

ABOR Budget Justification

SENIOR PERSONNEL:

N/A

OTHER PERSONNEL:

Two ABOR personnel will commit 7.2 months of effort and primarily be responsible for closely managing and monitoring all the proposed initiatives by convening quarterly project meetings, coordinating key communications among the project team, monitoring project progress and performance, managing project costs, coordinating and submitting required reports, and engaging faculty, staff, and community partners. The budget is estimated based on an expected base salary of \$70,000.

FRINGE BENEFITS:

The fringe benefit rate for the two individuals is 27.91% for all years of the project.

EQUIPMENT: N/A

TRAVEL: N/A

PARTICIPANT SUPPORT: N/A

OTHER DIRECT COSTS:

Subawards

We will have a subaward to Arizona State University in the amount of \$14,984,000.

We will have a second subaward to Northern Arizona University in the amount of \$16,423,602.

We will have a third subaward to the University of Arizona in the amount of \$16,412,061.

Their budget breakdown and work details can be found below.

INDIRECT COSTS:

The total amount of indirect costs requested are \$61,220

Indirect costs are calculated on Modified Total Direct Costs (MTDC) using the 10% de minimus rate. MTDC includes salaries and wages, fringe benefits, materials and supplies, services, travel, and the first \$25,000 of each subaward. Exclusions from MTDC include graduate student tuition remission, participant support, facility rental, subawards over the first \$25,000, capital equipment, and scholarships/fellowships.

ASU Budget Justification

EQUIPMENT:

Solar and Battery Storage

We will be pursuing 2 solar projects and 3 battery storage projects for a total budget of \$14,429,000.

	SOLAR					
	kWDC	Annual kWh	Construction	Burden/ Contingency	Tax Incentives ¹	Net Cost
MAPS	830	1,343,713	\$ 4,150,000	\$ 1,037,500	\$ 1,245,000	\$ 3,942,500
Novus	934	1,712,587	\$ 4,670,000	\$ 1,167,500	\$ 1,401,000	\$ 4,436,500
West Valley						

	BATTERY STORAGE						
	kWDC	kWh Capacity	Construction	Burden/Contingency	Tax Incentives ¹	Other Incentives ²	Net Cost
MAPS	1,000	2,000	\$2,500,000	\$500,000	\$750,000	\$0	\$2,250,000
Novus	1,000	2,000	\$2,500,000	\$500,000	\$750,000	\$0	\$2,250,000
West Valley	1,000	2,000	\$2,500,000	\$500,000	\$750,000	\$700,000	\$1,550,000

NOTES:

1 Tax Incentives are assuming that Inflation Reduction Act incentives are applicable, we are assuming that they will cover 30% of construction costs.

2 Other incentives for the West Valley Campus project is a grant received from APS.

Fleet Electrification

We will be converting 24 light duty trucks and vans (equipment) from internal combustion engine vehicles to battery electric vehicles. Total cost of those replacements is: \$1,635,000 (full vehicle purchase price) - \$1,080,000 (ASU contributions) = \$555,000 (grant request).

INDIRECT COSTS:

The total amount of indirect costs requested are \$0.

Indirect costs are calculated on Modified Total Direct Costs (MTDC) using rates approved by US Department of Health and Human Services (DHHS). The University's Rate Agreement was approved on May 24th, 2023 at 57% of Modified Total Direct Costs (MTDC) for on-campus research projects. MTDC includes salaries and wages, fringe benefits, materials and supplies, services, travel, and the first \$25,000 of each subaward. Exclusions from MTDC include graduate student tuition remission, participant support, facility rental, subawards over the first \$25,000, capital equipment, and scholarships/fellowships.

COST SHARE:

ASU will be contributing \$1,080,000 in voluntary cost share for this project.

ABOR Tri-U CPRG NAU subrecipient Budget Narrative

Applicants must submit a budget narrative attached to their project narrative (including an optional budget spreadsheet unlimited pages and up to 10 additional pages).

NAU--subrecipient

Personnel:

To accurately track and report on the efficacy of our GHG measures, we anticipate 2 weeks of data analysis and reporting each year from our sustainability analyst, Dayna Cook.

Personnel costs include training time for EV mechanics and bus drivers and data analyst time to track and report of GHG emissions annually. We budgeted for two mechanics to be trained at \$105/hr. for 36 hours each in year one and a 4-hour training for 27 bus operators and managers on electric drivetrains at \$43.50/hr. so that our transition to EV buses will go smoothly.

Fringe benefits

NAU fringe benefits include employee insurance, retirement, unemployment and are calculated at 49.5% for Dayna Cook and 8.06% of personnel costs for the Mechanics and Operators.

Travel

Before electric buses are delivered from the manufacturer to the university, two Transportation Services employees will travel to the manufacturing facility for a final inspection and instructions. These costs include air travel (\$500/each) and authorized Lodging and M&I (\$257/day) and have been estimated at \$2,028, assuming procurement from a California based manufacturer.

Equipment

Under Arizona's PCAP **measure 7: Zero emissions fleets**, we will purchase EV charging equipment and EV buses, trucks, vans and neighborhood electric vehicles. We will leverage IRA EV tax credits/rebates for all qualifying vehicles and NAU planned vehicle replacement budget (hereafter referred to as NAU contribution) towards these purchases. Stacking funding sources will cost effectively catalyze our transition to zero emissions vehicles through a strategy of downsizing the fleet, promoting shared vehicle use and downsizing vehicle size by initiating the use of neighborhood electric vehicles. To enable fleet electrification, we will purchase and install the following EV level 2 chargers: 1) 4 150kW bus installed chargers costing \$258,056 (minus \$100,000 university contribution) for a total of \$158,056, 2) 10 level 2 chargers with an installed cost @ \$8,500 for a total of \$85,000. 3) Upgrade the panel and electrical services for the bus barn facility where the electric bus chargers will be installed. Facility services estimates the installed costs of the required upgrades to cost approximately \$50,000.

We plan to purchase the following vehicles: 1) 4 40ft electric buses at a cost of \$850,000 each, or a total of \$3,400,000 (minus NAU contributions and IRA rebates of \$560,000) with a total budget request of \$2,840,000 or \$710,000 each to replace existing diesel buses that travel approximately 11,000 miles/yr., total cost of buses. 2) 9 electric trucks/SUVs with a cost of \$492,000 (minus \$107,500 in NAU contributions and IRA credits) for a total cost of trucks/suvs \$384,500, 3) 8 electric vans \$448,000 (minus \$60,000 in NAU contributions and IRA credits) \$388,000, 4) 10 neighborhood electric vehicles totaling \$307,210. Only one truck will be purchased in year two as a planned vehicle replacement and the others will be placed into service in Year one to immediately reduce fleet emissions. (see attached inventory of estimated vehicle purchases)

Equipment for Mechanics to diagnose and service vehicles includes a high voltage oscilloscope (min 4 channel) at a quote of \$5,000.

Supplies and Materials

Additional supplies and materials necessary for mechanics to service electric buses, trucks, and neighborhood electric carts include: CATIII Megohmmeter (\$1,000), CATIII Digital multimeter (\$850), Insulated tool set (1,00v rated) (\$3,500), lineman gloves (\$500), arc flash shield (\$200), Rescue hook (\$600), safety shoes (\$300).

Contractors/Vendors

Under AZ PCAP measure 4—**Implement on-site renewable generation and battery storage at public universities** and consistent with NAUs climate action plan, we will use a competitive bidding process to procure a vendor to provide equipment and installation of the following renewable energy systems:

- 1) 550kW-dc ground mount solar system @\$2.2/W for total construction costs of \$1,210,000. After applying IRA rebates of \$363,000, the requested budget is \$847,000 spread out over two years.
- 2) 1450kW-dc solar parking snow load canopies (@\$4.450/W) for total construction costs of \$6,452,500. After applying IRA rebates of \$1,935,750, the requested budget is \$4,516,750 spread out over two years,
- and 3) 1MW-4hours battery storage at \$1,430,998 installed costs after applying IRA rebates of \$557,532.

Design and commissioning

We plan to contract an outside firm to design and commission the solar and battery projects. Based on similar capital projects, NAU facility services estimates the design and commissioning costs of this work to be \$1,203,952 (\$601,976 in Y1 and \$601,976 in Y2) for the detailed planning of the solar and battery systems and commissioning throughout the construction.

Geotech assessment and surveys

We plan to contract an outside firm to conduct necessary Geotech assessments and surveys prior to planning to examine soil conditions, bedrock location, slope stability, and provide essential information for foundation design, construction requirements and mitigate risks to construction to ensure successful construction. Based on similar capital projects, NAU facility services estimates the costs of Geotech assessments and surveys to be \$459,057 (\$229,529 in Y1 and \$229,529 in Y2) across two years given the number of candidate areas to locate the battery and solar canopy structures.

Permitting and Plan Review

We plan to contract an outside firm to obtain the necessary approvals and licenses for necessary compliance including application fees, plan review for compliance with codes, safety regulation and zoning requirement, inspection fees, environmental permits and impact fees and legal fees. Based on similar capital projects, NAU Facility Services estimates, the cost of permitting and plan review to be \$449,017 (\$224,509 in Y1 and \$224,509 in Y2).

Other expenses

Mandatory Insurance for capital construction projects: State required project insurance is 0.34% of estimated total project construction costs for the solar and battery planned activities. Cost is estimated ($0.34\% \times \$11,225,434$) for \$38,166 (\$19,083 in Y1 and \$19,083 in Y2).

Site costs for capital construction projects:

Because these sites are revenue generating locations on campus run by a separate university cost center, we will need to pay to close these sites during Geotech surveys and the construction and commissioning of the projects. Given the scope of work and the areas to be restricted or closed, NAU facility services estimates project costs of \$446,298 (\$223,148 in Y1 and \$223,148 in Y2).

Indirect Costs

Indirect costs are requested at the other on campus sponsored activity rate of 29.4% MTDC in accordance with Northern Arizona University's approved Colleges and Universities Rate Agreement (June 29, 2023) (Cognizant Agency: U.S. Dept. of Health and Human Services). The MTDC base consists of all salaries and wages, fringe benefits, materials, supplies, services, travel and subgrants and subcontracts up to the first \$25,000 of each subgrant or subcontract (regardless of the period covered by the subgrant or subcontract). Modified total direct costs shall exclude equipment, capital expenditures, charges for patient care, participant support costs, student tuition remission, rental costs of off-site facilities, scholarships, and fellowships as well as the portion of each subgrant and subcontract in excess of \$25,000.

Cost Share contributions

NAU contributions listed above under the electric vehicle measure consist of monies available for planned vehicle replacements that will contribute to successful implementation of the project scope. The total of these contributions are \$560,000 for bus charging infrastructure and bus and vehicle replacement.

University of Arizona Budget Justification

UArizona will conduct a formal, sealed competitive Request for Proposals (RFP) process, as is required with any purchase exceeding \$100,000. RFP evaluations are based on award criteria within the RFP including but not limited to quality, delivery, and price. As noted in Section 5, UArizona will also prioritize vendors that demonstrate strong environmental sustainability practices, support local and disadvantaged communities, and contribute to the advancement of clean and renewable energy technologies to the largest extent possible.

As with all other significant construction projects that UArizona manages, funds will be released to vendors according to pre-determined schedules and based upon satisfactory work completion per agreed upon contracts created following the RFP process.

This was built using the following estimates and assumptions. Additional documentation for these estimates can be found in the University of Arizona Supporting Budget Documentation below.

Carport Solar Installations

Each solar installation was strategically selected to optimize the usable area for solar energy, minimizing long-term conflicts such as roof replacements and planned building projects, while also enhancing the long-term potential for fleet electrification.

- **Installed system capacity (kW)**
 - Square feet of parking lot * 70% usable space * 0.011kW/square foot = installed system capacity (kW)
 - Example (Lot 4052, UA_S2): 80,900 square feet * 70% * 0.011kW/square foot = **623kW**
- **Annual production (kWh)**
 - Installed system capacity * 1850kWh/year for 1kW of solar production in Tucson, Arizona = annual production (kWh)
 - Example (Lot 4052, UA_S2): 623kW * 1800kWh/year for 1kW of solar production = **1,993,376kWh**
- **Estimated cost (\$)**
 - Installed system capacity * \$3,200/kW = estimated cost
 - Example (Lot 4052, UA_S2): 623kW * \$3,200/kW = **\$1,034,880**
- **Construction Contingency (\$)**
 - 13% of the estimated construction costs to cover unforeseen expenses, including cost escalation of installed equipment.

Battery Storage Installations

Each battery system was sized to match the corresponding solar installation, ensuring that the solar array could consistently charge the battery throughout the year. This alignment enables the battery to be used effectively during peak electrical periods, maximizing its contribution to reducing greenhouse gas emissions.

- 8-hour discharge, 300kW (2,400 kWh) system: **\$3,295/kW**
- 4-hour discharge, 300kW (1,200 kWh) system: **\$2,035/kW**
- 2-hour discharge, 300kW (600 kWh) system: **\$1,596/kW**

- Construction contingency - 13% of the estimated construction costs to cover unforeseen expenses.

Electric Vehicle Charging Infrastructure

The electric vehicle charging infrastructure was strategically positioned alongside proposed solar and battery systems, which will also accommodate a substantial number of fleet vehicles and the University of Arizona's on-campus transit system.

- Level 2, dual-port commercial electric vehicle charger:
 - Charger cost: **\$9,200**
 - Installation cost: **\$4,400**
 - Construction contingency - 13% of the estimated construction costs to cover unforeseen expenses.
- Level 3 (150kW), dual-port commercial electric vehicle charger:
 - Charger cost: **\$91,400**
 - Installation cost: **\$94,000**
 - Construction contingency - 13% of the estimated construction costs to cover unforeseen expenses.

Electric Vehicle Replacement

Refer to the University of Arizona Supporting Budget Documentation for a list of fleet vehicles proposed for replacement, their replacements, and the budget details for each vehicle.

UArizona has allocated funds to replace two buses in its on-campus transit system. We commit to sharing the cost of this portion of the proposal at a rate of \$306,822 while requesting \$385,034 through this grant opportunity to support the incremental cost between the budgeted amount for a traditional internal combustion bus and its electric equivalent.

- Internal combustion option: \$153,411
 - $\$153,411 \times 2 = \mathbf{\$306,822 \text{ that UArizona will commit}}$
- Electric option: \$345,928
- Incremental cost: \$192,517
 - $\$192,517 \times 2 = \mathbf{\$385,034 \text{ that is requested through CPRG funding}}$

Indirect Costs

Total indirect costs: \$3,953,610.

Indirect costs are calculated on Modified Total Direct Costs (MTDC) using rates approved by US Department of Health and Human Services (DHHS). The University's Rate Agreement was approved on January 24th, 2024 at 38% of Modified Total Direct Costs (MTDC) for on-campus other sponsored activity projects. MTDC includes salaries and wages, fringe benefits, materials and supplies, services, travel, and the first \$25,000 of each subaward. Exclusions from MTDC include graduate student tuition remission, participant support, facility rental, subawards over the first \$25,000, capital equipment, and scholarships/fellowships.

Cost Share

The University of Arizona will be committing \$306,822 in cost share towards this project.

University of Arizona Supporting Budget Documentation

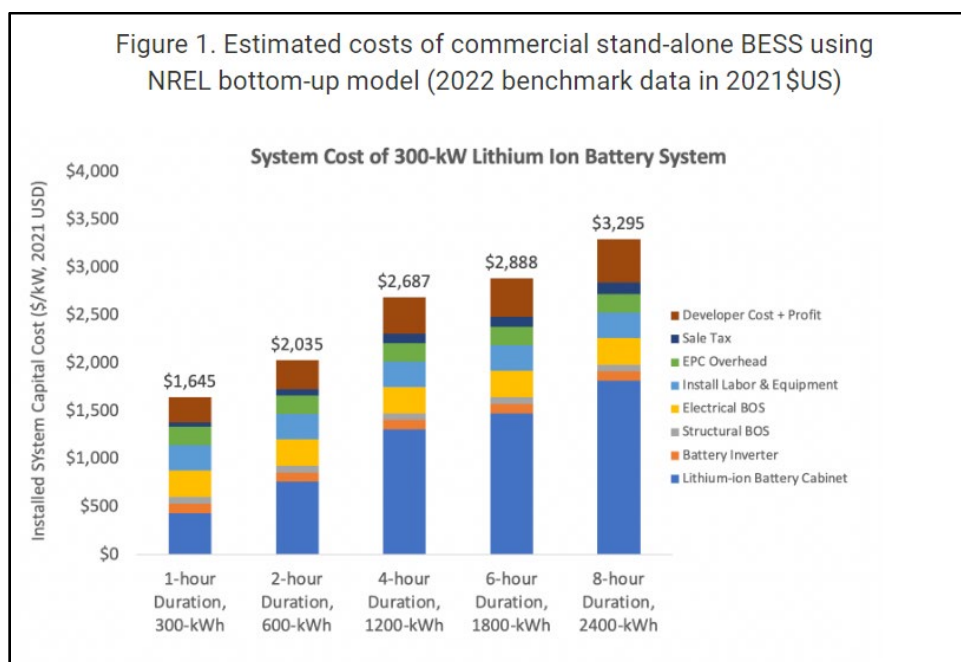
Carport Solar Installations

We based our cost estimate for carport solar installations on confidential bids from a peer institution's request for proposals process which had a similar scope. The bids ranged from \$2,500-\$3,500/kW of installed capacity, predominantly clustering between \$3,000 and \$3,500. Therefore, we adopted \$3,250/kW as our reference figure.

Battery Storage Installations

The National Renewable Energy Laboratory provides the following cost estimates for commercial battery storage costs in their Annual Technology Baseline assessment, with each of the following used in our cost estimates (see Figure 1 for more information):

- 8-hour discharge, 300kW (2,400 kWh) system: \$3,295/kW
- 4-hour discharge, 300kW (1,200 kWh) system: \$2,035/kW
- 2-hour discharge, 300kW (600 kWh) system: \$1,596/kW



https://atb.nrel.gov/electricity/2023/commercial_battery_storage

Electric Vehicle Charging Infrastructure

The National Renewable Energy Laboratory provides the following cost estimates for electric vehicle supply equipment (EVSE) costs in their publication, "The 2030 National Charging Network: Estimating U.S. Light-Duty Demand for Electric Vehicle Charging Infrastructure," with each of the following used in our cost estimates. We confirmed these estimates with an electric vehicle and electric vehicle charger vendor (see Table 5 for more information):

- L2 commercial, dual port charger:
 - Charger: \$9,200
 - L2 commercial high estimate - $\$4,600 \times 2 = \$9,200$
 - Installation: \$4,400
 - L2 commercial low estimate - $\$2,200 \times 2 = \$4,400$
- DC 150kW (L3 commercial), dual port charger:
 - Charger: \$91,400
 - The vendor we consulted provided an estimate of \$80,000-\$90,000 for a dual port L3 commercial charger, so this figure was not doubled as was done with the L2 commercial charger.
 - Installation: \$94,000

Charger Hardware		Unit Cost per Port	Install Cost per Port ^a	References
L1 residential	Low: High:	\$0 \$0 ^b	\$100 \$1,000	(Fixr.com 2022; Courtney 2021; HomeAdvisor 2022)
L2 residential	Low: High:	\$400 \$1,200	\$500 \$1,700	(Borlaug et al. 2020; Fixr.com 2022; Courtney 2021; HomeAdvisor 2022)
L2 commercial	Low: High:	\$2,200 \$4,600	\$2,200 \$6,000	(Nicholas 2019; Nelder and Rogers 2019; Borlaug et al. 2020; Bloomberg New Energy Finance 2020; Pourmazeri 2022)
DC 150 kW	Low: High:	\$66,400 \$102,200	\$45,800 \$94,000	(Nicholas 2019; Nelder and Rogers 2019; Borlaug et al. 2020; Bloomberg New Energy Finance 2020; Borlaug et al. 2021; Gladstein, Neandross & Associates 2021; Bennett et al. 2022)
DC 250 kW	Low: High:	\$91,400 \$134,800	\$54,750 \$105,950	Inferred from DC 150-kW and 350-kW costs
DC 350+ kW	Low: High:	\$116,400 \$167,400	\$63,700 \$117,900	(Nicholas 2019; Bloomberg New Energy Finance 2020; Borlaug et al. 2021; Gladstein, Neandross & Associates 2021; Bennett et al. 2022)

^a These ranges do not span the set of all possible situations. They are meant to be plausible optimistic (low) and pessimistic (high) estimates for assessing network capital costs at scale. In some cases, it was not possible to verify exactly what was included within each study's estimate for installation costs, thus some discrepancies may be present across sources.

^b L1 chargers tend to be included with the purchase of a PEV and are thus excluded as an infrastructure cost from this analysis.

<https://www.nrel.gov/docs/fy23osti/85654.pdf> (page 33)

Electric Vehicle Replacement

We based our cost estimates for light-duty electric vehicles on manufacturer prices provided on their websites. Heavy-duty electric bus cost estimates were based on a contract with the State of Arizona.

- Ford F-150 Lightning: \$50,000
 - <https://www.ford.com/trucks/f150/f150-lightning/?gnav=header-trucks-vhp>
- Polaris XP Kinetic Premium: \$30,000
 - <https://www.polaris.com/en-us/off-road/ranger/models/ranger-xp-kinetic/?model=ranger-xp-kinetic-premium&option=3-SEAT&trim=icy-white-pearl>
- Vantage Vehicle: \$20,000

- <https://www.vantagevehicle.com/copy-of-eactive>
- John Deere, TE 4x2 EV: \$15,500
 - <https://www.deere.com/en/gator-utility-vehicles/traditional-gators/te-4x2-electric-utility-vehicle/>
- Chevy Bolt: \$26,500
 - <https://www.chevrolet.com/electric/bolt-ev>
- Ford E-Transit, Low Roof: \$50,000
 - <https://shop.ford.com/configure/e-transit/model/customize/?intcmp=vhp-bb-fbc>
- Ford E-Transit, High Roof: \$55,000
 - <https://shop.ford.com/configure/e-transit/model/customize/?intcmp=vhp-bb-fbc>