPLACED WITH HEAT PUMP AT ROOF LEVEL
--NO STRUCT UPGRADE ANTICIPATED AS UNIT IS SIM IN SIZE.

A. PROVIDE LG L3x3x10GA, GALV AT EA CORNER OF UNIT; PROVIDE POSITIVE CONNECTION BETWEEN UNIT AND SUPPORT FRAMING; SCREW CONNECTION FASTENING UNIT TO L CLIP WITH LAG SCREW CONNECTION FASTENING UNIT TO (E) WOOD FRAMING AND/OR WOOD SLEEPER.

2. (E) GAS FURNACE REPLACED WITH ASHP WITH FLOOR MOUNTED ERV (GREENHECK)

A. PROVIDE CONCRETE EXPANSION ANCHOR FASTENING ASHP AND ERV TO STRUCTURE.
--CONC ANCHORS = 3/8" DIA HILTI TZ WITH 2-1/2" MINIMUM EMBED; QNTY = 4

B. MECH EQUIPMENT IS FLOOR MOUNTED (ASSUMED).

C. 3. HK PAD CAN ALSO BE PROVIDED;
--IF HK PAD OPTION IS SELECTED PROVIDE 3-1/2" THICK CONC HK PAD WITH EQUIPMENT FOOTPRINT + 6" ALL AROUND;
--PROVIDE MIN STRENGTH = 3000 PSI, REINF WITH #4@18 IN OC AT MID DEPTH OF PAD;
--PROVIDE #4 EPOXY DOWEL WITH STD HOOK AT EACH CORNER AND INFILL AT 16" SPCG ALL AROUND WITH 2FT OC FIELD SPACING; SET WITH HILTI HY-200 EPOXY DOWEL WITH 2-1/2" EMBED.

3. (E) GAST WATER HEATER REPLACED WITH NEW ELECTRIC WATER HEATER

PROVIDE FACTORY STRAP AT (2) LOCATIONS FASTENING TO WALL

4. ALT REPLACEMENT OPTION
--NO ADDITIONAL STRUCT SCOPE IN ADDITION TO BASE MECH SCOPE

A. GROUND SOURCE CONDENSER WATER LOOP

B. ALT REPLACEMENT MECH EQUIPMENT IS SIM TO BASE SCOPE

--NO STRUCTURAL UPGRADE ANTICIPATED FOR REPLACEMENT MECH EQUIPMENT.

LOUISVILLE GOLF MAINTENANCE MECHANICAL PRICING DOCUMENT WITH STRUCTURAL_04-26-23

CURRENT GOLF MAINTENANCE MECHANICAL DESIGN INCLUDES:
- (1) GAS FURNACE
- (1) GAS-FIRED RADIANT TUBE HEATERS
- GAS WATER HEATER

BASE REPLACEMENT OPTION:
- REPLACE GAS FURNACE WITH RESIDENTIAL-STYLE AIR-SOURCE HEAT PUMP WITH 100% EMERGENCY ELECTRIC REHEAT AND ERV WITH DUCTED CONNECTIONS TO EXTERIOR FOR OUTDOOR AIR AND EXHAUST AIR
  - HEAT PUMP BASIS OF DESIGN:
    - GOODMAN GVZC200481, **318#**
  - ERV BASIS OF DESIGN:
    - GREENHECK MINIVENT-450-VG
- REPLACE GAS RADIANT HEATER WITH (4) NEW SUSPENDED ELECTRIC UNIT HEATERS, (1) IN EACH CORNER
  - ELECTRIC UNIT HEATER BASIS OF DESIGN:
    - KING KB2010-1-PLTMX, **45#** [QTY: 4]
- REPLACE GAS WATER HEATER WITH HEAT PUMP WATER HEATER
  - HEAT PUMP WATER HEATER BASIS OF DESIGN:
    - RHEEM XE40T10H45U0, **490#**

STRUCTURAL NOTES PERTAINING TO MECH SCOPE:

BASE MECH SCOPE:

1. (E) GAS FURNACE REPLACED WITH RESIDENTIAL STYLE ASHP AND ERV AT MEZZANINE LEVEL
--NO STRUCT UPGRADE ANTICIPATED AS UNIT IS SIM IN SIZE.

A. PROVIDE POSITIVE LAG BOLT CONNECTION AT HP AND ERV, FASTENING EQUIPMENT BASE TO UNDERLYING WOOD FRAMING (ASSUMED); FOR CONNECTION, PROVIDE 1/4"DIA x 2-1/2 LAG BOLT (SIMPSON SDS SCREW OR EQUIVALENT).

2. (E) GAS RADIANT HEATER REPLACED WITH SUSPENDED ELECT UNIT HEATERS, TYP AT (4) LOCATIONS.

--NO STRUCT UPGRADE ANTICIPATED AS SUSPENDED UNITS WEIGH < 400#.

A. PROVIDE CABLE BRACED CONNECTION PER DET 7;
B. CABLES CONFIGURED FOR MAINTENANCE ACCESS.CONCRETE EXPANSION ANCHOR
C. FOR PRICING, ESTIMATE THE FOLLOWING:
--ATR = 1/4 AT EA CORNER, QNTY = 4
--SAMMY'S ROD HANGER 1/4" DIA X 2" THREAD, QNTY = 8 AT WOOD FRAMING
--CABLE = GRIPPLE GS-10, TYP AT EA CORNER, QNTY = 4
D. SUPPORT FRAMING ASSUMED TO BE WOOD FRAMING.

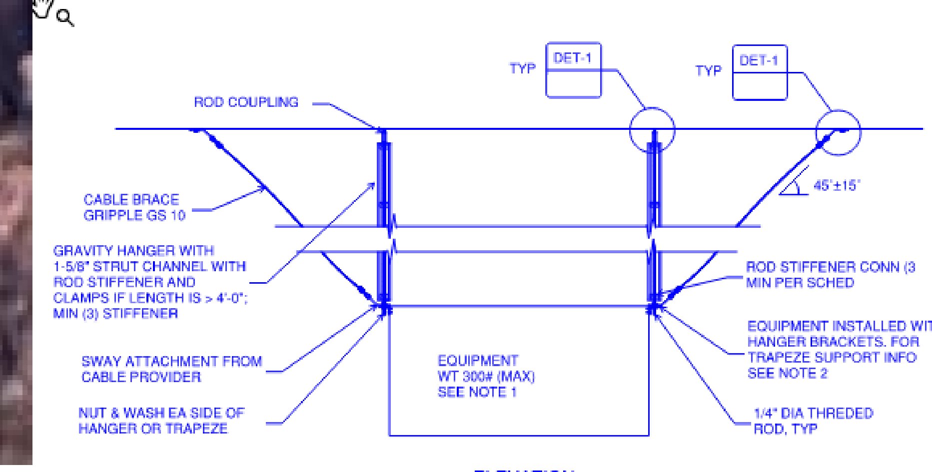
3. (E) GAST WATER HEATER REPLACED WITH NEW HEAT PUMP WATER HEATER AT MEZZANINE LEVEL

--NO STRUCT UPGRADE ANTICIPATED AT MEZZ IS ANTICPATED

A. PROVIDE FACTORY STRAP AT (2) LOCATIONS FASTENING TO WALL

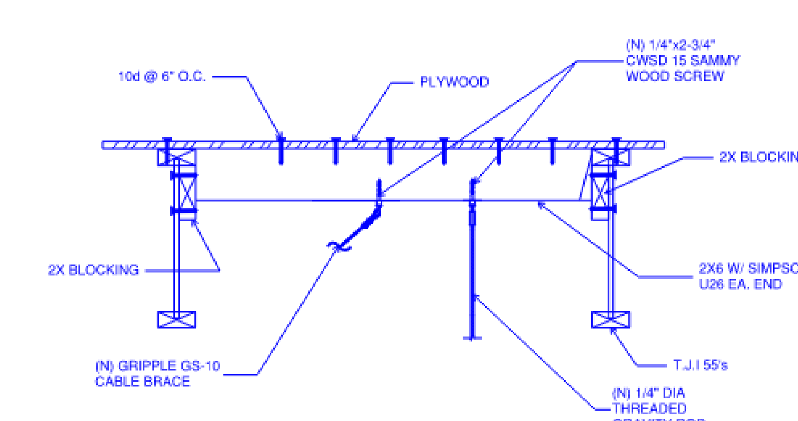
1 Main Floor Plan
Scale: NO SCALE

N



ELEVATION

NOTES:
1. MAX WT 300# FOR RIGID AND 200# FOR SPRING-ISSOLATED MECH EQUIPMENT.
2. IF EQUIPMENT LACKS HANGER BRACKETS, INSTALL P1000 STRUT TOP AND BOT AND ATTACH WITH #10 TEK @ 12" OC.
3. PROVIDE CABLE AT EACH CORNER OF UNIT WITH HORIZONTAL ANGLE SET TO 45°±15°
4. IF AIRCRAFT CABLE IS USED IN LIEU OF GRIPPLE, PROVIDE THIMBLE AT AT DOUBLE SWAGE OR DOUBLE CABLE CLAMP (TYP).



DET-1 CONN DETAIL @ MEB-1

7 SUSPENDED EQUIPMENT SEISMIC DETAILS
SCALE: NTS

Appendix

1. Mechanical System Matrix Options
2. Mechanical Decarbonization Scoping
3. Electrical Decarbonization Scoping
4. Structural Scoping
5. Electric Vehicle Charging Narrative
6. Renewables Scoping
7. Cost Estimating

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City of Louisville
Golf
Electric Vehicle Charging Narrative

Electric Vehicle Charging Narrative

Electric Vehicle Charging Narrative

Fleet or EV Charging

As part of the decarbonization study, the fleet vehicles were analyzed for replacement with EV equivalents. In addition, building electrical capacities were reviewed to determine if they have enough capacity to charge the fleet vehicles and if any electrical upgrades may be needed to the buildings.

EV Fleet Conversion

Based on current technology, transitioning from internal combustion engine (ICE) vehicles to EVs can substantially lower overall carbon emissions. A caveat to consider in assessing the environmental impact of EVs is the variation of electricity generation sources in a given area. The state of Colorado relies mainly on coal and natural gas. However, the share of these fuel sources as a percentage of total generation is decreasing. Alternative energy sources such as wind and solar are increasing rapidly. By using additional onsite renewable energy sources and phasing in vehicle replacement it will be possible for Louisville's fleet to be entirely carbon free.

In the current vehicle market mainly light duty vehicles are being produced. The battery technology is still being developed for heavy-duty vehicles. The market is rapidly changing so over the course of the next 5 years new innovation should allow heavy duty vehicles to be carbon free through either advanced battery technology or other yet to be determined technology.

EVs typically have a higher initial capital cost to purchase or lease when compared to ICE vehicles, EVs can cost less in the long-term due to lower fuel costs, different maintenance requirements, and longer vehicle lives. Therefore, it is important to consider the entire lifespan of a vehicle when investing in fleet vehicles. There are also limiting factors of EVs to consider, such as range and power needs of certain fleet vehicles, as well as the near-constant changes in the electric vehicle and infrastructure technology.

Charging Infrastructure

When planning for EV charging infrastructure, it is recommended to proactively plan for the number of charging stations needed by installing more electrical equipment (e.g. transformers and conduits) than is needed for the initial purchase of EVs. It is more cost effective to install excess electrical equipment during the initial installation than having to add electrical wires each time additional stations are required. This electrical equipment installation does not include purchasing all the charging stations that can fit with that equipment, but instead having the electrical capacity to purchase charging stations to meet future capacity needs without additional construction. The city has already thought about this and this report is the result of that forward thinking.

While there are three levels of EV charging infrastructure currently available, Level 2 charging is currently the most prevalent among them and requires electrical infrastructure upgrades to extend 240 volt AC service to locations where the EVs would charge. It charges at over twice the rate of level 1, adding 12 to 80 miles of range per hour charging. Level 3 charges are also becoming more common and can add from 80 to 500 miles of range per hour. Level 3 charging typically requires a 480 volt AC service. The level 2 and 3 chargers with the increased rate of charging can justify the costs to serve the needs of fleet management in a timely manner. Costs per unit can vary within these ranges depending on the installation and labor costs, warranties for equipment, and operation and maintenance costs for the equipment. Level 2 chargers provide good value for infrastructure investment when factoring in cost and time required to charge when compared to Level 3 chargers. Level 3 chargers can make sense when high use vehicles need quick recharging, though these chargers will cost more to install and incur a higher charging cost than level 2 chargers.

Electric Vehicle Charging Narrative

For the public chargers the City may want to consider charging a some type of fee for usage. Many charging stations charge a usage fee at some dollar per kWh of charging. This can help offset the peak demand that may be incurred by the city. Another option is to charge an idle fee. This type of fee encourages people not to leave there vehicle plugged in for long period of times once the vehicle has reached full charge.

Another consideration for charging infrastructure is the daily charging schedule. Most of the buildings reviewed for this study are on a secondary general rate schedule. This rate schedule does not have time of use rates for electrical consumption or peak demand. This means depending on when and how many vehicles charge relative to the buildings peak demand, it may increase the demand charges the city pays. Xcel Energy does offer a EV charging rate plan that incentivize the intentional reduction of electricity use during peak energy demand periods, such as during hot summer days. This rate plane does require a separate service for just the charging stations. Planning for fleet recharging during off-peak periods can add up to thousands of dollars in savings.

Battery capacity

Battery technology is changing rapidly, resulting in increased charge capacity and lower operating cost per mile. Many manufactures now offer eight year/100,000 mile warranties on their EV batteries (generally covering defects and workmanship), and some offers an eight year/100,000 mile warranty on battery capacity. Auto manufacturer warranties and charge capacity have generally reduced consumer concern about battery life and range. As a result, the analysis of total ownership cost does not account for the cost of EV battery replacement, assuming that municipal vehicles will be retired at the warranty expiration.

Golf Course and Golf Maintenance

Only one City fleet vehicle is kept at the golf maintenance facility for snow plowing. No fleet vehicles are stored at the golf course.

Department	Make	Model	Total
Parks	Chevy	Silverado	1

We recommend installing 2 public-facing dual head chargers at the clubhouse. The clubhouse already has 1 level 2 public charger.

Existing Public charging stations	Existing Public Charger Level	Quantity of New Level 2 Public Charger	Quantity of New Level 3 Public Charger	Quantity of New Level 2 Fleet Charger	Quantity of New Level 3 fleet Charger
1	2	2	0	0	0

The quantity of public chargers selected for this site was based on the remaining parking spots near the existing charger and proximity to the electrical services. More or less spots could installed or located in other areas but this will affect the cost.

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City of Louisville Decarbonization Study

Louisville Golf Course

RENEWABLES SUPPORTING ANALYSIS

LOUISVILLE, CO

AUGUST 18, 2023

Together Building a Thriving Planet

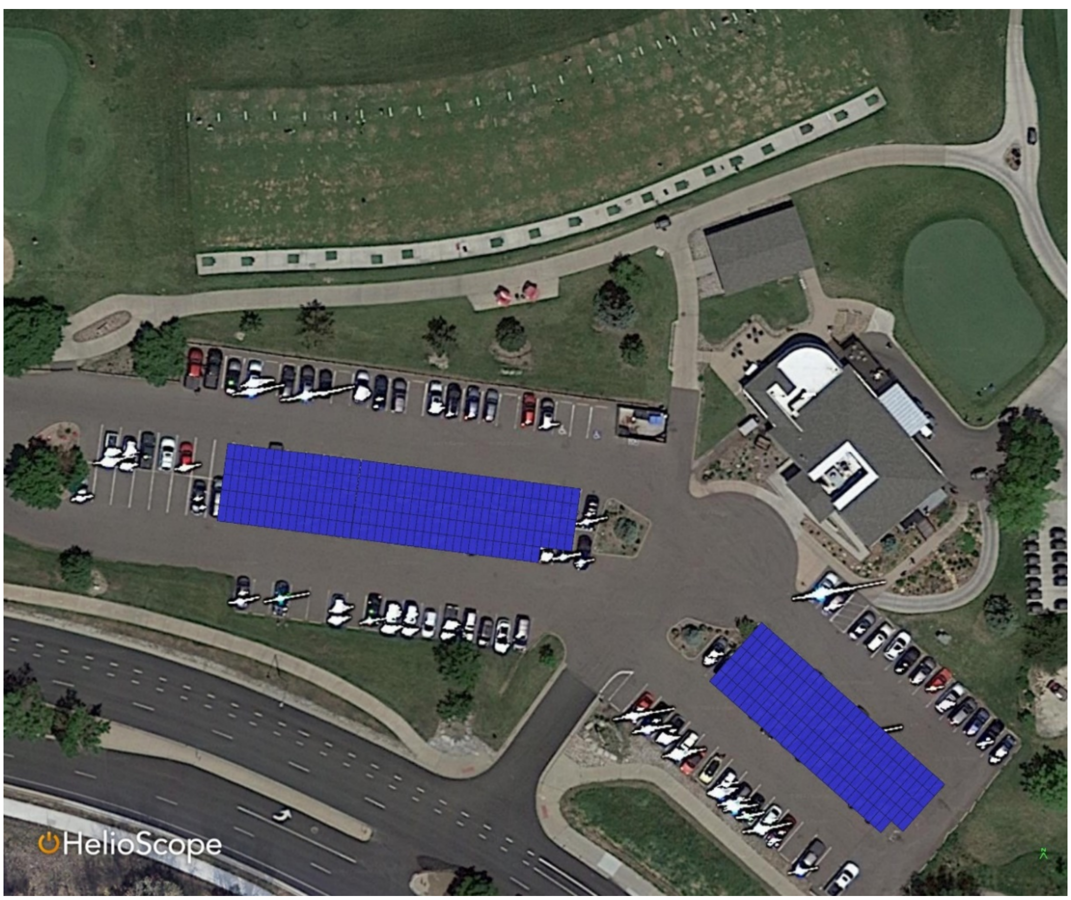
Louisville Golf Course

The Louisville Golf Course is a great candidate for a carport mounted solar PV system. At this site, roof and ground space is limited but the parking lot would allow for a large array affixed to a canopy providing the added benefit of shaded parking for patrons to this facility. The economics of the utility savings makes the system advantageous to the City of Louisville's Decarbonization Plan. The overarching benefit is a 50+ year shade structure that is paid for within the solar lifetime.

1. Proposed Solar PV System Overview

Below is a high-level summary of the proposed system specifications. Please note, specific equipment manufacturers and models may change depending on availability and market conditions at the time of construction.

SITE NAME	SITE ADDRESS	SIZE (KW-DC)	SIZE (KW-AC)	SYSTEM TYPE	YEAR 1 PRODUCTION (kWh)
Louisville Golf Course	585 W Dillon Rd, Louisville, CO 80027	201.96	156	Carport	301,936



Louisville Golf Course

LOUISVILLE GOLF COURSE EQUIPMENT AND QUANTITY SUMMARY

QUANTITY	EQUIPMENT DESCRIPTION
374	JA Solar, JAM72D30-540 (540W) – Bifacial Mono PERC Half Cell Double Glass Modules
2	CPS SCA60KTL-DO/US-480 - Inverters
1	CPS SCA36KTL-DO/US-480 - Inverters
1	Solar Carport
1	AlsoEnergy Data Acquisition System (DAS) Package – PLCS400
1	Electrical Balance ofSystems Package

AlsoEnergy Data Acquisition System (DAS) includes the equipment/functionality listed below.

- NEMA 4 Enclosure and Data Logger
- Cellular modem
- CT Based Revenue Grade Meter
- Inverter Direct Monitoring
- 5-year service plan
- A Meteorological Station consisting of the following:
    - Cell Temp Sensor
    - Pyranometer
- Publicly accessible web-based dashboard functionality

The Electrical Balance of Systems Package includes all components to create an electrically complete solar PV carport installation. This includes grounding materials, wiring, conduit, MCT, panelboards/combiners, switchgear, fuses, and disconnects.

2. Production Modeling

Array layouts and system production are modeled in Helioscope, an industry-standard design and energy modeling software package with 3-dimensional modeling capabilities. Through Helioscope, we can incorporate site-specific characteristics of buildings and shade producing obstructions to determine their impacts upon system layout and production. McKinstry further applies our knowledge of codes and regulations, industry best practices, and professional judgment to ensure that designs are code-compliant and strike a balance across customer preferences, production, constructability, and price concerns.

Helioscope provides robust PV system output modeling capabilities. We use these in conjunction with Typical Meteorological Year (TMY) weather datasets, real-world equipment specifications, proprietary 3rd-party-engineered dust and snow soiling models, and professional judgment to determine a system's annual kWh production. For City of Louisville, we are using the TMY, DENVER INTL AP, NSRDB (tmy3,I) weather data set and soiling conditions from the DNV-GL NOAA Lafayette station. Annual production is estimated at 301,936kWh. Full Helioscope report below.

Louisville Golf Course

HelioScope

Annual Production Report produced by Mountain Bryan H

Cohort 3 - Coal Creek Golf Course Canopy City of Louisville, 951 Spruce St, Louisville, CO 80027

Report

Project Name	City of Louisville
Project Address	951 Spruce St, Louisville, CO 80027
Prepared By	Mountain Bryan H bryanh@mckinstry.com

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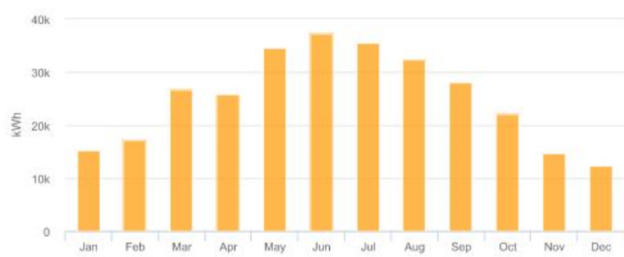
System Metrics

Design	Cohort 3 - Coal Creek Golf Course Canopy
Module DC Nameplate	202.0 kW
Inverter AC Nameplate	156.0 kW Load Ratio: 1.29
Annual Production	301.9 MWh
Performance Ratio	86.0%
kWh/kWp	1,495.0
Weather Dataset	TMY, DENVER INTL AP, NSRDB (tmy3, I)
Simulator Version	f1afba56bc-0d48734f56-22c03a577b-429aea41ae

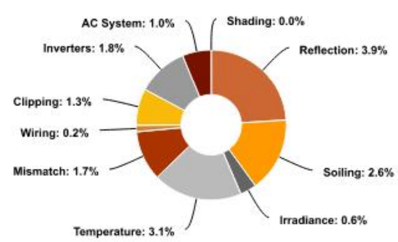
Project Location

Monthly Production



Month	GHI (kWh/m²)	POA (kWh/m²)	Shaded (kWh/m²)	Nameplate (kWh)	Grid (kWh)
January	77.6	87.3	87.3	15,742.1	15,313.1
February	88.7	96.2	96.2	17,581.2	17,087.9
March	144.4	152.0	152.0	28,409.2	26,780.9
April	143.6	147.1	147.1	27,847.9	25,749.9
May	196.1	198.4	198.4	38,884.5	34,578.7
June	218.0	219.0	219.0	43,514.9	37,294.0
July	208.2	209.1	209.1	41,039.6	35,607.5
August	185.7	189.3	189.3	37,113.4	32,484.4
September	155.3	161.9	161.9	31,233.5	28,004.5
October	114.2	123.0	123.0	23,571.2	22,021.0
November	73.9	82.0	82.0	15,156.1	14,631.2
December	64.4	73.0	73.0	12,845.8	12,382.8

Sources of System Loss



Louisville Golf Course

HelioScope

Annual Production Report produced by Mountain Bryan H

Annual Production

	Description	Output	% Delta
Irradiance (kWh/m²)	Annual Global Horizontal Irradiance	1,670.2	
	POA Irradiance	1,738.4	4.1%
	Shaded Irradiance	1,738.4	0.0%
	Irradiance after Reflection	1,671.2	-3.9%
	Irradiance after Soiling	1,628.0	-2.6%
	Total Collector Irradiance	**1,628.0**	**0.0%**
Energy (kWh)	Nameplate	332,939.4	
	Output at Irradiance Levels	331,039.6	-0.6%
	Output at Cell Temperature Derate	320,761.1	-3.1%
	Output After Mismatch	315,206.3	-1.7%
	Optimal DC Output	314,497.3	-0.2%
	Constrained DC Output	310,493.1	-1.3%
	Inverter Output	304,985.6	-1.8%
	Energy to Grid	**301,935.7**	**-1.0%**
Temperature Metrics			
	Avg. Operating Ambient Temp		15.0 °C
	Avg. Operating Cell Temp		23.8 °C
Simulation Metrics			
		Operating Hours	4513
		Solved Hours	4513

Condition Set

Description	Carport 5 degrees
Weather Dataset	TMY, DENVER INTL AP, NSRDB (tmy3, I)
Solar Angle Location	Project Lat/Lng
Transposition Model	Perez Model
Temperature Model	Diffusion Model

Temperature Model Parameters

Rack Type	U_{const}	U_{wind}
Fixed Tilt	29	0
Flush Mount	15	0
East-West	29	0
Carport	29	0

Soiling (%)

J	F	M	A	M	J	J	A	S	O	N	D
6	6	5	4	1	0	1	1	2	2	4	8

Irradiation Variance	3.5%
Cell Temperature Spread	3° C
Module Binning Range	0% to 2.5%
AC System Derate	1.00%

Trackers

Maximum Angle	Backtracking
60°	Enabled

Module Characterizations

Module	Uploaded By	Characterization
JAM72D30-540/MB (JA Solar)	HelioScope	Spec Sheet Characterization, PAN

Component Characterizations

Device	Uploaded By	Characterization
CPS SCA60KTL-DO/480 (Chint)	HelioScope	Spec Sheet
CPS SCA36KTL-DO/US-480 (2023) (CPS)	HelioScope	Spec Sheet

Components

Component	Name	Count
Inverters	CPS SCA60KTL-DO/480 (Chint)	2 (120.0 kW)
Inverters	CPS SCA36KTL-DO/US-480 (2023) (CPS)	1 (36.0 kW)
Strings	10 AWG (Copper)	22 (1,749.7 ft)
Module	JA Solar, JAM72D30-540/MB (540W)	374 (202.0 kW)

Wiring Zones

Description	Combiner Poles	String Size	Stringing Strategy
Wiring Zone	-	16-17	Along Racking
Wiring Zone 2	-	17-17	Along Racking
Wiring Zone 3	-	17-17	Along Racking

Field Segments

Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
Field Segment 3	Carport	Portrait (Vertical)	5°	187.44586°	0.0 ft	1x1	136	136	73.4 kW
Field Segment 3 (copy)	Carport	Portrait (Vertical)	5°	221.46564°	0.0 ft	1x1	153	153	82.6 kW
Field Segment 3 (copy 1)	Carport	Portrait (Vertical)	5°	187.44586°	0.0 ft	1x1	85	85	45.9 kW

 2 / 3 June 26, 2023

3. Annual Utility Savings and Value of Solar Energy

To analyze utility bill savings, we utilize Energy Toolbase, an industry-standard bill modeling software package. Energy Toolbase estimates bill savings based upon a site's electric load characteristics, PV system production (imported from Helioscope or other sources), and local utility tariffs and net metering polices. Xcel Energy tariffs and Net Metering tariff adjustments used in this analysis are:

- Secondary General (SG)
- Secondary Photovoltaic Time-of-Use (SPVTOU)
- Net Metering Service (Schedule NM)

To properly calculate the annual utility savings associated with the solar PV, we need to analyze the building load after all electrification and carbon reduction measures are implemented. As noted in the Summary Report, there are three bundles of measures – Bundle 1 (Full Electrification), Bundle 2 (High Performance Electrification). For this site we've included a Bundle 3 (Existing Conditions) to show the value of the solar system pre-electrification measures. Each create a slightly different building load baseline. Therefore, all scenarios are listed below. Baseline utility year is 2019 and the assumed DOE building profile is Standalone Retail which models a 7 day a week daytime usage more closely representing the hours of the Golf Clubhouse meter.

OPTION 1 – CARPORT MOUNT ONLY ESTIMATE WITH SPVTOU RATE SWITCH

SCENARIO	ANNUAL SAVINGS	ENERGY SAVINGS	DEMAND SAVINGS
Bundle 1	$24,899	$15,138	$9,761
Bundle 2	$21,590	$14,069	$7,521
Bundle 3	$20,360	$13,198	$7,162

All Bundles are modeled with a rate switch to SPVTOU. To qualify for a rate switch to SPVTOU, the building must have a minimum 30% load factor for the trailing 12 months and less than 500kW service demand. The average existing load factor for this site is above 50%, and the service demand is below 500kW.

4. System Price and Financial Results

There are two main avenues City of Louisville can choose to finance these projects – cash purchase or tax-exempt lease purchase (TELP). As a tax-exempt entity, City of Louisville is eligible for direct pay in Year 1 at Energy Investment Tax Credit (ITC) rates. These rates are 30% for cash purchase and 25.5% for TELP.

At this early feasibility study stage of a portfolio, we focus on simple payback to get a high-level look at the project economics. Our simple payback calculation is based on Year 1 solar production, Year 1 annual utility savings, and the Solar*Rewards C&I incentive program. Should any of these projects move into the next stage of development, McKinstry would develop more detailed proformas and cash flows to include items like solar degradation, Operations & Maintenance, discount rates, and more.

McKinstry aims to recommend solar systems that will pay back in the system lifetime, between 25-30 years. In all funding scenarios using IRA credit, this system would pay back within the solar lifetime.

Louisville Golf Course

BUNDLE 1 FULL ELECTRIFICATION	SYSTEM PRICE	ANNUAL SAVINGS	UTILITY INCENTIVE	SIMPLE PAYBACK (YRS)
Cash Purchase or Tax-Exempt Lease Purchase (TELP)	$1,150,000	$24,899	$11,292	32.14
TELP with IRA	$856,750			23.94
Cash Purchase with IRA	$805,000			22.49
BUNDLE 2 HIGH PERFORMANCE	**SYSTEM PRICE**	**ANNUAL SAVINGS**	**UTILITY INCENTIVE**	**SIMPLE PAYBACK (YRS)**
Cash Purchase or Tax-Exempt Lease Purchase (TELP)	$1,150,000	$21,590	$11,292	35.38
TELP with IRA	$856,750			26.36
Cash Purchase with IRA	$805,000			24.76
BUNDLE 3 EXISTING LOADS	**SYSTEM PRICE**	**ANNUAL SAVINGS**	**UTILITY INCENTIVE**	**SIMPLE PAYBACK (YRS)**
Cash Purchase or Tax-Exempt Lease Purchase (TELP)	$1,150,000	$20,360	$11,292	36.74
TELP with IRA	$856,750			27.37
Cash Purchase with IRA	$805,000			25.72

Please note that there is a proposed service upgrade for this site associated with all Bundles. The cost of that upgrade is included in the Electrification scope of work. The full PV scope from the Point of Interconnection, to the Solar Disconnect, Solar Meter, AC Combiner, Inverters to Modules is included in the pricing below. Additionally, pricing below assumes Louisville moves forward with a system at the City Services building and City Hall; there are cost efficiencies in material, installation, and construction management scopes using a portfolio approach.

Another metric that may be useful as the City of Louisville considers the best way to decarbonize is levelized cost of electricity (LCOE). This is defined as capital cost divided by the estimated system lifetime production with units of $/kWh. It can help the City of Louisville compare the value of owning onsite solar versus subscribing to renewable utility programs like Renewable Connect and Windsource. The table below shows LCOE with and without the Solar*Rewards C&I incentive.

Louisville Golf Course

BUNDLES 1-4	LCOE – NO UTILITY INCENTIVES ($/KWH)	LCOE – W/ UTILITY INCENTIVES ($/KWH)
Cash Purchase or Tax-Exempt Lease Purchase (TELP)	$0.127	$0.100
TELP with IRA	$0.095	$0.068
Cash Purchase with IRA	$0.089	$0.062

5. Future Considerations and Next Steps

Should Louisville decide to move forward with the Golf Course PV system, next steps would involve a geotechnical study, utility locates, land survey, racking and electrical bid sets, an interconnection application to Xcel, a subcontractor RFP to get final pricing, and any other due diligence items necessary to de-risk the project and ready it for implementation.

Assumptions, Inclusions, and Exclusions

- Codes and Utility Standards:
  - NEC 2020
  - IBC 2018
  - IFC 2018
  - Xcel Energy Blue Book (7/31/2022 Version)
  - Xcel Energy DG Tech Manual (10/28/2021 Version)
- Tax-exempt
- Prevailing wage
- Geotechnical Analysis results allows for drilled pier foundations.
- No hazardous soils or materials (asbestos, PFAS, etc.). Should monitoring, mitigation, abatement, and/or disposal be required, Louisville would be responsible for this additional scope.
- The provided financial model projects that this site will qualify for SPVTOU rate class as its existing Load factor is over 45% (30% is the minimum required amount) and site demand is below 500kW.
- Pricing assumes a portfolio approach; Louisville will move forward with a solar PV system at both the City Services Building and City Hall.
- Pricing includes payment & performance bond
- Terms & Conditions listed in the Xcel Energy Interconnection Agreement
- Current labor rates
- Modeling:
  - TMY, DENVER INTL AP, NSRDB (tmy3,I) weather file
  - Soiling data from DNV-GL
- Design Loads
  - Wind speed:
    - Risk Category II: 145mph
    - Exposure: C
  - Ground snow load: 30 psf
    - Risk Category II: 1.0 importance factor

Louisville Golf Course

- No interconnection upgrade costs
- No grounding transformers
- Major equipment warranties
    - Modules – 12 year Product
    - Modules – 30 year Power Output
    - Inverters – 10 years
    - DAS – 5 years
    - AC Combiners – 5 years
    - LEDs – 5 years
- No extended warranties
- No ongoing DAS Costs
    - Any ongoing fees beyond year 5 are excluded (both Cell Service and Data Subscription Monitoring fees).
- No backup generation
- Xcel Energy Solar*Rewards C&I Incentives: Tier 1: <250kWac = $0.04/kWh for 20 years

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Golf Clubhouse & Maintenance Cost Estimates

Three sets of numbers are listed below:

1. Cost Delta of Decarbonization – These are the total construction costs minus the replacement costs that would've been spent to replace the existing units with like-for-like fossil fuel units. These numbers represent the true cost of this decarbonization effort.
2. Total Decarbonization Construction Costs – These are the total amounts of money that will need to be allocated for budgetary purposes. The delta between the above numbers and the below numbers represents the cost of decarbonization.
3. Baseline Costs - These are the costs that would be spent to replace the existing gas-based systems with like-for-like gas units.

All numbers are "all-in costs", including all GC markups, permitting, etc. They are also Rough Order of Magnitude (ROM) numbers, with a +/-20% range. See the "Construction Pricing Context" section in the report body for more detail. All costs associated with the solar PV systems (including the electrical infrastructure to support these systems) are included in the Renewables costs as outlined in a separate section of the Appendix.

Cost Delta of Decarbonization

Decarbonization Delta Costs
Coal Creek Clubhouse + Maintenance

Scope	Total Cost
Option 1 (Full Electrification)	$ 1,000,649
Option 2 (High-Performance Electrification)	$ 1,543,649

Total Decarbonization Construction Costs

Option 1 (Full Electrification)

	Coal Creek Clubhouse	Maintenance
Scope	Total Cost	Total Cost
HVAC Ductwork	$ 262,000	$ 107,000
HVAC Piping	$ 79,000	$ 58,000
Plumbing	$ 63,000	$ 45,000
Electrical	$ 557,000	$ 248,000
Structural	$ 36,000	
Total:	$ 997,000	$ 458,000

Option 2 (High-Performance Electrification)

Scope	Coal Creek Clubhouse Total Cost	Maintenance Total Cost
HVAC Ductwork	$ 126,000	$ 107,000
HVAC Piping	$ 795,000	$ 58,000
Plumbing	$ 62,000	$ 45,000
Electrical	$ 557,000	$ 248,000
Structural	$ -	$ -
Total:	$ 1,540,000	$ 458,000

Electric Vehicle Charging
Coal Creek Clubhouse

Scope	Total Cost
EV Charging	$ 168,000

Baseline Costs

Gas Like-for-Like Replacement

Scope	Coal Creek Clubhouse Total Cost	Maintenance Total Cost
Option 1 (Full Electrification)	$ 318,419	$ 135,932
Option 2 (High-Performance Electrification)	$ 318,419	$ 135,932