Powering Up Utah Renewable Communities- Salt Lake City Technical Appendix

I. Greenhouse Gas (GHG) Reductions from the Utah Renewable Communities (URC) Program

Summary

The following GHG reductions are projected to result from launching the (URC) program with the following cost-effectiveness:

Table 1. GHG Reduction and Cost Effectiveness Summary

Time Period	GHG Reduced (metric tons CO2e)	Grant Request	Cost Effectiveness ($ per metric ton CO2e)
2025-2030	1,151,417	$49,633,447	$43.11
2025-2050	4,976,762		$9.97

Methods

The electric power sector accounted for an estimated 25% of United States (US) greenhouse gas (GHG) emissions in 2021, almost exclusively in the form of carbon dioxide (CO2). Fossil fuel power plants also emit criteria pollutants, including sulfur dioxide (SO2), nitrous oxides (NOx), particulate matter of 2.5 microns or smaller (PM2.5), volatile organic compounds (VOCs), and ammonia (NH3) that adversely impact human health by causing respiratory and cardiovascular problems and premature mortality.

The Utah Renewable Communities (URC) project aims to reduce electric power sector emissions in the Northwestern region of the US by supporting the purchase of new clean electricity. For this analysis, the amount of clean electricity is equivalent to the addition of 200 Megawatts (MW) of solar photovoltaic (PV) generation in Utah in 2027.

The addition of clean electricity reduces electric power sector emissions by reducing the dispatch of fossil fuel power plants. The AVoided Emissions and GeneRation Tool (AVERT) (EPA 2024a) allows users to evaluate expected changes to regional power sector emissions in response to clean electricity additions.

To estimate GHG reductions, EPA's AVERT version 4.2 for desktop was used to model the addition of 200 MW of solar energy to the Northwest region at a 30.2% capacity factor. The 30.2% capacity factor was chosen because that is the capacity factor used by (PacifiCorp 2023) for a solar farm located in Milford, Utah (see Table 7.1 beginning on numbered page 180). Please see Table 1 for a summary of AVERT inputs.

Table 2. AVERT Inputs

Input Description	Input Value
Region	Northwest
Utility Solar Capacity	200 MW

Annual Average Capacity Factor for Utility Solar PV	30.2%

With these inputs, AVERT estimated the reduction of 328,260 metric tons of CO2 in 2022 resulting from changes in the dispatch of regional fossil fuel plants caused by this 200 MW solar addition (please see optional workbook, sheet **B-AVERT output 2022 metric tons** yellow highlighted cell F12).

However, the URC program's addition of 200 MW of solar electricity to the Northwest region is not expected until calendar year 2027 and the emissions intensity of the electricity grid is expected to change between now and then and continue to change afterward.

To project the 2022 metric tons of CO2 reduced forward in time, an emissions intensity schedule was created using numbers accessed from the AVERT software's "Emissions rates over time" function (please see optional workbook, sheet **C-CO2 Emissions Rates** yellow highlighted cells). The yellow highlighted cells represent the average CO2 emissions rate in 2022 as well as future emissions rates in 2024, 2026, 2028, 2030, 2035, and 2040 using Cambium SRMER Mid-Case.

The SRMER Mid-Case scenario was chosen because it assumes "no changes in additions or retirements of power plants in response to the modeled load change," reflecting recent Utah legislation that prioritizes the continued operation of dispatchable energy resources. This legislation will likely delay the date when these resources would otherwise be selected for retirement based upon cost considerations and system reliability requirements alone.

Years for which the CO2 emissions rate was missing between 2022 and 2040 were interpolated and emissions rates from 2041 through 2050 were extrapolated using the five-year trend from 2036 through 2040 (please see optional workbook sheet **A-Pollution & Benefit Estimates** blue highlighted column header C3).

Beginning in 2023, a scaling factor was calculated for each year by dividing each year's emissions rate by the prior year's emissions rate (please see optional workbook sheet **A-Pollution & Benefit Estimates** green highlighted column header E3).

In this way, the emissions reduction of 328,260 metric tons of CO2 in 2022 can be scaled from one year to the next to reflect a smaller CO2 reduction as the grid's emissions intensity falls over time between 2022 and 2050 (please see optional workbook sheet **A-Pollution & Benefit Estimates** lavender highlighted column header G3).

Finally, the metric tons of CO2 reduced in each year was scaled up to metric tons of CO2-equivalent (CO2e) by using a scaling factor derived using EPA's Emissions and Generation Resource Integrated Database (eGRID) (EPA 2024b).

Using eGRID, the CO2e emissions rate in 2022 for the Northwest Power Pool (NWPP) was obtained for both CO2 and CO2e (please see optional workbook **D-CO2 to CO2e eGRID** yellow highlighted cells G6 and C6, respectively). Dividing the latter by the former yields a conversion factor of 1.006278, meaning that each metric ton of CO2 from the power sector should be grossed up by roughly 0.6278% to convert to CO2e (please see optional workbook sheet **D-CO2 to CO2e eGRID** green highlighted cell J6).

This scaling factor was applied to CO2 metric tons reduced in each year to calculate CO2e metric tons reduced in each year (please see optional workbook sheet **A-Pollution & Benefit Estimates** orange highlighted column header I3).

The magnitude of GHG reductions from 2025 through 2030

Using the above method, CO2e reduced by the addition of 200 MW of Utah solar in 2027 through 2030 is estimated to total 1,151,417 metric tons (please see optional workbook sheet **A-Pollution & Benefit Estimates** orange highlighted cell I36).

The magnitude of GHG reductions from 2025 through 2050

Using the above method, CO2e reduced by the addition of 200 MW of Utah solar in 2027 through 2050 is estimated to total 4,976,762 metric tons (please see optional workbook sheet **A-Pollution & Benefit Estimates** orange highlighted cell I40).

Cost effectiveness

Utah's Administrative Rules Governing the Community Renewable Energy Program at R746-314 ("Rules") require that projected program rates reflect "quantifiable costs and benefits of the program" and that such rates "may not result in a shifting of costs or benefits to customers of the utility that are not eligible or have elected not to participate in the program."

Such an accounting must therefore consider not only the cost of clean energy resources, but also the financial benefit that results from these new clean energy resources. If the financial cost exceeds the financial benefit, then program customers would be expected to pay a premium to cover this excess cost.

Energy Strategies, LLC, an independent energy consulting firm, estimated the excess cost associated with acquiring electricity from 200 MW Utah solar (proxy) resource to serve the URC program using publicly available data produced by Rocky Mountain Power and its parent company, PacifiCorp.

To introduce a measure of price conservatism, the 200 MW of solar was calculated as the cost of solar from ten 20 MW solar power plants (small solar plants have higher costs per unit of energy generated than large solar plants).

Costs were obtained from PacifiCorp (2023) reflecting a 20 MW solar farm in Milford, Utah. Benefits were estimated using Rocky Mountain Power (2023) Utah solar avoided costs with a constant escalation from 2039 through 2050 at 2.27%.

The cost and benefit streams between 2026 and 2050 were summed, discounted using the PacifiCorp (2023) discount rate of 6.77%, netted, and multiplied by a factor of ten to scale to 200 MW. This procedure resulted in a calculated excess cost of $47,259,388 (please see optional workbook sheet **G-Small UT Solar Premium** highlighted cell H7).

When combined with program administration costs and the cost of three URC navigator positions, the total requested in this application is 49,352,850 as shown in Table 4.

Table 3. Total Application Costs by Program Category

Program Category	Amount
Administration Subsidy	$1,683,034
Clean Electricity Subsidy	$47,259,388
URC Navigators	$230,342
TOTAL	**$49,633,447**

II. Low-Income and Disadvantaged Communities (LIDAC) Benefits Analysis

Summary

The following financial benefits are estimated to accrue to populations living in LIDAC areas as compared to the population as a whole:

Table 4. GHG Reduction and Cost Effectiveness Summary

Time Period	Total Population	LIDAC Population	% LIDAC
Climate Damages Avoided at $51 per metric ton (2025 thru 2030)	$58,722,290	$24,639,873	41.96%
Health Damages Avoided (2025 thru 2030)	$14,971,856	$6,300,009	42.08%

Method

For this analysis, geographic areas were considered LIDAC if they meet either one of the following two criteria:

- census tracts identified as disadvantaged by the Climate and Economic Justice Screening (CEJST) tools
- census block groups identified as disadvantaged by EPA's Economic Justice Screening Tool (EJ Screen) because they meet or exceed that tool's 90th percentile supplemental indexes

Because the benefits of pollution reduction are difficult to resolve at the geographic scale of census tracts and census blocks, the percent of the US population living in LIDACs was determined for each county and the United States.

Data was downloaded from EJScreen (EPA 2023a) showing population at the block group level and merged with EJ Screen (EPA 2023b) data labeling each block group as Inflation Reduction Act (IRA) disadvantaged or not and summarized across counties.

Across all United States counties, 41.96% of the total population was determined to live in LIDACs (see optional workbook, sheet **E-LIDAC Population by County**, highlighted cell D3235).

The LIDAC share of total population and the LIDAC share of each county's population were then used to calculate two different benefits, respectively:

- Avoided climate change costs using a widely cited figure for the social cost of carbon ($51 per metric ton), and
- Avoided health costs in one year as estimated by using EPA's CO-Benefits Risk Assessment (COBRA) (EPA 2024c) tool

Climate change financial benefit through 2030 – LIDAC benefits

The benefit of avoided climate change was calculated by multiplying the estimated metric tons of CO2e avoided every year by a social cost of carbon at $51 per metric ton (please see optional workbook sheet **A-Pollution & Benefit Estimates** column N). The share of this benefit belonging to LIDACs was calculated by multiplying the total yearly benefit by the share of the US population living in LIDACs (please see optional workbook sheet **A-Pollution & Benefit Estimates** column O).

In this way, total climate benefits through 2030 total $58.7 million (see optional workbook sheet **A-Pollution & Benefit Estimates**, highlighted cell N36), of which a little more than $24.6 million (41.96%) belongs to people living in LIDACs (see optional workbook sheet **A-Pollution & Benefit Estimates**, highlighted cell O36).

Health financial benefit through 2030 – LIDAC benefits

As described previously, EPA's AVERT tool was used to model the estimated pollution reduction that would occur as the result of adding 200 MW of solar in the Northwest region at a 30.2% capacity factor. This same AVERT model run was also used to generate input files for the COBRA tool.

Using these AVERT-generated input files and selecting 2023 for the analysis year, the COBRA tool estimated health benefits expected to result from these pollution reductions for each county in the continental United States in the baseline year 2023, with total health benefits estimated at $4.57 million at the low estimate (please see optional workbook sheet **F-COBRA Benefits by County** highlighted cell K3110).

The estimated total health benefits (low estimate) for each county were then multiplied by the percent of each county's population living in a designated LIDAC area. In this way, total health benefits in 2023 attributable to LIDAC populations are estimated to total a little over $1.92 million (please see optional workbook sheet **E-LIDAC Population by County** highlighted cell F3235).

The estimated total health benefits and LIDAC health benefits for the year 2023 were then projected through 2030 by scaling according to changes in the projected emissions rate over time (please see optional workbook sheet **A-Pollution & Benefit Estimates** columns P and Q).

Through 2030, health benefits are estimated to total roughly $14.97 million (please see optional workbook sheet **A-Pollution & Benefit Estimates** green highlighted cell P36) with $6.3 million (42.08%) attributable to people living in LIDACs (please see optional workbook sheet **A-Pollution & Benefit Estimates** green highlighted cell Q36).

Limitations of this Benefits Analysis

The climate benefits were not localized to areas of the country facing extreme climate risks; rather, they were apportioned by percent population living in LIDAC areas without regard for specific geographic climate vulnerabilities.

COBRA health benefits were estimated in the analysis year of 2023 and projected forward to years 2027 through 2030 using changes in the CO2 emissions rate for the Northwest region. These projected health benefits do not reflect changing population demographics over this period.

Future climate and health benefits calculated reflect nominal dollars.

III. Converting the clean electricity subsidy and program administration subsidy into estimated participant support costs

The clean electricity subsidy and the program administration subsidy can be converted into a five-year average Participant Support Cost of **$2.40 (column d)** per month for the typical household. During this time, households participating in the URC program are estimated to pay an additional **$2.53 (column g)** per month on average to fund another 2029 clean electricity acquisition to substantially meet the program's 2030 net-100% clean electricity target and cover other program costs. Without an EPA grant to cover Participant Support Costs, the typical household would pay an additional **$4.93** per month on average to participate in the URC program. Actual program rates will be subject to approval by the Utah Public Service Commission (UPSC) and may be different than those presented here.

`	*(a)*	*(b)*	*(c)* *(b) / (a)*	*(d)* *(c) x 700*	*(e)*	*(f)* *(e) / (a)*	*(g)* *(f) x 700*
Year	**Est. URC participation (kWh)**	**Participant Support Costs (PSC) ($)**	**PSC per kWh ($)**	**Avg. monthly PSC for typical household using 700kWh ($)**	**Cost to acquire additional 2029 clean electricity and fund 10-yr administration reserve ($)**	**Additional clean electricity cost per kWh ($)**	**Additional clean electricity cost for typical household using 700kWh ($)**
2025	2,721,532,779	776,690	0.000285387	0.20	12,675,258	0.004657397	3.26
2026	2,789,026,792	522,644	0.000187393	0.13	12,678,258	0.004545764	3.18
2027	2,858,194,657	15,874,807	0.005554138	3.89	12,681,333	0.004436833	3.11
2028	2,929,077,884	15,880,926	0.005421818	3.80	12,684,485	0.004330539	3.03
2029	3,001,719,016	15,887,355	0.005292752	3.70	872,869	0.000290790	0.20
			Five-Year Avg.	**2.40**		**Five-Year Avg.**	**2.53**

IV. Estimating eligible customers, participating customers, and new connection requests – activities that drive program administrative costs

Summary

Customer-related budget determinants that drive program administration costs are shown below.

Table 5. Customer determinants of budgeted program administration costs

Customer Noticing Determinants		Customer Phone Support Determinants		
(2A) 272,476	Eligible Customers	1st opt-out notice 2nd opt-out notice	(3A) 6,103 hours	2-month opt-out period

(2C) 6,892	Connection Requests per Month	Ongoing opt-out notices	(3B) 6,844 hours	3-month cancellation period
			(3C) 926 hours	Ongoing per year

Please see the calculation of these budget determinants below.

Method

The table below depicts the number of Rocky Mountain Power customers by rate schedule for all 18 member communities of the URC in the year 2022. For each rate schedule, an estimate was made for the percentage who will remain in the URC program: 80% of residential customers, 30% of commercial customers (defined as the smaller non-residential rate schedules), 5% of industrial customers (defined as the largest non-residential schedules), and zero percent of lighting and renewable rate schedules.

	(a)		*(b)*	*(c)* *(a) x (b)*
Rate Schedule	**Customers (#)**	**Customer Type**	**Est. Participation (%)**	**Est. Participating Customers (#)**
1	213,966	Residential	80%	171,173
2	294	Residential	80%	235
3	5,429	Residential	80%	4,343
6	4,943	Commercial	30%	1,483
6A	124	Commercial	30%	37
6B	-	Commercial	30%	-
7	2,227	Lighting	0%	-
8	87	Commercial	30%	26
9	24	Industrial	5%	1
9A	1	Industrial	5%	-
9M	4	Industrial	5%	-
10	168	Commercial	30%	50
11	74	Lighting	0%	-
12	263	Lighting	0%	-
15	1,154	Lighting	0%	-
21	-	Lighting	0%	-
23	24,405	Commercial	30%	7,322
31	3	Commercial	30%	1
32	3	Renewable	0%	-
TOTAL	**(1A) 253,169**			**(1B) 184,671**

The total number of eligible customers (1A) and estimated participating customers (1B) as well as the number of new connection requests in participating communities are projected forward in time to Year 1 (2025) and Year 2 (2026) of the grant performance period at an annual growth rate of 2.48% per year.

	2022	2023	2024	Year 1 (2025)	Year 2 (2026)
Eligible Cust. at 2.48% (#)	(1A) 253,169	259,448	265,882	(2A) 272,476	
Participating Cust. at 2.48% (#)	(1B) 184,671	189,251	193,944	198,754	(2B) 203,683
Avg. New Connection Requests per month at 2.48% (#)		6,404	6,563	6,726	(2C) 6,892

These numbers were also used to estimate customer phone support costs to support the URC program.

Assuming an average customer contact rate of 10% and an average call per contact of 0.112 hours (based on the recent high volume call month of January 2024), phone support hours can be estimated:

- during the two-month opt-out period, using the number of eligible customers (2A) as the basis
- during the three-month cancellation period, using the number of participating customers (2B) as the basis, and
- for ongoing phone support, using the number of monthly new connection requests (2C) as the basis

		(a)	*(b)*	*(c)*	*(d)*	*(e)* *(a) x (b) x (c) x (d)*	*(f)* *(a) x (b) x (c) x (d)*
	Customer Support Basis (#)		Contact Rate (%)	Hours per Contact (#)	Months (#)	Year 1 (2025)	Year 2 (2026)
Customer Support Hours -- Opt-Out Period (#)	Eligible	(2A) 272,476	10%	0.112	2	(3A) 6,103	
Customer Support Hours -- Cancellation Period (#)	Participating	(2B) 203,683	10%	0.112	3		(3B) 6,844
Customer Support Hours - Ongoing (#)	New Connections	(2C) 6,892	10%	0.112	12		(3C) 926

V. Estimating the clean electricity subsidy

Large customer renewable electricity tariffs offered by Rocky Mountain Power in Utah account for both the financial cost of new clean electricity arrangements and the financial benefits these new clean electricity resources provide to the larger electricity system. Similarly, Utah's Administrative Rules Governing the Community Renewable Energy Program (R-746-314) require that projected program rates reflect "quantifiable costs and benefits of the program" (underline added for emphasis).

Consequently, the clean electricity cost attributable to the URC program will likely reflect the difference between the cost of clean electricity less the financial benefit resulting from this electricity – this can be referred to as the "excess cost" of the clean electricity acquired to serve the URC program.

Energy Strategies, LLC, an independent energy consulting firm, estimated the excess cost associated with acquiring electricity from a 20 MW Utah solar (proxy) resource using publicly available information. Costs are consistent with those used in the PacifiCorp 2023 Integrated Resource Plan, projected to 2026. Benefits are based on Rocky Mountain Power's avoided cost filing for solar in the second quarter of 2023, extended past 2038 at a rate of 2.27%. The Net Present Value (NPV) of costs and benefits over 25 years are discounted at 6.77%, reflecting the value used in PacifiCorp's 2023 IRP.

Year	UT Small Solar Fixed Costs @100% Wtg. ($000s)	Nominal UT Small Solar Energy Prod. @ 100% Wtg. (MWh)	Illustrative Solar Tracking UT 2023.Q2 at 32.25% CF ($/MWh)	Illustrative Solar Avoided Cost Benefit ($000s)
2026	$ 2,057	52,910	$ 11.27	$ (596)
2027	$ 2,104	52,910	$ 11.90	$ (630)
2028	$ 2,151	52,910	$ 31.95	$ (1,691)
2029	$ 2,200	52,910	$ 31.62	$ (1,673)
2030	$ 2,250	52,910	$ 36.13	$ (1,912)
2031	$ 2,301	52,910	$ 40.56	$ (2,146)
2032	$ 2,353	52,910	$ 29.22	$ (1,546)
2033	$ 2,407	52,910	$ 25.70	$ (1,360)
2034	$ 2,461	52,910	$ 25.02	$ (1,324)
2035	$ 2,517	52,910	$ 56.51	$ (2,990)
2036	$ 2,575	52,910	$ 64.29	$ (3,401)
2037	$ 2,633	52,910	$ 65.76	$ (3,480)
2038	$ 2,693	52,910	$ 67.95	$ (3,595)
2039	$ 2,754	52,910	$ 49.14	$ (2,600)
2040	$ 2,816	52,910	$ 50.25	$ (2,659)
2041	$ 2,880	52,910	$ 51.39	$ (2,719)
2042	$ 2,946	52,910	$ 52.56	$ (2,781)
2043	$ 3,013	52,910	$ 53.75	$ (2,844)
2044	$ 3,081	52,910	$ 54.97	$ (2,909)
2045	$ 3,151	52,910	$ 56.22	$ (2,975)
2046	$ 3,222	52,910	$ 57.50	$ (3,042)
2047	$ 3,296	52,910	$ 58.80	$ (3,111)
2048	$ 3,370	52,910	$ 60.14	$ (3,182)
2049	$ 3,447	52,910	$ 61.50	$ (3,254)
2050	$ 3,525	52,910	$ 62.90	$ (3,328)
25-Yr NPV	**$ 30,132**	**629,585**		**$ (25,406)**

As shown below, combining the 25-Yr NPV cost and benefit and multiplying by 10 yields the estimated excess cost of the output of 200 MW of Utah solar attributable to the URC program at $47,259,388 shown as (d) below.

(a)	*(b)*	*(c)* *(a) + (b)*	*(d)* *(c) x 10*
20 MW UT Solar 25-Yr Cost NPV ($)	**20 MW UT Solar 25-Yr Benefit NPV ($)**	**20 MW UT Solar 25-Yr Excess Cost NPV ($)**	**200 MW UT Solar 25-Yr Excess Cost NPV ($)**
$ 30,131,975	$ (25,406,036)	$ 4,725,939	$ 47,259,388

The excess cost of electricity from a 200 MW Utah solar resource was calculated as the cost of output from ten 20 MW Utah solar farms to introduce price conservatism since smaller solar farms produce each unit of electricity at a higher cost than larger solar farms.

This total 25-Yr excess cost is assumed to be paid between 2027 (when the resource is assumed to come online) and 2029 (at the end of the grant performance period).

References

Environmental Protection Agency (EPA). (2024a). *AVoided Emissions and geneRation Tool (AVERT)* (Version 4.2) [Desktop edition]. Retrieved February 2024 from https://www.epa.gov/avert/download-avert

Environmental Protection Agency (EPA). (2024b). *Emissions and Generation Resource Integrated Database (eGRID) – Data Explorer*. Retrieved February 2024 from https://www.epa.gov/egrid/data-explorer

Environmental Protection Agency (EPA). (2023a). *Download Geodatabase of National EJScreen Data at the Block Group Level*. Retrieved March 2024 from https://gaftp.epa.gov/EJScreen/2023/2.22_September_UseMe/EJSCREEN_2023_BG_with_AS_CNMI_GU_VI.gdb.zip

Environmental Protection Agency (EPA). (2023b). *EPA IRA Disadvantaged Communities*. Retrieved March 2024 from https://epa.maps.arcgis.com/home/webmap/viewer.html?useExisting=1&layers=f3be939070844eac8a14103ed6f9affd

Environmental Protection Agency (EPA). (2024c). *Co-Benefits Risk Assessment Health Impacts Screening and Mapping Tool (COBRA)* [Desktop edition]. Retrieved February 2024 from https://www.epa.gov/cobra/forms/download-cobra-and-sign-updates

PacifiCorp. (2023). *2023 Integrated Resource Plan*. Retrieved March 20, 2024, from https://www.pacificorp.com/content/dam/pcorp/documents/en/pacificorp/energy/integrated-resource-plan/2023-irp/2023_IRP_Volume_I.pdf.

Rocky Mountain Power. (2024). *Re: Docket 23-035-28 – 2023.Q2 Avoided Cost Input Changes Quarterly Compliance Filing*. Retrieved March 20, 2024, from https://pscdocs.utah.gov/electric/23docs/2303528/330048RMP2023Q2AvdCstInptChngs9-27-2023.pdf