



**California Energy Commission  
April 12, 2023 Business Meeting  
Backup Materials for Agenda Item No 03b:  
Verdant Associates LLC**

The following backup materials for the above-referenced agenda item are available in this PDF packet as listed below:

1. Proposed Resolution.
2. Contract Request Form.
3. Scope of Work.

STATE OF CALIFORNIA  
STATE ENERGY RESOURCES  
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION: Verdant Associates LLC

**RESOLVED**, that the State Energy Resources Conservation and Development Commission (CEC) adopts the staff CEQA findings contained in the Agreement or Amendment Request Form (as applicable); and

**RESOLVED**, that the CEC approves Agreement 800-22-006 with Verdant Associates LLC for a \$500,000 contract to provide technical assistance in support of the Demand Scenarios Project. These demand scenarios project energy consumption for electricity and fuels based on assumptions that reflect energy policies and programs to decarbonize California's economy. They are a key input into the requirements of Senate Bill (SB) 100 to assess the complete decarbonization of the electric generation sector; and

**FURTHER BE IT RESOLVED**, that the Executive Director or their designee shall execute the same on behalf of the CEC.

**CERTIFICATION**

The undersigned Secretariat to the CEC does hereby certify that the foregoing is a full, true, and correct copy of a resolution duly and regularly adopted at a meeting of the CEC held on April 12, 2023.

AYE:  
NAY:  
ABSENT:  
ABSTAIN:

Dated:

\_\_\_\_\_  
Liza Lopez  
Secretariat



## CONTRACT REQUEST FORM (CRF)

### A. New Agreement Number

**IMPORTANT:** New Agreement # to be completed by Contracts, Grants, and Loans Office.

New Agreement Number: 800-22-006

### B. Division Information

1. Division Name: Energy Assessments Division
2. Agreement Manager: Anitha Rednam
3. MS-22
4. Phone Number: 916-237-2524

### C. Recipient's Information

1. Recipient's Legal Name: Verdant Associates LLC
2. Federal ID Number: 85-1131755

### D. Title of Project

Title of project: Demand Scenarios Project

### E. Term and Amount

1. Start Date: 05/12/2023
2. End Date: 03/31/2025
3. Amount: \$500,000

### F. Business Meeting Information

1. Operational agreement to be approved by Executive Director? No
2. Are the ARFVTP agreements \$75K and under delegated to Executive Director? No
3. The Proposed Business Meeting Date: 04/12/2023
4. Consent or Discussion? Consent
5. Business Meeting Presenter Name: Anitha Rednam
6. Time Needed for Business Meeting: 5 minutes.
7. The email subscription topic is: energypolicy, efficiency, electricity, naturalgas, transportation

#### Agenda Item Subject and Description:

Proposed resolution approving Agreement 800-22-006 with Verdant Associates LLC for a \$500,000 contract to provide technical assistance in support of the Demand Scenarios Project. These demand scenarios project energy consumption for electricity and fuels as a result of assumed energy policies and programs that reflect goals to decarbonize California's economy. They are a key input into the requirements of SB100 to assess the complete decarbonization of the electric generation sector.

### G. California Environmental Quality Act (CEQA) Compliance

#### 1. Is Agreement considered a "Project" under CEQA?

No

If yes, skip to question 2.

If no, complete the following (PRC 21065 and 14 CCR 15378) and explain why Agreement is not considered a "Project":



Agreement will not cause direct physical change in the environment or a reasonably foreseeable indirect physical change in the environment because: the contract will provide technical expertise and assistance to CEC staff in the Advanced Electrification Analysis Branch to adapt and expand modeling for use in future energy demand projections.

**2. If Agreement is considered a "Project" under CEQA answer the following questions.**

a) Agreement **IS** exempt?

No

Statutory Exemption?

No

If yes, list PRC and/or CCR section number(s) and separate each with a comma. If no, enter "None" and go to the next question.

PRC section number: "None"

CCR section number: "None"

Categorical Exemption?

No

If yes, list CCR section number(s) and separate each with a comma. If no, enter "None" and go to the next question.

CCR section number: "None"

Common Sense Exemption? 14 CCR 15061 (b) (3)

No

If yes, explain reason why Agreement is exempt under the above section. If no, enter "Not applicable" and go to the next section.

Enter "Not applicable" or reason why Agreement is exempt under the above section

b) Agreement **IS NOT** exempt.

**IMPORTANT:** consult with the legal office to determine next steps.

No

If yes, answer yes or no to all that applies. If no, list all as "no" and "None" as "yes".

| <b>Additional Documents</b>            | <b>Applies</b> |
|--|----------------|
| Initial Study                          | No             |
| Negative Declaration                   | No             |
| Mitigated Negative Declaration         | No             |
| Environmental Impact Report            | No             |
| Statement of Overriding Considerations | No             |
| None                                   | No             |

**H. Subcontractors**

List all Subcontractors listed in the Budget (s). Insert additional rows if needed. If no subcontractors to report, enter "No subcontractors to report" and "0" to funds. **Delete** any unused rows from the table



| Subcontractor Legal Company Name               | Budget |
|--|--------|
| Evolved Energy Research, LLC                   | \$ 0   |
| Jai John Mitchell dba Jai J Mitchell Analytics | \$ 0   |

**I. Key Partners**

List all key partner(s). Insert additional rows if needed. If no key partners to report, enter "No key partners to report." **Delete** any unused rows from the table.

| Key Partner Legal Company Name           |
|--|
| "No Key Partner Legal Company to report" |
|  |

**J. Budget Information**

Include all budget information. Insert additional rows if needed. If no budget information to report, enter "N/A" for "Not Applicable" and "0" to Amount. **Delete** any unused rows from the table.

| Funding Source | Funding Year of Appropriation | Budget List Number | Amount    |
|----------------|-------------------------------|--------------------|-----------|
| ERPA           | 2021/2022                     | 800.128            | \$100,000 |
| ERPA           | 2021/2022                     | 800.100            | \$400,000 |

**TOTAL Amount: \$500,000**

R&D Program Area: Enter R&D Program Area. Example: EDMFO: EDMF

Explanation for "Other" selection Enter explanation for "Other"

Reimbursement Contract #: Enter Reimbursement Contract Number

Federal Agreement #: Enter Federal Agreement Number

**K. Contractor's Contact Information**

**1. Contractor's Administrator/Officer**

Name: Jean Shelton

Address: 1972 Los Angeles Ave

City, State, Zip: Berkeley, CA 94707

Phone: 858-414-2502

E-Mail: jean@verdantassoc.com

**2. Contractor's Project Manager**

Name: Mr. William Marin

Address: 1972 Los Angeles Ave



STATE OF CALIFORNIA  
CALIFORNIA ENERGY COMMISSION

Contract Request Form  
CEC-94 (Revised 01/2023)

City, State, Zip: Berkeley, CA 94707

Phone: 530-632-2103

E-Mail: [william@verdantassoc.com](mailto:william@verdantassoc.com)

**L. Selection Process Used**

There are three types of selection process. List the one used for this CRF.

| Selection Process  | Additional Information  |
|--|-------------------------|
| Competitive Solicitation #   | RFP-22-803, # of Bids 4 |
| Non Competitive Bid ( <i>Attach DGS-GSPD-09-007</i><br><a href="https://www.dgs.ca.gov/PD/Forms">https://www.dgs.ca.gov/PD/Forms</a> ) | "Not Applicable"        |
| Exempt   | "Not Applicable".       |

**M. Contractor Entity Type**

| Contractor Entity Type  | Yes or No? |
|---|------------|
| Private Company ( <i>including non-profits</i> )  | Yes        |
| CA State Agency ( <i>including UC and CSU</i> )   | No         |
| Government Entity ( <i>i.e. city, county, federal government, air/water/school district, joint power authorities, university from another state</i> ) | No         |

**N. Is Contractor a certified Small Business (SB), Micro Business (MB) or Disabled Veterans Business Enterprise (DVBE)?**

The contractor is a certified: "SB".

**O. Civil Service Considerations**

- a. Not Applicable (Agreement is with a CA State Entity or a membership/co-sponsorship)? No
- b. Public Resources Code 25620, et seq., authorizes the Commission to contract for the subject work. (PIER) No
- c. The Services Contracted: Yes.

If no, go to the next question. If yes, which of the following applies to the contract? More than one can apply, list each answer choice, and separate them with a comma:

- are not available within civil service
- cannot be performed satisfactorily by civil service employee
- are of such a highly specialized or technical nature that the expert knowledge, expertise, and ability are not available through the civil service system



The following applies to the contract: “are of such a highly specialized or technical nature that the expert knowledge, expertise, and ability are not available through the civil service system”.

- d. The Services are of such an urgent, temporary, or occasional nature that the delay to implement under civil service would frustrate their very purpose?

“urgent”, “occasional nature”.

**Justification:**

This technical contract provides the necessary specialized expertise and technical support to complement the staff’s current analytic capabilities. It also fills in highly technical and specialized knowledge gaps that will be needed to quickly and accurately assess decarbonization strategies for California’s highly integrated energy systems so that state goals can be achieved in a reliable and cost-effective manner. The Contractor will work under the direction of the Advanced Electrification Analysis Branch Staff to complete the analyses.

**P. Payment Method**

1. Is the payment method Reimbursement, Advanced Payment, or Other?

“Reimbursement”.

If Other, explain: Enter explanation for "Other" payment method.

2. If Reimbursement, is it in arrears based on Itemized Monthly, Itemized Quarterly, Flat Rate, or One-time?

“Itemized Monthly”.

**Q. Retention**

Is Agreement subject to retention? Yes.

If Yes, Will retention be released prior to Agreement termination? Yes.

**R. Justification of Rates**

The rates are similar to the rates for this company in a previous contract. The contract was competitively bid and the contractor received the highest score.

**S. Disabled Veteran Business Enterprise Program (DVBE)**

Provide requested additional information.

1. Exempt (Interagency/Other Government Entity) No.
2. Meets DVBE Requirements DVBE Yes.  
Amount: \$ DVBE %:3
3. Is the Contractor Certified DVBE or Subcontracting with a DVBE? If subcontracting with a DVBE, provide the name of the DVBE company. If none applies, enter “Not Applicable”.
4. Jai J Mitchell dba Jai J Mitchell Analytics Contractor selected through CMAS or MSA with no DVBE participation No.
5. Requesting DVBE Exemption (attach CEC 95) No.

**T. Miscellaneous Agreement Information**



1. Will there be Work Authorizations? Yes.
2. Is the contractor providing confidential information? No.
3. Is the contractor going to purchase equipment? No.
4. What is the check frequency of the progress reports? Monthly, Quarterly, or Other? If Other, please provide explanation.  
Monthly.
5. Will a final report be required? Yes.
6. Is the Agreement, with amendments, longer than three years? If yes, why?  
No.

**U. The following items should be attached to this CRF (as applicable)**

List all items that should be attached to this CRF by entering "Yes" or "No".

| Item Number | Item Name  | Attached |
|-------------|--|----------|
| 1           | Exhibit A, Scope of Work/Schedule                | Yes      |
| 2           | Exhibit B, Budget Detail                         | Yes      |
| 3           | DGS-GSPD-09-007, NCB Request                     | No       |
| 4           | CEC 95, DVBE Exemption Request                   | No       |
| 5           | Awardee CEQA Documentation                       | No       |
| 6           | Resumes  | Yes      |
| 7           | CEC 105, Questionnaire for Identifying Conflicts | Yes      |

**Approved By**

Individuals who approve this form must enter their full name and approval date in the MS Word version.

**Agreement Manager:** Agreement Manager Name

**Approval Date:** Agreement Manager's Approval Date

**Office Manager:** Office Manager Name

**Approval Date:** Office Manager's Approval Date

**Deputy Director:** Deputy Director Name

**Approval Date:** Deputy Director's Approval Date



**Exhibit A**  
**SCOPE OF WORK**

**TASK LIST**

| <b>Task #</b> | <b>Task Name</b>  |
|---------------|---|
| 1             | Agreement Management  |
| 2             | Adapt/Develop Demand Scenarios Model & Prepare Reference Scenario Projections |
| 3             | Establish Scenarios, Develop & Document Projections                           |
| 4             | Develop Cost Inputs and Projections   |
| 5             | Develop Model for Aviation Sub-Sector   |

**ACRONYMS/GLOSSARY**

*Specific acronyms and terms used throughout this scope of work are defined as follows:*

| <b>Acronym</b> | <b>Definition</b>   |
|----------------|---|
| AEAB           | Advanced Electrification Analysis Branch  |
| Bidder         | Respondent to this RFP  |
| CAISO          | California Independent System Operator  |
| CAM            | Commission Agreement Manager  |
| CAO            | Commission Agreement Officer  |
| CARB           | California Air Resources Board  |
| CCS            | Carbon Capture & Storage  |
| CEC            | California Energy Commission  |
| CED            | California Energy Demand  |
| CPUC           | California Public Utilities Commission  |
| DER            | Distributed Energy Resource   |
| DGS            | Department of General Services  |
| DVBE           | Disabled Veteran Business Enterprises   |
| GHG            | Greenhouse Gas  |
| PM             | Program Manager   |
| IEPR           | Integrated Energy Policy Report   |
| NOPA           | Notice of Proposed Award, a public notice by the Energy Commission that identifies award recipients |
| Proposal       | Formal written response to this document from Bidder  |
| RFP            | Request for Proposals   |
| State          | State of California   |
| SB 100         | Senate Bill 100 – The 100 Percent Clean Energy Act of 2018  |
| TCU            | Transportation, Communications, and Utilities   |
| WA             | Work Authorization  |

## **BACKGROUND/PROBLEM STATEMENT**

In the initial implementation of the CEC Demand Scenarios Project, Advanced Electrification Analysis Branch (AEAB) staff worked to develop a model that relied upon the basic framework of the PATHWAYS model with certain portions bypassed and replaced with projections developed by AEAB staff. This tool is referred to as Adapted-PATHWAYS. The tool was used to develop annual energy demand projections in all customer sectors for all fuels and their GHG emissions for several types of scenarios. This project anticipates retaining the basic approach but improving selected areas and updating most input assumptions from statewide to electric planning area levels to drive model results.

In support of developing demand scenarios that will be included in the 2023 IEPR proceeding as well as the SB100 report, the contractor would either adapt and expand the existing Adapted-PATHWAYS Model or create a new model to make annual energy demand projections by electric planning area covering the entire state that reflects user-defined input assumptions. For electricity, the model will generate annual 8760 hourly load projections out to 2050 for the same planning areas used in the CEC demand forecast. The final Demand Scenarios Model will be a combination of results from the AEAB staff's energy projections in the residential, commercial, transportation and industrial sectors (electricity and natural gas) and the contractor's analysis for the remaining fuels in these sectors and all fuels used in the other sectors (transportation-aviation, agriculture, oil and gas, petroleum refining, TCU) for the various scenarios staff envisions for this project.

Staff plans to develop various types of scenarios including additional measures proposed by the California Air Resources Board (CARB) in their 2022 Scoping Plan Scenario and incorporated into energy planning by the California Public Utilities Commission (CPUC) in their 2023 Integrated Resources Plan. Staff will also develop additional sensitivities to reflect the implications of emerging policy innovations to be included in the 2023 IEPR proceeding as well as the SB100 report.

## **GOALS /OBJECTIVES OF THE AGREEMENT**

The objective of this work authorization contract is to provide technical assistance to the Energy Assessments Division (EAD) by adapting and expand the existing Adapted-PATHWAYS Model or create a new model to make annual energy demand projections by electric planning area covering the entire state that reflects user-defined input assumptions. For electricity, the model will generate annual 8760 hourly load projections out to 2050 for the same planning areas used in the CEC demand forecast. The CEC will be the sole and exclusive owner and copyright holder of any and all models developed as part of Tasks 2 – 5.

## **WORK AUTHORIZATIONS**

The Contractor will assist the Energy Assessments Division by performing the tasks specified in this Scope of Work under the direction of the Energy Commission's Commission Agreement Manager (CAM). The CAM will oversee the management and administration of the agreement. The resulting agreement will include defined tasks for Task 1. The technical tasks will be defined in several Work Authorizations (WAs). Additional WAs can be used on an as-needed basis. The specific activities and the degree of effort for each activity may vary. Work assigned through WAs will depend on availability of funding as well as the Energy Commission's demand for service as determined by the CAM.

No work shall be undertaken, except for Task 1, unless authorized by the CAM through a specific WA. The CAM will prepare and issue the written work authorizations and shall set a maximum price, budget, and schedule for the work to be performed. The CAM will work, in consultation with the Contractor, to assign work to either the Contractor or a Subcontractor.

## **FORMAT/REPORTING REQUIREMENTS**

### **Deliverables/Reports**

When creating reports, the Contractor shall use and follow, unless otherwise instructed in writing by the CAM, the latest version of the Consultant Reports Style Manual published on the Energy Commission's web site:

[http://www.energy.ca.gov/contracts/consultant\\_reports/index.html](http://www.energy.ca.gov/contracts/consultant_reports/index.html)

Each final deliverable shall be delivered as one original, reproducible, 8 ½" by 11", camera-ready master in black ink. Illustrations and graphs shall be sized to fit an 8 ½" by 11" page and readable if printed in black and white.

### **Electronic File Format**

The Contractor shall deliver an electronic copy (CD ROM or memory stick or as otherwise specified by the CAM) of the full text in a compatible version of Microsoft Word (.doc).

The following describes the accepted formats of electronic data and documents provided to the Energy Commission as contract deliverables and establishes the computer platforms, operating systems and software versions that will be required to review and approve all software deliverables.

- Data sets shall be in Microsoft (MS) Access or MS Excel file format.
- PC-based text documents shall be in MS Word file format.
- Documents intended for public distribution shall be in PDF file format, with the native file format provided as well.
- Project management documents shall be in MS Project file format.

### **Software Application Development**

If this scope of work includes any software application development, including but not limited to databases, websites, models, or modeling tools, contractor shall utilize the following standard Application Architecture components in compatible versions:

- Microsoft ASP.NET framework (version 3.5 and up) Recommend 4.0
- Microsoft Internet Information Services (IIS), (version 6 and up) Recommend 7.5
- Visual Studio.NET (version 2008 and up) Recommend 2010

- C# Programming Language with Presentation (UI), Business Object and Data Layers
- SQL (Structured Query Language)
- Microsoft SQL Server 2008, Stored Procedures Recommend 2008 R2
- Microsoft SQL Reporting Services Recommend 2008 R2
- XML (external interfaces)

Any exceptions to the Software Application Development requirements above must be approved in writing by the Energy Commission Information Technology Services Branch.

## **TASK 1- AGREEMENT MANAGEMENT**

### **TASK 1.1 KICK-OFF MEETING**

The goal of this task is to establish the lines of communication and procedures for implementing this Agreement

#### **The Contractor shall:**

- Attend a “kick-off” meeting with the CAM, the Contracts Officer, and a representative of the Accounting Office. The meeting will be held via Teams or Zoom or teleconference. The Contractor shall include their Project Manager, Contracts Administrator, Accounting Officer, and others designated by the CAM in this meeting. The administrative and technical aspects of this Agreement will be discussed at the meeting.
- Arrange the meeting including scheduling the date and time.
- Provide a draft agenda to the CAM for review.
- Provide a final agenda to all potential meeting participants prior to the kick-off meeting.

#### **The CAM shall:**

- Review and approve the draft agenda from the contractor prior to the kick-off meeting.
- Coordinate with all relevant CEC staff to participate in the kickoff meeting.

#### **Deliverables:**

- Draft and Final Agendas.
- Summary of the kickoff to be included in the monthly progress report.

### **TASK 1.2 INVOICES**

#### **The Contractor shall:**

- Prepare invoices for all reimbursable expenses incurred performing work under this Agreement in compliance with the Exhibit B of the Terms and Conditions of the Agreement. Invoices shall be submitted with the same frequency as progress reports (Task 1.4). Invoices must be submitted to the Energy Commission's Accounting Office.

**Deliverables:**

- Monthly invoice (to be included with monthly progress reports)

### **TASK 1.3 MANAGE SUBCONTRACTORS**

The goal of this task is to ensure quality products, to enforce Subcontractor Agreement provisions, and in the event of failure of the Subcontractor to satisfactorily perform services, recommend solution to resolve the problem.

**The Contractor shall:**

Manage and coordinate Subcontractor activities. The Contractor is responsible for the quality of all Subcontractor work and the CEC will assign all work to the Contractor. If the Contractor decides to add new Subcontractors, they shall 1) comply with the Terms and Conditions of the Agreement, and 2) notify the CAM who will follow the Energy Commission's process for adding or replacing Subcontractors.

### **TASK 1.4 PROGRESS REPORTS**

The goal of this task is to periodically verify that satisfactory and continued progress is made towards achieving the objectives of this Agreement.

**The Contractor shall:**

- Prepare progress reports which summarize all Agreement activities conducted by the Contractor for the reporting period, including an assessment of the ability to complete the Agreement within the current budget and any anticipated cost overruns. Each progress report is due within 15 calendar days after the end of the reporting period. The CAM will provide the format for the progress reports.

**Deliverables:**

Monthly Progress Reports

### **TASK 1.5 WORK AUTHORIZATIONS**

The goal of this task is to develop and manage all technical and budgetary aspects of work authorizations (WA) in accordance with the requirements of this Agreement for work to be performed under Technical Tasks 2 through 5.

**The Contractor shall:**

- Help prepare WAs in accordance with the contract requirements.
- The WA format and content shall be specified by the CAM.
- The WA end date should be no later than 60 days prior to the term end date of the Agreement.
- Submit all required WA Documents to the CAM.
- Administer WAs
- Establish and maintain contractual agreements with entities performing work.
- Develop project schedules.
- Manage Subcontractor activities in accordance with the Agreement terms and conditions.
- Provide oversight and first-level review of reports and documentation, and comment on the content of deliverables.
- Review and approve all WA invoices.
- Provide audit and accounting services for all WAs.
- Immediately report any significant variances affecting performance of WAs and recommend mitigation actions for consideration by the Project Manager and CAM. Examples of significant variances include the inability to submit deliverables by key WA due dates, unavailability of key personnel that will affect timely submittal of deliverables, and key technical issues that would require change in scope, redirection of the effort, or discontinuation of the project.
- Coordinate with the CAM to close out completed WAs and remaining unallocated balances.
- Monitor and track each WA and the overall agreement.
- Provide updated WA project schedules, as needed, and determine if each WA is on schedule and deliverables are satisfactory.
- Determine the fiscal status of each WA and the overall Agreement.
- Prevent cost overruns.
- Track the start, progress, and closure of each WA.

**Deliverables:**

WA Documents

## **TASK 1.6 FINAL REPORT**

The goal of this task is to prepare a comprehensive written final report that describes the original purpose, approach, results, and conclusions of the work completed under this Agreement. The final report shall be prepared in language easily understood by the public or layperson with a limited technical background.

The final report must be completed before the termination date of the Agreement in accordance with the schedule of deliverables.

The final report shall be a public document. If the Contractor has obtained confidential status from the CEC and will be preparing both a public and a confidential version of the final report, the Contractor shall perform the following subtasks for both the public and confidential versions of the final report.

### **Deliverables:**

Final Reports

## **TECHNICAL TASKS**

### **TASK 2: ADAPT/DEVELOP DEMAND SCENARIOS MODEL & PREPARE REFERENCE SCENARIO PROJECTIONS**

In support of developing demand scenarios as part of the 2023 IEPR proceeding and used within the SB100 proceeding, the contractor shall either further adapt the existing Adapted-PATHWAYS Model or create a new model to make annual energy demand projections from 2022 to 2050 by electric planning area covering the entire state that reflects user-defined input assumptions. The final Demand Scenarios Model will be a combination of results from the AEAB staff's energy projections in the residential, commercial, transportation and industrial sectors (electricity and natural gas) and the contractor's analysis for the remaining fuels in these sectors and all fuels used in the other sectors (transportation-aviation, agriculture, oil and gas, petroleum refining, TCU) for the various scenarios staff envisions for this project.

The staff and contractor will first work to develop the framework for the scenarios. For the demand scenarios model, developing the level of disaggregation, the fuels to be covered in each economic sector, the nature and level of granularity of the staff-supplied projections in the sectors identified above, and the contractor-developed sectors/fuels projections is required. Once the framework and model development is agreed to, the contractor will work with staff to reach an understanding of what needs to be done to incorporate staff projections of annual energy demands in the residential, commercial, transportation, and industrial sectors along with the portion of the model developed by the contractor. The contractor will then further adapt the Adapted-PATHWAYS model or develop a new model.

## **TASK 2.1: MODEL CAPABILITY TO ASSESS ENERGY CONSEQUENCES OF DEMAND SCENARIOS AND SENSITIVITIES**

Staff anticipates developing various types of scenarios with some additional sensitivities to reflect the implications of emerging policy innovations. Some elements of these scenarios will be developed using staff-developed projection tools and some must be addressed in the portions of the model developed by the contractor. Staff will complete the initial annual energy projections for the residential, commercial, transportation, and industrial sectors. Staff will then hand the projections to the consultant to generate a complete Reference Scenario covering all sectors and fuels.

- a. The various types of Scenarios are:
  - Reference Scenario – Planning forecast extended out to 2050.
  - Policy/Compliance Scenario – Reference Demand scenario adjusted by program levers, such as: Title 24 ratchets, Title 20, Utility Retrofit programs, Transportation standards. This scenario and multiple sensitivities assessing specific programmatic innovations will illustrate the impact of actual policies that are not fully included in the Reference scenario.
  - Enhanced Programmatic Scenario (Additional Policies, Not Goal Constrained). This scenario and multiple sensitivities add additional standards, programs, policies, and assumptions beyond those already included in the Policy/Compliance Scenario that are not yet approved.
  - Scenarios including additional measures proposed by the California Air Resources Board (CARB) in their final 2022 Scoping Plan and by the California Public Utilities Commission (CPUC) in their 2023 Integrated Resources Plan.
- b. AEAB Staff will work with the contractor to define the parameters of all the Scenarios to be implemented in the Demand Scenarios Model. The contractor will then use the model to evaluate the energy and GHG outcomes of all these Scenarios statewide and by electric planning area (PG&E, SCE, SDG&E, LADWP, BANC and Others).
- c. The contractor will then review these results with AEAB staff.

## **TASK 2.2: REFINE TRANSLATION OF ANNUAL ELECTRIC ENERGY PROJECTIONS INTO HOURLY 8760 LOAD PROJECTIONS BY PLANNING AREA**



Since the core unit of geography of the Task 2.1 model development is at the level of electric planning area, the mechanics of developing hourly 8760 projections from annual electric energy projections can be improved compared to the initial 2021/22 demand scenarios tool. Contractor will work with CEC staff to design improved mechanics for the hourly projections, including, but not limited to, time-of-use rates and schedules. Once the WAM is satisfied with a proposed approach, the contractor will modify the model to implement the model changes. Once preliminary results are obtained, results will be compared to previous projections for consistency and further refinements may be needed. Changes to load profiles at the planning area/sector/sub-sector level for the final projections will be addressed in Task 3.3.

### **TASK 2.3: REFINE/DEVELOP GHG EMISSION FACTORS**

Regulatory requirements and various programs can be expected to modify the GHG emissions per unit of fuel combusted in each sector. For example, the essence of SB100 is to reduce the GHG emissions of electric generation in California by increasing the share of generation produced by renewables and other non-carbon emission generating technologies not qualifying for Renewable Portfolio Standard credits. Regulatory requirements for fuels may require fuel-specific GHG emission factors to also change through time. The Contractor will develop a series of annual GHG emission factors for each sector/fuel type combination reflecting these impacts by drawing upon existing studies. The contractor will also develop non-energy GHG emissions projections for the various scenarios and sensitivities.

The Contractor will develop a preliminary Reference scenario projection for fuel demand by sector/fuel type/electric planning area and associated GHG emissions at the same level of granularity for review by EAD staff. Significant departures of the new preliminary reference scenario projections from the previous reference scenario results of the initial 2021/22 demand scenarios project results will be reviewed and may lead to model and/or input assumption revisions.

### **TASK 2.4: ENERGY DEMAND IMPACTS OF CARBON, CAPTURE AND SEQUESTRATION & DIRECT AIR CAPTURE TECHNOLOGIES**

The Contractor will develop new capabilities to endogenously project energy demand consequences of carbon, capture and sequestration and direct air capture technologies, as well as GHG impacts and costs for selected sectors such as petroleum refining and industrial sector for all the 13 scenarios in the Model. The costs could include initial capital costs, operating and maintenance costs. In the CARB Scoping Plan Scenario the penetration rates of these technologies will match those included by CARB in the final 2022 Scoping Plan.

#### **Task 2 Deliverables:**

- a) Framework alignment between AEAB and contractor on the various scenario themes, data input assumptions and modifications which help the model development so that it can accept AEAB's annual energy projections for residential, commercial, transportation and industrial sectors.
- b) Further adapt the Adapted-PATHWAYS model provided by the CEC or develop a new model that satisfies the framework and model development requirements.
- c) Working model with results (energy demand, GHG impacts, CCS) from preliminary projections for CEC Reference Scenario.
- d) Working documentation explaining the model and its preliminary results.

### **TASK 3: ESTABLISH SCENARIOS, DEVELOP & DOCUMENT PROJECTIONS**

The scope and schedule for this task must conform to AEAB staff plans to host a Demand Scenarios workshop in the 2023 IEPR proceeding by the end of 2023 outlining the nature of the project, goals for use of the demand scenario projections in the SB 100 proceeding with the contractor's project support for quantification of scenario results.

#### **TASK 3.1 ESTABLISH SCENARIOS AND SENSITIVITIES**

The contractor will work with CEC staff to translate the framework and descriptions developed in Task 2 into detailed specifications for various scenarios and sensitivities. An initial set of scenarios/sensitivities listed below provides a sense of the scope and nature of the scenarios/sensitivities to be assessed. In compliance with general state goals to electrify most elements of energy usage, these scenarios all emphasize high electrification (HE), but sensitivity cases will explore the added consequences of additional measures to reduce traditional fuel consumption or augment electricity consumption in specific applications where electricity technologies are infeasible or too inefficient. In addition, Distributed Energy Resources (DER) or Demand Response (DR) programs/technologies may modify energy consumption or hourly system electric load shapes. These scenario/sensitivity cases include:

- High Electrification (HE)
- HE augmented by Biofuels
- HE augmented by Hydrogen
- HE augmented by Distributed Energy Resources (DER)
- HE augmented by Electric Demand/Load Flexibility Measures.
- 2022 CARB Scoping Plan Scenario
- 2023 CPUC Integrated Resource Plan Scenario

CEC Staff currently contemplate a total of 13 developed scenarios/sensitivities with annual energy projections from 2023 through 2050. Staff expects to hold a workshop on the Demand Scenarios Framework and results. The lead contractor should attend and be prepared to describe the development of the model, inputs and assumptions at that workshop.

**Task 3.1 Deliverables:**

- a) Demand Scenarios model covering the entire statewide footprint but developed at the level of CEC staff planning areas, that can develop projections that are sensitive to program and policy inputs reflecting the range of scenarios listed in deliverable c).
- b) Model results in Excel spreadsheet format out to 2050 for 13 statewide scenarios by electric planning areas (PG&E, SCE, SDG&E, LADWP, BANC & Others)
- c) Final input datasets and a final working model. .

**d) Scenarios & Sensitivities**

| S No. | Demand Scenarios                            | Demand Scenario/Sensitivity                      |
|-------|---|--|
| 1     | Reference                                   | Reference Scenario                               |
| 2     | Policy/Compliance                           | High Electrification (HE)                        |
| 3     | Policy/Compliance (Sensitivity)             | HE augmented by Biofuels                         |
| 4     |   | HE augmented by Hydrogen                         |
| 5     |   | HE augmented by DER                              |
| 6     |   | HE augmented by Demand Response/Load Flexibility |
| 7     | Enhanced Programmatic Scenario              | High Electrification (HE)                        |
| 8     | Enhanced Programmatic (Sensitivity)         | HE augmented by Biofuels                         |
| 9     |   | HE augmented by Hydrogen                         |
| 10    |   | HE augmented by DER                              |
| 11    |   | HE augmented by Demand Response/Load Flexibility |
| 12    | 2022 CARB Scoping Plan Scenario             | TBD  |
| 13    | 2023 CPUC Integrated Resource Plan Scenario | TBD  |

**TASK 3.2 DEVELOP DEMAND SCENARIO PROJECTIONS**

Once the specifications of the Policy/Compliance and Enhanced Programmatic Scenarios have been finalized in Task 2 both staff and contractor will develop their respective projections to collectively reflect each of these two scenarios and their sensitivities as outlining in Task 2. Staff will then deliver the final energy demand projections for the residential, commercial, transportation, and industrial sectors for each of the scenarios in Task 2. The contractor will then incorporate these energy demand components in the model to generate 2022 – 2050 projection results for each of the Reference Scenario, Policy/Compliance Scenario and Enhanced Programmatic Scenario with the various scenario sensitivities. The contractor will then review results with key AEAB staff. The Contractor shall make revisions as directed by AEAB staff as a result of the review.

The contractor shall also identify GHG emission consequences from various fuel types (Energy emissions) and Non-Energy emissions and develop a list of methods for estimating the Total GHG emissions by economic sectors. The model will be capable of reporting GHG emission projections in two alternative reporting schema - CEC economic sectors and CARB scoping plan sectors - for all scenarios. For Non-Energy emission sources, the model will rely upon CARB 2022 Scoping Plan projections.

Staff and the contractor will present at a workshop a description of their methodology and results for the various types of scenarios and their sensitivities.

The contractor will prepare a 20-30 page draft and final white paper describing the process they used to modify input assumptions and calculations to run the Demand Scenarios model to accept AEAB's projections, summarizing the model input assumptions and energy consumption and greenhouse gas emissions results for the various types of scenarios evaluated. The white paper will incorporate one round of staff comments.

### **Task 3.2 Deliverables:**

- a) Energy Demand projection results in Excel format including all scenario projections for 2022-2050 for each scenario, sector, fuel type, planning area combinations.
- b) Draft/Final white paper on the inputs/assumptions/outputs used to develop the Demand Scenarios that staff can review.
- c) Identify and incorporate GHG emission consequences from combustion GHG sources in the model.
- d) Identify and incorporate GHG emission consequences from non-combustion GHG sources in the model.

### **TASK 3.3: DEVELOP AND EVALUATE LOAD PROFILES BY SUB-SECTOR**

In support of staff's effort to develop long term demand scenarios, the contractor will collaborate with staff to review and develop selected load profiles by sector/subsector/end-use for use in translating annual electric energy into scenario 8760 hourly projections. AEAB staff use hourly load profiles in various demand forecasting tools and load modifier projection tools to generate hourly load projections. Both the contractor and AEAB staff will compare each other's existing load profiles and the assumptions behind these load profiles and subsequently develop a consensus about what load profile assumptions to use to translate annual electric energy demand into hourly loads by year/sector/scenario/sensitivity case out to 2050.

Staff will review the contractor's recommendation and determine which portions to utilize in this task.

Following the determination by staff, the contractor shall provide any non-CEC 8760 hourly profiles by sector/subsector to the AEAB staff in a format compatible with the load modifier and sector specifications.

**Task 3.3 Deliverables:**

- a) PowerPoint slide deck summarizing the contractor's comparison of their load profiles versus CEC's load profiles by sector/subsector/end-use. This summary will provide relative strengths and weaknesses of the respective load profiles.
- b) Memo comparing the contractor's load profiles with AEAB's load profiles documenting the differences in methodology, and the consensus for which load shapes to use in the Demand Scenarios project.
- c) Excel workbook conveying recommended load profiles for use in CEC hourly projection tools.

**TASK 3.4: DEVELOP HOURLY LOAD PROJECTIONS FOR THE ESTABLISHED SCENARIOS**

To extend the results of Task 3 annual electric energy projections for each scenario into hourly load projections useful for production simulation models, the contractor shall (1) review the basic approach implemented in the initial 2021/22 demand scenarios project, and (2) propose feasible options that can be completed by the end of calendar 2023. Following a selection from these options by the Contract Manager the contractor shall develop a method of projecting 8760 hourly loads from 2022 to 2050 given that there is a mix of electric energy hourly demand sources for each scenario (some generated by the contractor, and some imported from CEC forecasting and load modifier tools). Once the method is implemented and tested, the contractor will generate 8760 hourly results by sector/subsector by planning area for each of the scenario types (Reference, Policy/Compliance and Enhanced Programmatic) and for each sensitivity case with relevant electricity load pattern implications.

**Task 3.4 Deliverables:**

- a) Memo identifying feasible methods for generating 8760 hourly projections by planning area and scenario.
- b) 8760 load results by planning area for Reference, Policy-Compliance, and Enhanced Programmatic scenarios, using the load shapes based on Task 4
- c) Model used to make the projections in deliverable b.
- d) Spreadsheets/draft write up on the inputs/assumptions/outputs used to develop the Demand Scenarios that Staff can review.
- e) Final write up and associated output spreadsheets detailing the work and results.

**TASK 3.5: DEVELOP MODEL TRAINING FOR STAFF**

The contractor will provide training sessions along with preparation assignments to prepare staff to run the Demand Scenarios Model. The training will include a detailed

walkthrough of model mechanics and the translation method of the annual loads in the model to hourly loads, with emphasis on hourly shapes.

**Deliverables:**

- a) Training on the initial model mechanics and process of scenario development after each scenario is being developed.
- b) Training on translating annual electric energy demand in the model into hourly loads.
- c) Six two-hour Demand Scenarios Model training Sessions (and preparation assignments)

## **TASK 4: DEVELOPMENT OF COST INPUTS AND PROJECTIONS**

The contractor will acquire from existing sources or develop new estimates of the costs to end-users of the technologies, along with program delivery costs, embodied in the projections for each scenario. Since the Adapted-PATHWAYS model or its replacement consists of some inputs from CEC staff modeling tools and some come from the original PATHWAYS itself, this task has two distinct sub-tasks that must be coordinated to the extent resources are available. The general objective of this cost assessment is to understand the relative net costs of alternative demand-side scenario elements with supply-side options as part of the SB100 proceeding.

### **TASK 4.1 COORDINATE INPUTS FROM CEC MODELS**

The Contractor shall work with the WA manager and CEC technical staff covering the residential, commercial, industrial, and transportation sectors to determine cost data to use in the Adapted-PATHWAYS model or its replacement. The cost data shall be consistent with the energy projections from the models developed in Tasks 2 and 3. When available in the timeline of this project, the contractor shall propose explicit formats to import these cost projections into the overall Adapted-PATHWAYS projection model.

### **TASK 4.2 DEVELOP COST PROJECTION CAPABILITIES FOR NON – CEC SECTORS**

To the extent policy-induced energy projections shift energy forms or energy consumption levels in sectors not addressed in CEC staff projections, the contractor will develop aggregate cost projections.

**Task 4 Deliverables:**

- a) Develop format for importing AEAB sectoral cost projections into the demand scenario model.
- b) Document methods and assumptions the contractor used to prepare aggregate sectoral cost estimates for Task 4.2.
- c) Draft/Final white paper on the inputs/assumptions/outputs used to develop the cost projections that staff can review and provide feedback.

## TASK 5: DEVELOP MODEL FOR AVIATION SUB- SECTOR

In support of the Transportation Energy Demand Forecast (TEDF) and its incorporation into the IEPR, Demand Scenarios Project, and SB 100 proceedings, the contractor will develop improvements to the TEDF passenger/freight aviation fuel demand model. The leading product will be a literature review of various aviation fuel technologies, including but not limited to sustainable aviation fuel (SAF) as a drop-in replacement for jet fuel, other potential drop-in combustion fuels with low carbon impacts, battery-electric aviation technologies, hydrogen fuel cell aviation technologies, and hydrogen combustion technologies. After a review and assessment of the technology introduction schedule for each of the technologies, the contractor will develop and propose new additions to the aviation fuel demand model that incorporate each of the technologies where feasible or appropriate. The Aviation fuel demand model will translate external inputs of Aviation travel demand into projected demand for individual fuels. The model will also incorporate any existing or proposed aviation fuel regulations or goals and be capable of being easily responsive to regulatory, programmatic, or technological changes that must be addressed in future IEPR cycles.

### Deliverables:

- a) Literature review of sustainable or low-carbon aviation technologies, including zero-emission fuels.
- b) An improved fuel demand model integrating technologies, regulations, and flexibility to incorporate additional state goals.

### SCHEDULE OF DELIVERABLES AND DUE DATES

Note: Actual deliverables will be specified in each Work Authorization.

| Task Number | Deliverable   | Due Date |
|-------------|---|----------|
| 1           | <b>Agreement Management</b>                                     |          |
| 1.1         | Kickoff Meeting, including meeting notes and next steps summary | Monthly  |
| 1.2         | Prepare Invoices  | Monthly  |
| 1.3         | Manage Subcontractors   | Monthly  |
| 1.4         | Monthly Progress Reports  | Monthly  |
| 1.5         | Work Authorizations   | Monthly  |

|          |   |                 |
|----------|---|-----------------|
| 1.6      | Final Report  | TBD             |
| <b>2</b> | <b>Adapt/Develop Demand Scenarios Model &amp; Prepare Reference Scenario Projections</b>                    | <b>9/29/23</b>  |
| 2.1      | Model Capability to Assess Energy Consequences of Demand Scenarios and Sensitivities                        | Ongoing         |
| 2.2      | Refine Translation of Annual Electric Energy Projections into Hourly 8760 Load Projections by Planning Area | Ongoing         |
| 2.3      | Refine/Develop GHG Emission Factors   | Ongoing         |
| 2.4      | Energy Demand Impacts Of Carbon, Capture & Sequestration & Direct Air Capture Technologies                  | Ongoing         |
| <b>3</b> | <b>Establish Scenarios, Develop and Document Projections</b>  | <b>11/15/23</b> |
| 3.1      | Establish Scenarios & Sensitivities   | Ongoing         |
| 3.2      | Develop Demand Scenario Projections   | Ongoing         |
| 3.3      | Develop and evaluate load profiles by sub-sector  | Ongoing         |
| 3.4      | Develop Hourly load projections for the established Scenarios   | Ongoing         |
| 3.5      | Develop Model Training for Staff  | Ongoing         |
| <b>4</b> | <b>Develop Cost Inputs and Projections</b>  | <b>01/15/24</b> |
| 4.1      | Coordinate inputs from CEC Models   | Ongoing         |
| 4.2      | Develop cost projection capabilities for Non-CEC Sectors  | Ongoing         |
| <b>5</b> | <b>Develop Model for Aviation Sub-Sector</b>  | <b>09/01/23</b> |