



Appendices

Appendix A: Survey Instrument

The following is the survey given to respondents as delivered by surveyors. This was reviewed and approved by the Office of Management and Budget for the Paperwork Reduction Act of 1980.

Introduction:

Hello, my name is _____ and I am calling on behalf of the United States Department of Energy. We are conducting a national survey about the energy, energy-related, and advanced manufacturing industries. May I please speak to the person most knowledgeable about staffing at [organization]?

Is now a convenient time?

This survey uses specific terms to describe various technologies and activities. If you require any definitions for clarification, please ask me at any time.

The survey is **voluntary** and can take up to 45 minutes of your time.

(If needed): This important survey addresses businesses that research, develop, manufacture, install or work with products that generate, distribute or save energy.

(If needed): This includes organizations involved in fossil and renewable energy production, energy efficiency products and services, motor vehicles, solar, wind, fossil and other energy sources, and other energy related products and services.

(If needed): Your individual responses will **not** be published; only aggregated information will be used in reporting the survey results.

(If needed): Your participation will help determine how investments of time and money should be made to support the industry and prepare the present and future labor pool.

(If needed): If you have any questions about DOE's involvement in this survey, please contact David Keyser at [insert phone]

Paperwork Reduction Act Burden Disclosure Statement

These data are being collected to allow energy-related employment to be assigned by primary value chain activity, including: research and development; manufacturing; sales and distribution; installation, repair and maintenance; and professional services. It will also provide insight on workforce demographics and employers' ability to recruit qualified workers.

The data you supply will be used by industry, training organizations, community colleges, job seekers, federal agencies and other stakeholders, to better inform the workforce development system by highlighting changes in the industry that are driving demand for workers. The data will also inform energy economic development planning activities at the local, state and regional levels by providing a more detailed assessment of energy jobs, as well as the changing energy landscape and how such changes influence labor markets.

Public reporting burden for this collection of information is estimated to up to 45 minutes, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Office of the Chief Information Officer, Enterprise Policy Development & Implementation Office, IM-22, Paperwork Reduction Project OMB Control Number 1910-5179, U.S. Department of Energy, 1000 Independence Ave SW, Washington, DC, 20585-1290; and to the Office of Management and Budget (OMB), OIRA, Paperwork Reduction Project OMB Control Number 1910-5179, Washington, DC 20503.

Notwithstanding any other provision of the law, no person is required to respond to, nor shall any person be subject to a penalty for failure to comply with a collection of information subject to the requirements of the Paperwork Reduction Act unless that collection of information displays a currently valid OMB control number.

Submission of this data is voluntary.

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A. Does your organization have at least one location with employees in the United States, including territories? (Please count yourself as an employee if you are an owner-operated business or sole proprietor).

- 1 Yes [CONTINUE]
- 2 No [TERMINATE]

For this survey, please only answer for your current business location. If your organization has other U.S. locations, please do not include their data. What is the zip code of your current location? [SHOW ADDRESS FROM SAMPLE FILE]

_____ (Accept all five-digit responses)

(DON'T READ) Have check box for Refused (Terminate if Refused)

- B. Is your organization involved, in whole or part, with an activity related to energy? (PAUSE, IF UNSURE OR NO READ REMAINDER OF QUESTION, IF YES GO TO SC) We define this as being directly involved with researching, developing, producing, manufacturing, distributing, selling, implementing, installing, or repairing components, goods or services related to Electric Power Generation; Electric Power Transmission, Distribution, and Storage; Energy Efficiency, Including Heating, Cooling and Building Envelope; Fuels, including Extraction, Processing, Production, and Distribution; and Transportation, including Motor Vehicles. This also includes supporting services such as consulting, finance, tax, and legal services related to energy.

- 1 Yes [CONTINUE]
- 2 No [TERMINATE]
- 3 Not sure [TERMINATE]

- C. Which of the following industries describes your organization's work? [ALLOW MULTIPLE RESPONSES] [IF NEEDED: If your organization is involved in energy research or professional services for the industry, please select the options that are most relevant to your organization.]

1. Electric Power Generation
2. Electric Power Transmission and Distribution, including electric vehicle charging stations
3. Storage, including electric vehicle batteries
4. Energy Efficiency, Including Heating, Cooling and Building Envelope (IF NEEDED THIS INCLUDES THERMAL OR HOT WATER SOLAR)
5. Fuels
6. Transportation Vehicles, including Motor Vehicles (IF NEEDED: Including industrial and agricultural vehicles, such as forklifts, tractors, and recreational vehicles, such as golf carts)
7. Component Parts for Transportation Vehicles
8. Carbon Capture and Storage
9. Other (Specify _____) TERMINATE
10. DK/NA TERMINATE

[ASK SCREENER D IF SC COUNT>1]

- D. Which do you consider your organization's **primary** industry, based on the majority of labor hours performed at your location? [PIPE IN SC CATEGORIES, ACCEPT ONE]

1. Electric Power Generation
2. Electric Power Transmission and Distribution, including electric vehicle charging stations
3. Storage, including electric vehicle batteries
4. Energy Efficiency, Including Heating, Cooling and Building Envelope (IF NEEDED THIS INCLUDES THERMAL OR HOT WATER SOLAR)
5. Fuels
6. Transportation, including Motor Vehicles (IF NEEDED: Including industrial and agricultural vehicles, such as forklifts, tractors, and recreational vehicles, such as golf carts)
7. Component Parts for Transportation Vehicles
8. Carbon Capture and Storage

CREATE **SDPRIME** FROM SC IF SC COUNT=1, OR SD IF SC COUNT>1

E. [ASK FOR EACH SC] Which of the following [INSERT SC RESPONSE] technologies is your organization directly engaged with? [READ LIST, ALLOW MULTIPLE RESPONSES]

A. Electric Power Generation (IF SC=1) [RANDOMIZE]

1. Solar Electric Generation [SET SOLAR=1]
2. Land-based Wind Generation
3. Offshore Wind Generation
4. Geothermal Generation
5. Bioenergy/Bioenergy Generation
6. Low-Impact Hydroelectric Generation including Wave/Kinetic Generation
7. Traditional Hydroelectric Generation
8. Advanced/Low Emission Natural Gas
9. Nuclear Generation
10. Coal Generation
11. Oil and other Petroleum Generation
12. Natural Gas Generation
13. Combined Heat and Power
14. Other Generation (Specify)

B. Electric Power Transmission and Distribution (IF SC=2) [RANDOMIZE]

1. Traditional Transmission and Distribution
2. Electric Vehicle Charging Stations
3. Smart Grid
4. Micro Grids
5. Other Grid Modernization
6. Other (Specify)

C. Storage (IF SC=3) [RANDOMIZE] [IF SEA=1, “(including battery storage for solar generation)”

1. Pumped hydro-power storage
2. Battery storage, including electric vehicle batteries [IF SEA=1, “(including battery storage for solar generation)”
3. Mechanical storage (flywheels, compressed air energy storage, etc.)
4. Thermal storage
5. Liquefied natural gas
6. Compressed natural gas
7. Crude oil
8. Refined petroleum fuels (liquid)
9. Refined petroleum fuels (gas)
10. Coal storage (piles, domes, etc.)
11. Biofuels, including ethanol and biodiesel
12. Nuclear fuel
13. Other gas fuel (Specify)
14. Other liquid fuel (Specify)
15. Other Storage
16. Other (Specify)

IF SEC=2, ASK C_2 AND C_3

C_2. What type of Battery Storage do you work with? [READ LIST, ALLOW MULTIPLE RESPONSES] [RANDOMIZE]

1. Lithium batteries
2. Lead-based batteries
3. Other solid-electrode batteries (Specify)
4. Vanadium redox flow batteries
5. Other flow batteries (Specify)

C_3. What is the application of your battery storage work? [READ LIST, ALLOW MULTIPLE RESPONSES] [RANDOMIZE]

1. Consumer devices
2. Vehicles or other transportation (including electric vehicles)
3. Behind-the-meter (buildings or industrial facilities)
4. Front-of-meter (electric grid)
5. Other (Specify)

D. Energy Efficiency, Including Heating, Cooling and Building Envelope (IF SC=4) [RANDOMIZE]

1. ENERGY STAR® Certified Appliances (not including HVAC)
2. ENERGY STAR Certified Heating, Ventilation, and Cooling (HVAC), except air-source and ground-source heat pumps
3. ENERGY STAR Air-Source Heat Pumps
4. ENERGY STAR Ground-source or geothermal heat pumps
5. Other high efficiency HVAC that are out of scope for ENERGY STAR certification (e.g. indirect evaporative coolers, air to water heat pumps, energy recovery systems, etc.)
6. Traditional HVAC goods, control systems, and services
7. ENERGY STAR certified water heaters
8. ENERGY STAR Certified Electronics (TVs, Telephones, Audio/Video, etc.)
9. ENERGY STAR Certified Windows, Doors and Skylights
10. ENERGY STAR Certified Roofing
11. ENERGY STAR Certified Insulation
12. Air sealing
13. ENERGY STAR Certified Commercial Food Service Equipment
14. ENERGY STAR Certified Data Center Equipment
15. ENERGY STAR Certified LED lighting
16. Other LED, CFL, and efficient lighting
17. Solar thermal water heating and cooling [SET SOLAR=1]
18. Other renewable heating and cooling (bioenergy, etc.)
19. Advanced building materials/insulation
20. Recycled building materials
21. Reduced water consumption products and appliances
22. Energy auditing services
23. Other (Specify)

E. Fuels (IF SC=5) [RANDOMIZE]

1. Coal
2. Onshore petroleum, including gasoline and diesel
3. Offshore petroleum, including gasoline and diesel
4. Onshore natural gas
5. Offshore natural gas
6. Other Fossil Fuel

7. Corn Ethanol
8. Renewable Diesel
9. Biodiesel
10. Other Ethanol/Non-Woody Biomass
11. Woody Biomass/Cellulosic Biofuel
12. Waste Fuels
13. Other Biofuels
14. Nuclear Fuel
15. Other (Specify)

ASK EA IF SEE = 2 & 3

EA. Do you primarily work with onshore or offshore petroleum?

1. Onshore petroleum
2. Offshore petroleum
3. Don't know/ Refused

ASK EB IF SEE = 4 & 5

EB. Do you primarily work with onshore or offshore natural gas?

1. Onshore natural gas
2. Offshore natural gas
3. Don't know/ Refused

F. Transportation Vehicles, Including Motor Vehicles (IF SC=6) [RANDOMIZE]

1. Gasoline and Diesel Motor Vehicles (excluding freight transport)
2. Hybrid Electric Vehicles
3. Plug-In Hybrid Vehicles
4. Electric Vehicles
5. Natural Gas Vehicles
6. Hydrogen Vehicles
7. Fuel Cell Vehicles
8. Other (Specify _____)

G. Component Parts for Transportation Vehicles (IF SC=7) [RANDOMIZE]

1. Transportation Vehicle Engine & Drive Parts
2. Transportation Vehicle Exhaust System Parts
3. Transportation Vehicle Body Parts
4. Other Transportation Vehicle Parts (Specify _____)

SET SOLAR=1 IF SEA=1 OR 2, OR TSF=1, AND SED=5

IF SE TOTAL>1, ASK SEPRIME, IF NOT, SKIP

SEPRIME. Which of the following technologies is your organization *PRIMARILY* engaged with?

[PIPE-IN RESPONSES FROM SEA-SEG]

[IF RESPONDENT ONLY IDENTIFIES WITH ONE INDUSTRY AT SCREENER E (QC), USE THAT INDUSTRY FOR THE REMAINDER OF THE SURVEY IN PLACE OF “ENERGY” / IF MORE THAN ONE, CONTINUE TO USE “ENERGY.” EXCEPTION - IF THE ONLY SELECTION AT SCREENER C IS “OTHER” OR “DK/NA,” USE “ENERGY”]

F. Which of the following industry descriptions describe your organization’s focus as it relates to the [energy/ SC] industry? [ALLOW MULTIPLE RESPONSES]

1. An organization involved in agricultural goods and services
2. An organization involved in mining and extraction
3. An organization that manufactures and/or assembles [energy/ SC] goods or produces components that go into energy products
4. An organization that conducts research and development and related services for [energy/ SC]
5. An organization involved in the wholesale trade and distribution of [energy/ SC] products and services
6. An organization that installs [energy/ SC] systems or provides services for installation of [energy/ SC] systems
7. A public or private utility
8. An organization that provides consulting, engineering, finance, legal, or other professional services related to energy
9. An organization that conducts operations and maintenance (O&M) for [energy/ SC] systems
10. An organization primarily involved in education and training
11. Other support services (Specify: _____)
12. Other (Specify: _____)
13. (DON'T READ) Not sure

[ASK SCREENER G IF MORE THAN ONE SELECTED AT SCREENER F]

G. Which do you consider your organization's **primary** focus as it relates to the [energy/ SC] industry, based on the labor hours performed at your location

1. An organization involved in agricultural goods and services
2. An organization involved in mining and extraction
3. An organization that manufactures and/or assembles [energy/ SC] goods or produces components that go into energy products
4. An organization that conducts research and development and related services for [energy/ SC]
5. An organization involved in the wholesale trade and distribution of [energy/ SC] products and services
6. An organization that installs [energy/ SC] systems or provides services for installation of [energy/ SC] systems
7. A public or private utility
8. An organization that provides consulting, engineering, finance, legal, or other professional services related to energy
9. An organization that conducts operations and maintenance (O&M) for [energy/ SC] systems
10. An organization primarily involved in education and training
11. Other support services (Specify: _____)
12. Other (Specify: _____)
13. (DON'T READ) Not sure

SET SGPRIME BASED ON SCREENER G RESPONSE OR SCREENER F RESPONSE IF SCREENER F COUNT=1

ASK SFA IF SEA=14 **OR** SEB=6 **OR** SEC = 13, 14, 15, OR 16 **OR** SEE = 15, **AND** SF = 4, 8, OR 10

SFA. Does your organization work with hydrogen fuel in any capacity?

- 1. Yes (Please specify)_____
- 2. No
- 3. Don't know/ Refused

ASK SGA IF SC=4, OR IF SF = 4, 6, 8, OR 9

SGA. Is your organization considered an Energy Service Company (ESCO)?

- 1. Yes
- 2. No
- 3. Don't know/ Refused

IF SGPRIME=6, ASK SCREENER H, OTHERWISE SKIP

H. Does your organization work on ENERGY STAR certified new home construction?

- 1. Yes
- 2. No
- 3. DK/NA

I. Does your organization work on ENERGY STAR certified buildings and plants (commercial and industrial)?

- 1. Yes
- 2. No
- 3. DK/NA

J. Does your organization have an energy manager or director responsible for energy management at one or more facilities?

- 1. Yes
- 2. No
- 3. DK/NA

IF SGPRIME=7, ASK SCREENER K

K. Does your organization employ workers that are in charge of administering, managing, evaluating, or otherwise working on utility-led energy efficiency programs, rebates, and other activities?

- 1. Yes
- 2. No
- 3. DK/NA

.....

For this survey, we will just be asking about the employees that work from or directly report to your current location.

- 1. Including all full-time and part-time employees, how many permanent employees work at or from your current location?

Record # of employees _____

(DON'T READ) Have check box for Refused

- 2. Based on [Take Q1 #] full-time and part-time permanent employees at your location, how many employees do you expect to have at your location 12 months from now?

- 1 More [record # _____]
2 Fewer [record # _____]
3 (DON'T READ) Same number
4 (DON'T READ) Refused

[If amount differs by 10% or more in either direction, ask:]

Just to confirm, you currently have _____ permanent employees at your current location and you expect to have _____ (more/fewer) employees, for a total of _____ permanent employees 12 months from now.

- 3. Of the [Take Q1 #] full time and part-time permanent employees at your current location, how many of these workers support the [energy/ SC] portion of your business? Please note that your response should include administrative staff supporting the energy portion of your business.

Record # of employees _____

(DON'T READ) Have check box for Refused

[IF NEEDED: SUPPORT WORKERS ARE DEFINED AS THOSE INDIVIDUALS THAT SPEND ANY AMOUNT OF TIME, DIRECTLY WORKING ON ENERGY RELATED PROJECTS INCLUDING ADMINSTRATIVE SUPPORT WORKERS]
[Q3 SHOULD BE LESS THAN OR EQUAL TO Q1 - BUILD IN CHECK]

- 4. Of your [Take Q3 #] energy staff at your location (office staff and in the field), please classify them into the area where they spent most of their time over the last 12 months. Please count each employee only once.

- a. In-state within your region/metropolitan area [Record #] _____
b. In-state outside your region/metropolitan area [Record #] _____
c. Out-of-state [Record #] _____

- 5. How many full-time and part-time permanent employees did you have working at your current location 12 months ago that supported the [energy/ SC] portion of your business?

Record # of employees _____

(DON'T READ) Have check box for Refused

6. Based on [Take Q3 #] full-time and part-time permanent employees at your location that support the [energy/SC] portion of your business, how many employees do you expect to have at your location 12 months from now?

- 1 More [record # _____]
- 2 Fewer [record # _____]
- 3 (DON'T READ) Same number
- 4 (DON'T READ) Refused

Just to confirm, you currently have ____ permanent employees supporting the energy portion of your business and you expect that number to be _____ (more/fewer) 12 months from now, for a total of ____

7. Thinking of your [INSERT Q3] energy employees, how many spend at least 50% of their time supporting the energy portion of your business?

8. Thinking of your [Q3 ANSWER] energy employees, how many spend all of their time supporting the energy portion of your business?

Record: _____

SECTION 2 – Workforce Profile Questions

If SC COUNT > 1 response, ASK Q9

9. Thinking of your [Take Q3] [energy/ SC] workers at your location, please classify them in the following categories. Please count each employee only once and categorize them in the area where they spend the most time.

PIPE IN SCREENER C RESPONSES

Record # of employees _____

If SC COUNT > 1 response and Q7>0, ASK Q0

Thinking of your [Take Q7] [energy/ SC] workers that spend at least 50% of their time supporting the energy portion of your business, please classify them in the following categories. Please count each employee only once and categorize them in the area where they spend the most time.

PIPE IN SCREENER C RESPONSES AND EMPLOYMENT FROM Q8

Record # of employees _____

BUILD CHECK SO TOTAL MUST = Q7

IF SC = 1 and Screener E.A > 1 response, ASK Q10 OTHERWISE SKIP

USE Q3 IN PLACE OF Q9 IF SELECTED COUNT AT SCREENER C WAS ONE (ONE CHOICE)

10. Thinking of your [PIPE IN Q9/Q3 GENERATION ANSWER] energy generation workers at your location, please classify them in the following categories. Please count each employee only once and categorize them in the technology area where they spend the most time.

PIPE IN SCREENER E.A RESPONSES

Record # of employees _____

IF SC = 2 and Screener E.B > 1 response, ASK Q11 OTHERWISE SKIP

11. Thinking of your [PIPE IN Q8/Q3 ELECTRIC POWER TRANSMISSION AND DISTRIBUTION ANSWER] energy transmission, distribution, and storage workers at your location, please classify them in the following categories. Please count each employee only once and categorize them in the technology area where they spend the most time.

PIPE IN SCREENER E.B RESPONSES

Record # of employees _____

IF SC = 3 and Screener E.C > 1 response, ASK Q12 OTHERWISE SKIP

12. Thinking of your [PIPE IN Q9/Q3 STORAGE ANSWER] storage workers at your location, please classify them in the following categories. Please count each employee only once and categorize them in the technology area where they spend the most time.

PIPE IN SCREENER E.C RESPONSES

Record # of employees _____

IF Q12_2(BATTERY STORAGE)>0, ASK Q13

13. Thinking of your [PIPE IN Q12_2 #] battery storage workers at your location, please classify in them in the following categories. Please count each employee only once and categorize them in the battery storage application category where they spend the most time.

1. Consumer devices [Record # of employees]
2. Vehicles or other transportation [Record # of employees]
3. Buildings or industrial facilities [Record # of employees]
4. Electric Grid [Record # of employees]
5. Other (Specify) [Record # of employees]

IF SC = 4 and Screener E.D > 1 response, ASK Q14 OTHERWISE SKIP

14. Thinking of your [PIPE IN Q9/Q3 ENERGY EFFICIENCY, INCLUDING HEATING, COOLING AND BUILDING ENVELOPE ANSWER] energy efficiency, including heating, cooling and building envelope, workers at your location, please classify them in the following categories. Please count each employee only once and categorize them in the technology area where they spend the most time.

PIPE IN SCREENER E.D RESPONSES

Record # of employees _____

IF SC = 5 and Screener E.E > 1 response, ASK Q15 OTHERWISE SKIP

15. Thinking of your [PIPE IN Q9/Q3 FUELS ANSWER] fuels-related workers at your location, please classify them in the following categories. Please count each employee only once and categorize them in the technology area where they spend the most time.

PIPE IN SCREENER E.E RESPONSES

Record # of employees _____

IF SC = 6 and Screener E.F > 1 response, ASK Q16 OTHERWISE SKIP

16. Thinking of your [PIPE IN Q9/Q3 TRANSPORTATION VEHICLES ANSWER] motor-vehicle related workers at your location, please classify them in the following categories. Please count each employee only once and categorize them in the technology area where they spend the most time.

PIPE IN SCREENER E.F RESPONSES

Record # of employees _____

IF SC = 5 and Screener E.G > 1 response, ASK Q17 OTHERWISE SKIP

17. Thinking of your [PIPE IN Q9/Q3 COMPONENT PARTS ANSWER] energy generation workers at your location, please classify them in the following categories. Please count each employee only once and categorize them in the technology area where they spend the most time.

PIPE IN SCREENER E.G RESPONSES

Record # of employees _____

Demographic questions

18. Thinking of your [Take Q3] [energy/ SC] employees, how many are:

- a) Male: Record # employees _____
- b) Female: Record # of employees _____
- c) Gender non-binary: Record # of employees _____
- d) (DON'T READ) Refused

Q18 a+b must = Q3

19. Thinking of your [Take Q3] [energy/ SC] employees, please indicate the ethnicity:

- (a) Hispanic
- (b) Not Hispanic or Latinx
- (c) (DON'T READ) Refused

Q19 a+b must = Q3

20. Thinking of your [Take Q3][energy/SC] employees, please indicate the race and choose all that apply:

- a) American Indian or Alaskan Native: Record # of employees _____
- b) Asian: Record # of employees _____
- c) Black or African American, not Indigenous: Record # of employees _____
- d) Black Indigenous: Record # of employees _____
- e) Native Hawaiian or other Pacific Islander: Record # of employees _____
- f) White Record # of employees _____

- g) Two or more races: Record # of employees _____
- h) (DON'T READ) Refused

Q20 a-f must = Q3

21. Thinking of your [Take Q3] [energy/ SC] employees, how many:

- a) Are Veterans of the U.S. Armed Forces Record # of employees _____
- b) Are 55 and over Record # of employees _____
- c) Represented by Unions, Collective Bargaining Agreements, and/or Project Labor Agreements Record # of employees _____
- d) Identify as LGBTQ+
- e) Have a disability that requires accommodation
- f) Were formerly incarcerated
- g) (DON'T READ) Refused

22. Thinking of the current [Take Q3] [energy/ SC] employees at your location, how many are in the following occupational categories?

(Please only assign one category to each employee that supports the [energy/ SC] portion of your business. If they fall into more than one category, please assign them to the category in which they devote more of their time.)

- a. Mining and Extraction Field positions (includes oil field workers, miners, etc.)
- b. Production/Manufacturing positions (includes workers in refineries and assembly workers and those involved in the design, quality control and manufacturing process)
Record # of employees _____
(DON'T READ) Have check box for Refused
- c. Installation or repair positions (includes technicians, building trades people, and supervisors that are working at project site)
Record # of employees _____
(DON'T READ) Have check box for Refused
- d. Administrative positions (includes customer service representatives, clerks, office and operations support)
Record # of employees _____
(DON'T READ) Have check box for Refused
- e. Management/Professional positions (**does not include** those supervisors that spend a majority of their time at project sites or sales managers)
Record # of employees _____
(DON'T READ) Have check box for Refused
- f. Sales positions (includes cost estimators, sales representatives and sales managers)
Record # of employees _____
(DON'T READ) Have check box for Refused

g. Other (Specify: _____)
Record # of employees _____

(DON'T READ) Have check box for Refused

(CREATE INTERNAL CONTROL SO Q22 A+B+C+D+E+F+G EQUALS Q3]

SECTION 3 – Workforce Development & Training Needs

24. How many energy workers have you hired over the last 12 months, either for new positions or to replace former workers?

Record _____

IF Q24>0, ask Q25-28 otherwise SKIP

25. Thinking of the [Insert Q24] energy workers that you have hired at your location over the last 12 months, please indicate your level of difficulty finding qualified applicants to fill the positions.

- 1. Very difficult
- 2. Somewhat difficult
- 3. Not at all difficult
- 4. DK/NA

IF Q25 = 1 or 2 ask Q26 and Q27, otherwise SKIP

26. What are the two most significant reasons for the reported difficulty?

27. Please provide the two most difficult positions for your organization to fill at your location.

28. You reported [insert Q24] additional workers at your organization over the last 12 months. Of these [insert Q24] positions, how many:

a. Were newly created positions?
Record # of employees _____

b. Were existing employees that added energy responsibilities?
Record # of employees _____

c. Were hired to replace workers due to turnover or retirement?
Record # of employees _____

d. Were positions that required previous work experience related to the position?
Record # of employees _____

e. Required a bachelor's degree or beyond: _____

Record # of employees _____

f. Required an associate degree or academic certificate from an accredited college, but not a bachelor's degree: _____

Record # of employees _____

g. Required a vocational or technical postsecondary certificate or credential:

Record # of employees _____

h. Are represented by a union, collective bargaining agreement, or a project labor agreement: _____

Record # of employees _____

29. Does your firm have a formal or informal mentorship/sponsorship program?

- 1. Yes
- 2. No
- 3. DK/NA

30. Briefly describe the mentorship/sponsorship program?

31. Has your firm adopted any specific strategies, policies, or programs to increase the number of female hires?

- 1. Yes
- 2. No
- 3. DK/NA

IF Q31 = 1, ASK Q32

32. Briefly describe the strategies, policies, or programs to increase female hires?

33. Has your firm adopted any specific strategies, policies, or programs to increase the number of ethnic or racial minority hires?

- 1. Yes
- 2. No
- 3. DK/NA

IF Q33 = 1, ASK Q34

34. Briefly describe the strategies, policies, or programs to increase minority hires?

35. Has your firm adopted any specific strategies, policies, or programs to increase the number of LGBTQ+ hires?

1. Yes
2. No
3. DK/NA

IF Q35 = 1, ASK Q36

36. Briefly describe the strategies, policies, or programs to increase LGBTQ+ hires?

37. Does your firm offer or require a diversity and/or inclusion training program aimed at advocating workplace diversity and inclusion?

1. Yes
2. No
3. DK/NA

SECTION 4 – Business Questions

38. The following is a list of factors that may contribute to difficulty growing a profitable business. Please rate the significance of each factor. [READ ITEM, THEN SAY] is it very significant, somewhat significant, or not at all significant. [RANDOMIZE]

- a. Lack of capital
- b. Lack of qualified talent
- c. Poor demand
- d. Cost or supply of materials
- e. Permitting delays
- f. Interconnection delays
- g. Policy challenges

39. Thinking about your organization's energy related suppliers and vendors, what percent of your supply chain purchases (in dollars/value), are:

- a. In-state (Enter %) _____
- b. Out of state but in the United States (Enter %) _____
- c. Outside of the United States (Enter %) _____ (WEB ONLY SPECIFY COUNTRIES _____)
- d. DK/NA

40. Thinking about your organization's energy related customers, what percent are located:

1. In-State (Enter %) _____
2. In a bordering state but out of state (Enter %) _____
3. In the United States, but outside of a bordering state (Enter %) _____
4. Outside of the United States (Enter %) _____ (WEB ONLY SPECIFY COUNTRIES _____)
5. DK/NA

SECTION 5 – Revenue Questions

Ask Q41 if SGPRIME = 5 or 6

- 41. Can you name any specific rebates or incentives that can reduce the cost of selling, distributing or installing energy for your customers? [Record up to 3]

Record: ____

- 42. Approximately how much of your organization’s work at your current location, in terms of total gross revenue, is related to energy?

Record \$: _____

ASK Q43 if SE has multiple responses, otherwise SKIP

- 43. Approximately how much of your organization’s work at your current location, in terms of total gross revenue, is related to each of the following products or services? (Use numbers to indicate percentages, for instance 20=20%)

- 1. INSERT SE RESPONSE 1 ____%
- 2. INSERT SE RESPONSE 2 ____%
- 3. INSERT SE RESPONSE 3 ____%
- 4. ...
- 5. All other revenue not related to energy ____%

Q43 total must equal 100%

SECTION 6 – Motor Vehicles & Component Parts

ASK Q44 if SC = 6, otherwise SKIP

- 44. With which of the following types of transportation vehicles does your firm primarily design, manufacture, sell, repair, or otherwise work with? [SELECT ONE]

- 1. Automobiles
- 2. Light- or Medium- Duty Vehicles
- 3. Heavy Duty Vehicles
- 4. Industrial Vehicles, such as forklifts
- 5. Recreational Vehicles, such as golf carts
- 6. Rail
- 7. Other (specify _____)

ASK Q45-Q47 if SC = 7, otherwise SKIP

- 45. Does your firm manufacture, design, sell, and/or distribute parts solely used for alternative vehicles, or vehicles with a fuel source other than gasoline or diesel?

- 1. Yes, electric vehicles
- 2. Yes, hydrogen fuel cell vehicles
- 3. Yes, other (Specify)_____
- 4. No
- 5. Don’t know/ Refused

ASK Q46 IF Q45=1, otherwise SKIP

46. How much of your firm's work, as a percentage of your total revenue, is attributed to parts solely used for alternative vehicles, or vehicles with a fuel source other than gasoline or diesel?

- 1. All of it (100%)
- 2. Half to most of it (50% to 99%)
- 3. A quarter to almost half of it (25% to 49%)
- 4. Less than a quarter (1% to 24%)
- 5. (DON'T READ) DK/NA

47. Thinking of the type of fuel used, does your organization offer parts or products for any of the following types of transportation vehicles? [ALLOW MULTIPLE]

- 1. Gasoline and Diesel Motor Vehicles (excluding freight transport)
- 2. Hybrid Electric Vehicles
- 3. Plug-In Hybrid Vehicles
- 4. Electric Vehicles
- 5. Natural Gas Vehicles
- 6. Hydrogen Vehicles
- 7. Fuel Cell Vehicles
- 8. Other (Specify _____)

[If Q47 = 2,3, or 4, ask Q48, otherwise SKIP]

48. Which systems for electric and hybrid vehicles does your firm primarily work with?

- a. Body design or structure
- b. Batteries
- c. Charging components
- d. Electric propulsion (i.e. converter, controller, transmission, etc.)
- e. Auxiliaries (i.e. brakes, steering, climate control, etc.)
- f. Other (Specify _____)

SECTION 7 – Energy Efficiency

IF SCREENER H=1, ASK Q49

49. How many of your [Take Q3#] energy employees work on ENERGY STAR certified new home construction?

Record # of employees: _____

IF SCREENER I=1, ASK Q50

50. How many of your [Take Q3#] energy employees work on ENERGY STAR certified buildings and plants (commercial and industrial)?

Record # of employees: _____

IF SCREENER K=1, ASK Q51

51. How many of your [Take Q3#] energy employees work on administering, managing, evaluating, or otherwise working on utility-led energy efficiency programs, rebates, and other activities?

Record # of employees: _____

Thank you for completing the survey. Since it sometimes becomes necessary for the project manager to confirm responses to certain questions, please verify your contact information.

- da. First and Last Name (Interview note enter 99 for REF)
 - 1. First Name
 - 2. Last name
- db. Position (Interview note enter 99 for REF)
- dc. Phone (Interviewer Note 9999999999 for REF)
- dd. Email (Interview note enter 99 for REF)
- de. Organization Name (Interview note enter 99 for REF)
- df. Organization Street Address (Interview note enter 99 for REF)
- dg. Organization City (Interview note enter 99 for REF)
- dh. Organization State (Interview note enter 99 for REF)
- di. Organization Zip (Interviewer Note 99999 for REF)

Thank you very much for your time.

HOW DID THE CALL END?

- 1 COMPLETED INTERVIEW
- 2 SURVEY SAID THEY DID NOT QUALIFY
- 3 CALLBACK NEEDED, PARTIAL
- 4 REFUSAL
- 5 SOMETHING ELSE

Appendix B: Survey Definitions

The following appendix contains definitions given to respondents should they ask.

Technology Group

- Electric Power Generation – the process of generating electric power from other sources of primary energy whether connected to a distribution grid or not
- Electric Power Transmission, Distribution, and Storage – stores electricity or carries electricity from suppliers to demand sites
- Energy Efficiency, Including Heating, Cooling and Building Envelope (IF NEEDED THIS INCLUDES THERMAL OR HOT WATER SOLAR) – Goods and services that reduce electricity demand pursuant to EPA's Energy Star Standards or Department of Energy Efficiency Standards or refers to establishments that are involved with heating, ventilation and air conditioning (HVAC) from Renewable Energy sources or work that increases the Energy Efficiency of HVAC systems
- Fuel Production, including Fossil, Nuclear, and Renewable – substances that produce useful energy when they undergo a chemical or nuclear reaction
- Transportation Vehicles, including Motor Vehicles – includes fossil and non-fossil fuel related rail, aircraft, vessels, and vehicles
- Component Parts for Transportation Vehicles – parts for fossil and non-fossil fuel related rail, aircraft, vessels, and vehicles

Electric Power Generation

- Solar Photovoltaic Electric Generation – generating electrical power by converting solar radiation into direct current electricity using semiconductors that exhibit the photovoltaic effect.
- Concentrated Solar Electric Generation – generating solar power by using mirrors or lenses to concentrate a large area of sunlight, or solar thermal energy, onto a small area.
- Wind Generation – converting the wind's kinetic energy into electrical power.
- Geothermal Generation – using steam produced from reservoirs of hot water found a few miles or more below the Earth's surface to produce electricity.
- Bioenergy/Bioenergy Generation – generating electricity from materials derived from biological sources or any organic material which has stored sunlight in the form of chemical energy.
- Low-Impact Hydroelectric Generation including Wave/Kinetic Generation – similar to traditional, but certification criteria are aimed at ensuring that the certified dam adequately protects or mitigates its impacts in eight key resource areas: river flows, water quality, fish passage and protection, watersheds, threatened and endangered species, cultural

resources, and public access and recreation opportunities. The eighth criterion requires that the dam not have been recommended for removal (LIHI – Low Impact Hydropower Institute).

- Traditional Hydroelectric Generation – electricity generated by hydropower; the production of electrical power through the use of the gravitational force of falling or flowing water.
- Advanced/Low Emission Natural Gas – efficient, low emission, leak free natural gas, including systems that use any of the following technologies High Efficiency Compressor, Advanced Low NOx Combustion Technology, First Application of Closed Loop Steam Cooling in an Industrial Gas Turbine, Advanced Turbine Blade and Vane Materials, High Temperature TBC and Abradable Coatings, Advanced Row 4 Turbine Blades, 3-D Aero Technology, Advanced Brush Seal.
- Nuclear Generation – converting atomic energy into usable power.
- Coal Generation – the burning of thermal coal to create electricity.
- Oil and other Petroleum Generation – the burning of oil or other petroleum to create electricity.
- Natural Gas Generation, other than Advanced Natural Gas Generation – the burning of natural gas to create electricity.
- Combined Heat and Power – generating electricity and useful thermal energy in a single, integrated system. Heat that is normally wasted in conventional power generation is recovered as useful energy

Electric Power Transmission, Distribution, and Storage

- Traditional Transmission and Distribution – allows energy, including both fuels and electricity, to move across the country through infrastructure such as “poles and wires,” pipelines, trucks, rail, and air.
- Pumped Hydro Storage – hydroelectric energy storage used by electric power systems for load balancing. The method stores energy in the form of gravitational potential energy of water, pumped from a lower elevation reservoir to a higher elevation.
- Battery Storage – using a cell or connected group of cells to convert chemical energy into electrical energy by reversible chemical reactions and that may be recharged by passing a current through it in the direction opposite to that of its discharge
- Smart Grid – an electricity supply network that uses digital communications technology to detect and react to local changes in usage.
- Micro Grids – a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid.
- Other Grid Modernization – other modernization of the Nation's electricity transmission and distribution system to maintain a reliable and secure electricity infrastructure that can meet future demand growth.

Energy Efficiency, Including Heating, Cooling and Building Envelope

- Energy Star Appliances – appliances that meet the international Energy Star standard for energy efficient consumer products originated in the United States.
- LED, CFL and Other Efficient Lighting – energy efficient lighting sources.
- Traditional HVAC goods, control systems, and services – heating, ventilation, and air conditioning systems (HVAC), including building retro-commissioning and retrofits connected to heating and cooling.
- Energy Star/ High AFUE HVAC – HVAC that meets the international Energy Star standard for energy efficient consumer products originated in the United States or has high Average Fuel Utilization Efficiency (AFUE) rating of 90 or greater or 15 SEER or greater.
- Renewable Heating and Cooling (including Solar Thermal) – refers to establishments that are involved with heating, ventilation and air conditioning (HVAC) from Renewable Energy sources or work that increases the Energy Efficiency of HVAC systems (solar thermal – uses the sun's energy to generate thermal energy).
- Advanced Building Materials/Insulation – all materials that represent advances in efficiency over the traditional materials.
- Recycled building materials
- Reduced water consumption products and appliances high efficiency (HE) washing machines, faucet aerators, low flow shower heads, etc.

Fuels

- Coal – a combustible black or dark brown rock consisting mainly of carbonized plant matter, found mainly in underground deposits and widely used as fuel.
- Petroleum – a liquid mixture of hydrocarbons that is present in certain rock strata and can be extracted and refined to produce fuels including gasoline, kerosene, and diesel oil; oil.
- Natural Gas – flammable gas, consisting largely of methane and other hydrocarbons, occurring naturally underground (often in association with petroleum) and used as fuel.
- Other Fossil Fuel – a natural fuel such as coal or gas, formed in the geological past from the remains of living organisms.
- Corn Ethanol – ethanol produced from corn that is used as a bioenergy.
- Other Ethanol/Non-Woody Biomass Fuel, including Biodiesel – fuel made from other materials such as straw, manure, vegetable oil, animal fats, etc.
- Woody Biomass/Cellulosic Biofuel – fuel developed from the by-product of management, restoration, and hazardous fuel reduction treatments, as well as the product of natural disasters, including trees and woody plants (limbs, tops, needles, leaves, and other woody parts, grown in a forest, woodland, or rangeland environment)
- Other Biofuels – other fuel derived directly from living matter.
- Nuclear Fuel – a substance that will sustain a fission chain reaction so that it can be used as a source of nuclear energy.

Motor Vehicles

Transportation Vehicles, Including Motor Vehicles

- Gasoline and Diesel Motor Vehicles (excluding freight transport) – Vehicles that run on gasoline and diesel internal combustion engines.
- Hybrid Electric Vehicles – Vehicles that use two or more distinct types of power, such as internal combustion engine + electric motor.
- Plug-In Hybrid Vehicles – A hybrid electric vehicle that uses two or more distinct types of power, such as internal combustion engine and an electric motor that is powered by rechargeable batteries, or another energy storage device, that can be recharged by plugging it in to an external source of electric power.
- Electric Vehicles – A vehicle which uses one or more electric motors for propulsion, that recharges with batteries plugged in with external sources of electric power, and that have no onboard generator or non-electric motor.
- Natural Gas Vehicles – An alternative fuel vehicle that uses compressed natural gas (CNG) or liquefied natural gas (LNG) an alternative to petroleum.
- Hydrogen Vehicles – A vehicle that uses hydrogen as its onboard fuel for motive power.
- Fuel Cell Vehicles – A type of hybrid vehicle which uses a fuel cell, instead of an engine, in combination with a storage device, such as a battery, to power its on-board electric motor.

Component Parts for Transportation Vehicles

- Widely Commercially Available – Products that are sold in the regular course of business through developed sales channels.
- Development Stage – Products are either not yet commercially available or are available to customers in a pilot stage.
- Concept – Products that have been designed and sketched but are not available in physical form.
- Product Development – Products are in the early test phase with some engineering and early stage manufacturing but not yet in pilot stage.
- Pilot – Prototypes have been produced and are in test phase.
- Automobile – a passenger vehicle designed for operation on ordinary roads and typically having four wheels and a gasoline or diesel internal-combustion engine.
- Light Duty Vehicle – Trucks or truck-based vehicles with a payload capacity of less than 4,000 pounds.
- Heavy Duty Vehicle – Trucks or truck-based vehicles with a payload capacity of 4,000 pounds or greater.
- Industrial Vehicle – Any mobile power-propelled truck used to carry, push, pull, lift, stack or tier materials. Powered industrial trucks can be driven or controlled by a walking operator.
- Recreational Vehicles – a vehicle designed for recreational use, including golf carts and camping vehicles.

Appendix C: Overall Methodology

Introduction and Overview

The 2022 USEER methodology relies on the most recently available data from the BLS QCEW (QCEW, third quarter 2021), the BLS Unemployment Situation Table B-1 monthly reports, together with a detailed supplemental survey of business establishments across the United States designed and conducted by BW Research Partnership in partnership with the Department of Energy (DOE). During a time of rapid change in energy technology and business employment structure, supplemental surveys are an important tool to capture developing trends. Taken together, the BLS and survey data provide the most comprehensive calculation of energy-related employment available. The methodology has been used for local, state, and federal energy related data collection and analysis for a decade, including the Interstate Renewable Energy Council (IREC)'s National Solar Jobs Census series, traditional and clean energy reports for state agencies in the Commonwealth of Massachusetts, New York State, the State of Vermont, the Commonwealth of Pennsylvania, the State of California, the State of Connecticut, the State of New Hampshire, and State of Rhode Island, the State of Maryland, the State of Minnesota, and numerous nonprofit agencies across the United States.

The 2022 USEER survey uses a stratified sampling plan that is representative by industry code (North American Industry Classification System [NAICS] or ANAICS),²⁵ establishment size, and geography to determine the proportion of establishments that work with specific energy-related technologies, as well as the proportion of workers in such establishments that work with the same. These data are then analyzed and applied to existing public data published by the BLS, effectively constraining the potential universe of energy establishments and employment. For more detail, see the "USEER Sampling Plan" section below (section III).

The 2022 USEER survey was administered by telephone (more than 247,500 outbound calls) and by web, with more than 104,000 emails sent to participants throughout the United States. An additional 33,000 business locations were mailed an invite letter instructing respondents to complete the survey via phone or web (included a link). The phone survey was conducted by ReconMR. The web instrument was programmed internally, and each respondent was required to use a unique ID in order to prevent duplication.

The sample was split into two categories, referred to as the known and unknown universes. The known universe includes establishments that have previously been identified as energy-related, either in prior research or in some other manner, such as membership in an industry association or participation in government programs. These establishments were surveyed census-style, and their associated establishment and employment totals were removed from the unknown universe for both sampling and for resulting employment calculations and estimates.

The unknown universe included tens of thousands of businesses in potentially energy-related NAICS codes, across agriculture, mining and extraction, utilities, construction, manufacturing, wholesale

²⁵ ANAICS is a term used by BLS, which means Allocation NAICS, and refers to the industries included in the aggregation of industries likely to participate in said activities. https://www.bls.gov/ggs/ggs_technote_extended.pdf

trade, distribution (including pipeline distribution), professional services, and repair and maintenance. Each of these segments and their total reported establishments (within the BLS QCEW) were carefully analyzed by size (employment) and state to develop representative clusters for sampling. In total, approximately 33,000 business establishments participated in the survey effort, with approximately 7,500 providing full responses to the survey. These responses were used to develop incidence rates among industries (by state) as well as to apportion employment across various industry categories in ways currently not provided by state and federal labor market information agencies. The margin of error for incidence in the USEER is +/-0.54% at a 95% confidence interval.

For several industries, particularly transportation of goods, the USEER uses the methodology developed by the DOE and the National Renewable Energy Laboratory for the first installment of the QER. Proportion of employment was calculated by dividing commodity shipments by value (in millions of dollars) for coal, fuel oil, gas, motor vehicles, petroleum, and other coal and petroleum products out of total commodity value at the state level by truck, rail, air, and water transport. This proportion was applied to NAICS employment for truck transportation (NAICS 484), water transportation (NAICS 483), air transportation (NAICS 481), and Railroad Retirement Board employment for rail transportation at the state level. With this analysis, truck transportation represents the majority of energy-related transportation employment (70%), followed by rail (22%), water (7%), and air (1%).

Of important note, the USEER expressly excludes any employment in retail trade NAICS codes. This excludes motor vehicle dealerships, gas stations,²⁶ appliance and hardware stores, and other retail establishments.

All data in the USEER rely on the BLS QCEW data for the end of the third quarter of 2021, and the BLS Employment Situation Table B1 monthly reports through December 2021. Employment extrapolations are based off BLS QCEW and survey data, resulting in totals that carry precise decimal values. As a result, some employment totals for tables in the report will sum differently due to rounding. The USEER survey was administered between January 13, 2022, and April 18, 2022, and averaged 16 minutes in length.

Methodology Discussion

Employment data collected by the BLS provide information on many, but not all, energy-related job categories. Most notably, BLS does not collect data on employment levels by energy technology across business segments. For instance, residential solar installation establishments are typically labeled as electrical contractors (together with all other traditional electrical businesses) without being identified specifically as solar companies. Petroleum-engineering firms are included in engineering services, with civil, mechanical, and other engineers, while electric vehicle prototype manufacturers are combined with gasoline and diesel-fueled vehicle manufacturing. As a result, BLS employment data does not capture the full scope of energy employment trends.²⁷

²⁶ Gas station employment had been reported in previous years. The 2022 USEER excludes mention of employment in this industry.

²⁷ DOE, *Quadrennial Energy Review: Energy Transmission, Storage, and Distribution Infrastructure*, 8-7.

Given the complex relationship between energy and the overall economy, the 2022 USEER investigates, with a special supplemental survey, the three Traditional Energy sectors—Electric Power Generation, Fuels and Transmission, Distribution, and Storage—followed by individual analyses of employment in two important energy end-use sectors—Energy Efficiency and Motor Vehicles. The spread of business activities within each of the five analyzed sectors presents additional taxonomic challenges, as early-stage research and development, repair and maintenance, or professional and technical services vary across energy, energy efficiency, and manufacturing. Natural gas business activities, for instance, differ from business activities relating to advanced building materials and solar photovoltaic (PV) materials.

Historically, the BLS has conducted supplemental surveys to acquire more complete information on new industries, specific demographic profiles within the workforce, or new labor force trends such as the role of contingent workers. In this way, significant modification to the current BLS structure of industry and occupational classifications is avoided by capturing the required energy employment data using a supplemental survey tool based on existing BLS data and classifications.

The survey data are used to filter and analyze the concentration, intensity, and distribution of various energy technologies and activities throughout traditional industry sectors, using third-quarter 2021 employment data from the BLS QCEW and the BLS Employment Situation Table B-1 monthly reports through December 2021. USEER data also provides an additional layer of information to track sector-specific growth potential, obstacles, and opportunities. The data presented in the USEER are not intended to remove, replace, or replicate existing data from the BLS QCEW, but instead to reorganize categories and provide insight for policymakers and the public regarding trends in energy employment, energy production, and energy consumption across the United States.

The USEER provides data for direct employment only and does not attempt to estimate indirect employment or induced employment related to the analyzed sectors. Many employment studies, such as those included in chapter 8 of the first installment of the QER, generate employment estimates that rely on input/output modeling. These studies typically define an activity based on reported expenditures or expenditures and associated levels of employment reported by a defined industry or activity, such as U.S. solar PV installation. In this example, solar PV installation firm employment would be the “direct” jobs. Most studies go at least one step further, identifying “indirect” employment, which includes the supply chain or other support services to the industry. In the solar example, these would include U.S. manufacturing jobs related to producing PV equipment used in domestic installations (and their suppliers and vendors) as well as consulting, tax, legal, and other professional services to support domestic PV installation companies. Another typical calculation is “induced” jobs, which includes jobs created or supported by wages paid and other benefits provided by employers of direct and indirect employees.

In the USEER, by comparison, the direct job category of interest is defined as the solar industry generally, including utility-scale solar, residential, and commercial installations, as well as the manufacturing, professional services, and wholesale trade that make up the sector. However, the indirect jobs that support this industry are not included, such as polysilicon production (the raw material used in solar panels), aluminum production and extrusion activities for frame manufacturing, or other aspects of the solar energy value chain. Induced jobs—those created throughout the

economy as a result of the spending of wages by the employees whose income derives, in whole or part, from this industry—are also not included.

For this survey, a Qualifying Firm is—

An organization with employees in the United States that can be directly involved with researching, developing, producing, manufacturing, distributing, selling, implementing, installing, or repairing components, goods or services related to Electric Power Generation; Electric Power Transmission, Distribution, and Storage; Energy Efficiency, including Heating, Cooling and Building Envelope; Fuels, including Extraction, Processing, Production, and Distribution; and Transportation,²⁸ including Motor Vehicles. This also includes supporting services such as consulting, finance, tax, and legal services related to energy, fuels, energy efficiency, or motor vehicles.

Qualifying Workers are—

Employees of a qualifying firm that spend some portion of their time supporting the qualifying energy, energy-efficiency, or motor vehicle portion of the business.²⁹

This report provides detail into levels of employment activity that include both “a portion of their time” and “a majority of their time” when referencing qualifying workers. This is especially true within the Energy Efficiency sector where the employing construction or repair firms frequently are engaged in both traditional energy-related construction or installation as well as in high-efficiency activities that qualify for ENERGY STAR designation.

Primary energy consumption³⁰ in the United States is divided among four groups: Electric Power (37.8%), Buildings (11.5%), Industrial (23.2%), and Transportation (27.6%). This distribution of energy consumption by sector is based on total 2021 estimates published by the Energy Information Administration (EIA).³¹

End-use electricity consumption, in turn, is divided with 73.8% consumed by Residential and Commercial Buildings, 26.0% by Industrial; and 0.2% by Transportation.³² Thus, Buildings consumed 39.3% of all energy (an amount consisting of their direct energy end-use, their electricity end-use, and the electrical system energy losses allocated to the sector by EIA).³³

As with the 2021 report, the 2022 USEER identifies jobs that manufacture ENERGY STAR appliances and other ENERGY STAR labeled products, as well as employment in building design

²⁸ “Transportation” refers to the transportation of fuels. This includes pipeline, rail, and truck transportation. It additionally includes companies involved with the production of vehicles used for transporting goods.

²⁹ Data presented in this report exclude retail employees. Qualifying Workers in energy will be referenced as energy-related jobs. Where “portion of their time” includes employees whose activities are less than 50% of their time, specific reference will be made of that fact.

³⁰ Primary energy consumption is the direct consumption of energy at its first point of use. Importantly, this does not include consumption of electricity, so that primary energy consumption in the Residential and Commercial Building sector includes direct use of fuels like natural gas for heating, but not electricity used for lighting and cooling.

³¹ EIA, *Monthly Energy Review*, Table 2.1. Percentages are based on primary energy consumption in 2021 and do not add up to 100.0% due to rounding.

³² EIA, *Monthly Energy Review*, Table 7.6. Percentages of retail electricity sales in 2021.

³³ EIA, *Monthly Energy Review*, Table 2.1. Percentage based on total energy consumption in 2021.

and contracting services that provide insulation, improve natural lighting, and reduce overall energy consumption across homes and businesses.³⁴ As with the 2021 report, the 2022 USEER includes a section that disaggregates ENERGY STAR technologies more thoroughly, further highlighting the employment impacts of the program.

Motor Vehicles are included in this report primarily due to their intensive use of energy and contribution to carbon emissions.³⁵ This report delineates employment between traditional gas and diesel motor vehicles, hybrid and plug-in hybrid, all-electric, natural gas, hydrogen, and fuel cell technologies, as well as Motor Vehicle component parts for such vehicles. USEER does not, however, cover all sectors of transportation, such as aviation and maritime transportation. According to the EIA, the transportation sector accounted for 27.6% of primary energy consumption.³⁶ The transportation sector accounted for 67.2% of U.S. petroleum consumption.³⁷

Motor Vehicles employment reported at the state level includes overall value chain (manufacturing, wholesale trade, commodity flows or freight transport of motor vehicles, professional and business services, and repair and maintenance) and employment by detailed technology (gas and diesel, hybrid, plug-in hybrid, electric, hydrogen and fuel cell, natural gas, and other). Employment at the state level is not reported by value chain within detailed technology.

BW Research Partnership, an independent research organization, collected and analyzed the data. The data set includes technology, value-chain, and energy employment data in all 50 U.S. states and the District of Columbia. In a time of rapid change in energy technologies across the board, continued refinement of supplemental surveys will continue to be an important tool in analyzing existing BLS data sets.

Another benefit of using the QCEW framework and a supplemental survey is the ability to understand and report the concentration of energy-related activities within traditional industries, such as construction, manufacturing, and utilities. This helps to illustrate the significant impact that energy and energy-related activities have on the overall economy. The impacts to the various selected industries are illustrated briefly below.³⁸

USEER Sampling Plan

Universe

Geographic coverage includes the 50 States and the District of Columbia, and the U.S. Territories. Private establishments and government units are included, but units with average employment of zero over the last 12 months are excluded. Data are to be collected for establishments in 266

³⁴ Estimates do not include retail employment.

³⁵ The USEER covers motor vehicle employment across vehicle parts manufacturing, automotive repair and maintenance, as well as vehicle, parts, and supplies wholesalers, including air, rail, water, and truck transportation of motor vehicle parts and supplies. It does not capture jobs associated with the final assembly of some transportation equipment such as forklifts and golf carts.

³⁶ EIA, *Monthly Energy Review*, Table 2.1.

³⁷ EIA, *Monthly Energy Review*, Table 3.7c. Percentage calculated using the sum of sector totals in Tables 3.7a through 3.7c.

³⁸ Because the USEER uses modeling to estimate fuel-stock employment in agriculture and forestry, and because these industry codes are not effectively captured by QCEW, no estimate is made as to the percent of the total industry captured by the USEER.

detailed industries identified to be of specific interest for the USEER Survey. The industries are defined using the 6-digit detail of NAICS, includes 1,099 6-digit industries.

The sampling frame is a representative sample of employers drawn from establishment totals from the Quarterly Census of Employment and Wages (QCEW) Longitudinal Database (LDB) maintained by the Bureau of Labor Statistics, stratified by employment size categories developed by the Census Bureau County Business Patterns data set. The actual contact information and business names are drawn from a private dataset, DataAxleUSA, because the QCEW is confidential. About 2.7 million establishments with employment of 26 million are in the 266 in-scope industries.

For the purposes of USEER sample allocation, we aggregate 266 detailed industries into 7 groups of industries or “allocation” NAICS (ANAICS). For most in-scope industries, the ANAICS is the 2-digit NAICS and includes all in-scope NAICS-defined industries within the 2-digit. Within some 2-digit industries, ANAICS splits out specific 5- and 6-digit NAICS industries where we have historically had a higher incidence of energy activity. ANAICS 2- and 3-digit coding is the same as for NAICS, though restricted to USEER-eligible industries.

Industry sectors are also defined for use in allocation. Industry sectors are 2-digit ANAICS with two exceptions. The manufacturing sector combines three 2-digit codes. The trade sector combines retail trade and wholesale trade.

About 16,100 in-scope “Known Universe” establishments with one million employees were pre-identified as having energy activity. A database of Known Universe establishments was developed internally by BW Research by collecting industry association databases, approved utility contractor lists, and other public and private sources, as well as prior indication in a USEER survey collection. By comparing the information obtained through these sources and comparing the NAICS codes of these establishments in the QCEW, Known Universe establishments were matched to the QCEW/DataAxleUSA dataset and a “known” indicator was used to assist in oversampling “known” establishments.

Sample

BW Research Partnership contacts between 30,000 and 35,000 establishments per year. The total survey completion targets were based on a sample selected using the QCEW/DataAxleUSA frame for the second quarter of 2021. Quotas were established for each NAICS code or ANAICS code by size and state.

Stratification – The USEER is stratified by 6-digit NAICS and size class (1-9, 10-19, 20-49, 50-99, and 100+ employees) and systematic samples selected in the noncertainty strata. Known establishments can be of any ownership, are processed separately, and are excluded from the other portions of the frame. Federal government stratification is State by industry sector. State government stratification is State by industry sector. Local government stratification is State by industry sector for these sectors: utilities; transportation and warehousing; professional, scientific, and technical services; remediation services; educational services; arts, entertainment, and recreation; public administration (all other sectors combined to a residual category). For private establishments (excluding the Known Universe) three levels of stratification are examined during sample allocation:

1) State by industry sector, 2) national ANAICS, and 3) national 6-digit NAICS. Further stratification by establishment size did not prove to be practical for similar studies.

Sample Design

USEER panels have a probability-based sample aimed at satisfying data needs at both the State by industry sector level and the national ANAICS level. The basic sampling unit is an establishment. Response quotas are established based on the representation of total establishments by 6-digit NAICS, times the proportion of establishments in each size category as identified in the most recent available data from Census Bureau County Business Patterns.

Restricted to in-scope industries, establishment on the QCEW frame are separated into 5 mutually exclusive parts that are separately sampled. Approximate sample counts refer to a sample selected from the QCEW frame for quarter 2 of 2020.

- Known Universe; census, with up to six attempts; stratification industry by size class (can have any ownership code)
- Federal Government; sample 50; stratification state by industry sector
- State Government; sample 50; stratification state by industry sector
- Private; sample 29,900; complex stratification using state, industry

Known Sampling – All establishments in the Known Universe will be contacted up to six times. The responses will be treated separately, and the overall employment from the Known Universe sample will be deduplicated from the appropriate panel of ANAICS, based on the Known Universe respondent NAICS code.

Private Establishments and Government (excluding Known Universe) –The allocation has 4 basic steps.

- Establishments by State – relying on the most recent data available from QCEW, the proportion of establishments in each selected NAICS is determined, as a percentage of the total establishments in all selected NAICS.
- NAICS Establishments by Size– relying on the most recent data available in the Census Bureau’s County Business Patterns, the proportion of establishments within each size category in each 6-digit NAICS is determined. The total NAICS quota is allocated by the size proportions to develop the percentage of total state-level sample.
- Deduplicate Known Universe Establishments from Sampling Universe – verifying by name, NAICS, contact name, address, phone, and other identifying information, Known Universe establishments are removed from the private, state, and federal government sampling universes.
- Establish Quotas – State-level quotas are established by multiplying the total number of proposed survey completions per state by the percentage established in “Establishments by State” above, and by the percentage established in “NAICS Establishments by Size” above.

Union Methodology Update

A new feature of this year's USEER includes a methodology revision for union membership and union coverage rates. These data have been revised due to feedback from industry and concerns over both non-response bias and questions of what counts as union coverage, notably whether project labor agreements should be considered. As a result, the data on union membership are not comparable to previous USEERs. The updated methodology includes Current Population Statistics (CPS), CIC-NAICS crosswalks, and data from the Bureau of Labor Statistics (BLS), in addition to USEER survey data. Union membership is weighted by NAICS codes within each detailed technology and summed within each category to calculate final detailed technology union membership and coverage rates.

The question on union coverage was expanded from "Thinking of your energy employees, how many are represented by unions?" to "Thinking of your energy employees, how many are represented by unions, collective bargaining agreements, and/or project labor agreements?" for clarity.

Workers are counted as covered if they are a member of a labor union or of an employee association similar to a union or subject to a project labor agreement. Workers are counted as covered by a collective bargaining agreement if they are union members or if they are not members but say they are covered by a union contract." Definitions are from Barry T. Hirsch and David A. Macpherson, "Union Membership and Coverage Database from the Current Population Survey: Note," *Industrial and Labor Relations Review*, 56, no. 2 (January 2003): 349-54, <http://unionstats.gsu.edu/UnionStats.pdf>.

Appendix D: Union Methodology

Introduction

The Department of Energy requested unionization rate estimates to be created as part of its contract with BW Research Partnership to conduct research and analysis to develop the 2021 United States Energy and Employment Report (USEER). BW Research developed a comprehensive approach relying on multiple datasets to produce accurate and reliable estimates. This memorandum outlines the technical derivation of these estimates under the Unionization Methodology section, and explores results from alternative methodological approaches, using Solar Electric Power Generation and Coal Fuels unionization as examples. The alternate approaches result in largely similar results for unionization in these sectors.

Unionization Methodology

Workers are counted as union members if they are a member of a labor union or of an employee association similar to a union or subject to a project labor agreement. Workers are counted as covered by a collective bargaining agreement if they are union members or if they are not members but say they are covered by a union contract or if they are covered by a project labor agreement. This differs from previous reports where respondents were simply asked how many of their employees are represented by unions.³⁹

The unionization rate extrapolation process relies on two datasets to calculate union membership and coverage rates: the USEER survey and Unionstats.com, which derives its data from the Bureau of Labor Statistics (BLS) Current Population Survey (CPS). To account for variations in unionization within between industries, BW Research uses union rates by industry from the USEER survey and Unionstats.com weighted by industry employment within each subtechnology. To account for variations based on geographic employment trends, BW Research uses state level Unionstats data weighted by state subtechnology employment.

BW Research Partnership did not rely on Unionstats data because it uses BLS data, the same source organization that is used in the USEER employment extrapolations. The methodology behind the BLS CPS union data is consistent across categories like geography and industry, and the data produced is reliable. By using the CPS outgoing rotation group monthly files, Unionstats uses the same methodology and definitions of unionization as BLS and provides estimates with greater granularity than BLS.

BW Research used the Final Unionization approach outlined below to account for the limitations in both primary and secondary data. The USEER survey data is limited by non-response bias and low sample size for union employment. The Unionstats data is limited because the data is not energy-specific and the industries reported are not sufficiently granular. However, the approach used for the USEER makes use of available data in a way that acknowledges data limitations and attempts to account for the different factors impacting union rates. Below is a step-by-step outline of the process in full, using Solar Electric Power Generation and Coal Fuels as examples

Step 1: USEER Survey Data Analysis

Analyze raw USEER survey response union data and weight by industry. The resulting industry weighted union rates for solar electricity and Coal Fuels are listed on the following page.

³⁹ Previously respondents were asked, "Thinking of your energy employees, how many are represented by unions?" This was updated to "Thinking of your energy employees, how many are represented by unions, collective bargaining agreements, and/or project labor agreements?"

Table 52. Raw Survey Responses for Solar Electric Power Generation and Coal Fuels

Solar Electricity Industry Weighted	7.4%
Coal Fuel Industry Weighted	2.7%

Step 2: Unionstats Data Analysis

Use Unionstats industry union data (derived from BLS CPS) at national level

1. CIC to NAICS code crosswalk is found in the table below.
2. The Unionstats manufacturing rate is a sum of employment, membership, and covered data from durable and nondurable goods manufacturing.⁴⁰

Table 53. Unionstats Union Membership and Coverage by NAICS and CIC Code

CIC	NAICS	Unionstats Membership	Unionstats Coverage
0380	2121	11.3%	11.6%
0570	2211	24.5%	25.8%
0770	23	13.4%	14.2%
1070-3990	32-33	8.5%	9.3%
4070-4590	42-45	4.2%	4.7%
see footnote	51-56	3.7%	4.5%
8770-9290	81	2.6%	3.2%
Solar Emp Weighted		9.6%	10.3%
Coal Fuel Emp Weighted		9.8%	10.2%

Step 3: Combine Datasets

Average the industry union rates from step 1 and 2 (weighted 50/50) to combine USEER survey data and Unionstats data. The resulting union membership and coverage rates for coal fuels and solar electricity are listed below. Note that due to the low responses to the unionization question and potential non-response bias among coal fuels employers, the research team used Unionstats coal mining unionization rate as a substitute in the coal fuel industry weighted union response data.

⁴⁰ All union figures in Appendix C are from the 2021 USEER and represent membership and coverage in 2020.

Table 54. USEER Union Membership and Coverage for Solar Electric Power Generation and Coal Fuels

	Union Membership	Union Coverage
Solar Electricity	8.5%	8.9%
Coal Fuels	10.0%	10.2%

Step 4: State Weighting

Create state level weighted average union rate to adjust for geographic differences in unionization. Take Unionstats private union rates by state and divide by the national private union rate. Then multiply by the overall technology union rate detailed in section 2. Multiply this final rate by USEER employment within each state, then sum the state unionization numbers and divide by nationwide employment to calculate the state weighted average union rates. Below are tables detailing the process for solar and coal fuels as examples.

Table 55. USEER Solar Electric Power Generation Union Data By State

State	Solar Employment	State Union Membership	State Union Coverage	Solar Union Membership Employment	Solar Union Coverage Employment
Alabama	854	8.2%	8.9%	70	76
Alaska	83	14.3%	15.4%	12	13
Arizona	9,043	4.6%	4.9%	413	445
Arkansas	413	5.5%	5.9%	23	24
California	113,005	14.6%	15.8%	16,510	17,813
Colorado	7,719	7.6%	8.2%	587	634
Connecticut	2,645	13.1%	14.1%	346	373
Delaware	564	6.8%	7.4%	39	42
D.C.	1,431	7.2%	7.7%	102	110
Florida	11,271	5.5%	5.9%	618	666
Georgia	6,923	4.6%	4.9%	316	341
Hawaii	4,018	20.2%	21.8%	813	877
Idaho	693	5.3%	5.7%	37	40
Illinois	5,526	12.9%	14.0%	715	771
Indiana	3,612	8.8%	9.5%	319	344
Iowa	896	5.8%	6.2%	52	56

Appendices

Kansas	951	9.7%	10.5%	93	100
Kentucky	1,566	9.9%	10.7%	155	167
Louisiana	3,478	5.8%	6.2%	201	217
Maine	727	9.7%	10.5%	71	76
Maryland	6,104	9.6%	10.3%	585	631
Massachusetts	15,096	9.7%	10.5%	1,470	1,586
Michigan	4,555	16.9%	18.2%	769	830
Minnesota	4,442	11.4%	12.3%	507	547
Mississippi	1,141	7.9%	8.5%	90	97
Missouri	2,872	9.7%	10.5%	280	302
Montana	293	8.5%	9.2%	25	27
Nebraska	1,733	7.0%	7.6%	121	131
Nevada	8,722	14.6%	15.8%	1,274	1,375
New Hampshire	1,393	6.5%	7.1%	91	98
New Jersey	7,907	12.6%	13.6%	999	1,078
New Mexico	3,073	5.5%	5.9%	168	182
New York	12,314	19.2%	20.7%	2,361	2,548
North Carolina	8,068	2.7%	3.0%	221	238
North Dakota	229	5.5%	5.9%	13	14
Ohio	7,647	10.8%	11.7%	826	892
Oklahoma	1,160	5.8%	6.2%	67	72
Oregon	5,265	13.5%	14.6%	713	769
Pennsylvania	5,158	12.5%	13.5%	644	694
Rhode Island	1,391	15.1%	16.3%	210	226
South Carolina	3,530	2.9%	3.1%	102	110
South Dakota	605	4.1%	4.4%	25	27
Tennessee	4,540	4.3%	4.6%	193	209
Texas	11,782	4.1%	4.4%	484	522
Utah	7,033	2.7%	3.0%	193	208

Appendices

Vermont	1,701	8.4%	9.0%	142	154
Virginia	4,444	3.0%	3.3%	135	146
Washington	4,688	15.7%	16.9%	735	793
West Virginia	431	11.1%	12.0%	48	52
Wisconsin	3,768	9.9%	10.7%	373	402
Wyoming	174	7.8%	8.4%	13	15
Total Solar State Weighted	316,675	11.2%	12.1%	35,370	38,161

Table 56. Coal fuels Union Data By State

State	Coal Fuels Employment	State Union Membership	State Union Coverage	Coal Union Membership Employment	Coal Union Coverage Employment
Alabama	2,978	8.4%	8.4%	250	250
Alaska	188	14.6%	15.1%	27	28
Arizona	423	4.7%	5.0%	20	21
Arkansas	101	5.6%	6.5%	6	7
California	1,774	14.9%	15.1%	265	267
Colorado	1,568	7.8%	7.5%	122	118
Connecticut	211	13.4%	13.9%	28	29
Delaware	58	7.0%	7.0%	4	4
D.C.	178	7.3%	7.1%	13	13
Florida	1,059	5.6%	6.4%	59	68
Georgia	455	4.7%	6.1%	21	28
Hawaii	48	20.7%	20.9%	10	10
Idaho	71	5.4%	5.7%	4	4
Illinois	2,728	13.2%	12.9%	361	353
Indiana	2,100	9.0%	9.2%	189	194
Iowa	135	5.9%	6.5%	8	9
Kansas	165	10.0%	11.7%	16	19
Kentucky	5,687	10.1%	11.7%	575	663

Appendices

Louisiana	557	5.9%	6.3%	33	35
Maine	81	10.0%	9.7%	8	8
Maryland	666	9.8%	9.8%	65	65
Massachusetts	489	10.0%	10.2%	49	50
Michigan	500	17.3%	17.3%	86	87
Minnesota	262	11.7%	11.7%	31	31
Mississippi	326	8.1%	8.7%	26	28
Missouri	380	10.0%	9.7%	38	37
Montana	1,176	8.7%	8.8%	102	104
Nebraska	92	7.2%	7.1%	7	7
Nevada	119	14.9%	15.1%	18	18
New Hampshire	83	6.7%	6.7%	6	6
New Jersey	431	12.9%	13.7%	56	59
New Mexico	902	5.6%	5.8%	51	53
New York	1,035	19.6%	19.9%	203	206
North Carolina	475	2.8%	3.6%	13	17
North Dakota	1,143	5.6%	6.3%	64	72
Ohio	1,452	11.0%	11.1%	160	161
Oklahoma	332	5.9%	6.3%	20	21
Oregon	166	13.8%	13.2%	23	22
Pennsylvania	5,224	12.8%	12.7%	666	661
Rhode Island	59	15.4%	15.5%	9	9
South Carolina	225	3.0%	3.4%	7	8
South Dakota	31	4.2%	4.8%	1	1
Tennessee	450	4.4%	4.8%	20	22
Texas	3,717	4.2%	4.8%	156	180
Utah	1,345	2.8%	4.4%	38	59
Vermont	39	8.6%	9.7%	3	4
Virginia	2,443	3.1%	3.7%	76	90

Washington	321	16.0%	15.5%	51	50
West Virginia	11,241	11.4%	11.1%	1,276	1,247
Wisconsin	278	10.1%	10.4%	28	29
Wyoming	4,470	7.9%	9.0%	355	400
Total Coal Fuels State Weighted	60,438	9.5%	9.8%	5,723	5,929

Step 5: Final Data Weighting

Take the simple average (weight 50/50) of the overall union rates from steps 3 and 4 in order to incorporate variance in both industrial unionization and geographic unionization. This calculates the final solar unionization rates, 10% union membership and 10% union coverage. This calculates the final coal fuels unionization rates, 10% union membership and 10% union coverage.

Alternative Approaches

This section details three alternative approaches to calculating the overall unionization rate of a subtechnology, using USEER survey data only (outlined in step 1 in the Methodology section above), using Unionstats industry data only (outlined in step 2 in the Methodology section above), and using Unionstats industry data incorporating the EIA & MSHA data for coal fuels.

USEER Industry-Weighted Survey Data Only

To calculate union rates using only USEER survey data, BW Research ran USEER survey responses by industry code and weights on the appropriate employment within those corresponding industries. This process is detailed in Step 1 of the above Methodology section, below are the resulting union rates using this technique. Please note that survey data for coal mining & extraction is not available because mining & extraction is not a response option in the USEER survey. Calculating union rates using this technique is ineffective because it relies on data that is subject to non-response bias and small sample sizes.

Table 57. USEER Industry-weighted Survey Union Data Only Results

	Union Rate
Solar Electricity	7%
Coal Fuels	3%

Unionstats Industry-Weighted Data Only

To calculate union rates using only Unionstats data, BW Research pulled 2020 industry level data from Unionstats.com and weights the data on the corresponding industry employment within each subtechnology. This technique is ineffective because the industry codes used for the available union data are not granular enough to properly map to energy industries at the precision that is required.

Table 58. Unionstats Industry-weighted Union Data Only Results

	Union Membership	Union Coverage
Solar Electricity	10%	10%
Coal Fuels	10%	10%

MSHA Data (Coal Only)

BW Research reviewed unionization data from the US Energy Information Administration (EIA) and the US Mine Safety and Health Administration (MSHA). The data is useful because it has mine-specific data but is also limited in a number of ways. First, the data are not new, with the most recent from 2019. Second, the data set only tells you the total number of employees at mines and whether the mine is unionized, not the rate of membership or coverage. Some unknown percentage of the workers at a unionized mine are not members of or covered by a union (management and professional staff, etc.). Finally, the data cover direct mine employees only, not others in coal fuels such as support staff, contractors, and others in the supply chain, which make up more than one-third of the coal fuels sector.

When analyzing active mines during 2019, 19.9% of all workers at coal mines work at a unionized mine. However, not all these workers are part of the union – management and other supporting workers would not be covered. After running a staffing pattern analysis, BW Research determined a high-end estimate of 88.6% of coal mine occupations could be covered by unions – these are extraction, construction, installation, production, and transportation workers. After applying this rate to the 19.9%, the final coal mining and extraction unionization rate is 17.6%. Since this rate only applies to the coal mining & extraction industry within coal fuels, and coal mining & extraction accounts for 70% of coal fuels employment, Unionstats industry rates are applied to the other industries, the process of which is detailed in previous sections. This results in a final high-end estimate for coal fuels union membership of 14% and union coverage rate of 14%.