

CONTRACT REQUEST FORM (CRF)

I) List all key partners: (attach additional sheets as necessary)

Legal Company Name:

J) Budget Information

Funding Source	Funding Year of Appropriation	Budget List No.	Amount
NG Subaccount, PIERDD	12-13	501.001G	\$1,200,000
R&D Program Area: EGRO: Transportation		TOTAL:	\$
Explanation for "Other" selection			
Reimbursement Contract #:		Federal Agreement #:	

K) Contractor's Administrator/ Officer

Contractor's Administrator/ Officer		Contractor's Project Manager	
Name:	Joshua Silber	Name:	Doug Kirkpatrick
Address:	750 BATTERY ST STE 700	Address:	750 BATTERY ST STE 700
City, State, Zip:	SAN FRANCISCO, CA 94111-1527	City, State, Zip:	SAN FRANCISCO, CA 94111-1527
Phone:	415-273-6806 / Fax: - -	Phone:	415-273-6080 / Fax: - -
E-Mail:	jsilber@blackpaktech.com	E-Mail:	dkirkpatrick@blackpaktech.com

L) Selection Process Used (For amendments, address amendment exemption or NCB, do not identify solicitation type of original agreement.)

- Solicitation Select Type Solicitation #: _____ # of Bids: _____ Low Bid? No Yes
 Non Competitive Bid (Attach CEC 96)
 Exempt Select Exemption (see instructions)

M) Contractor Entity Type

- Private Company (including non-profits)
 CA State Agency (including UC and CSU)
 Government Entity (i.e. city, county, federal government, air/water/school district, joint power authorities, university from another state)

N) Is Contractor a certified Small Business (SB), Micro Business (MB) or DVBE? No Yes

If yes, check appropriate box: SB MB DVBE

O) Civil Service Considerations

- Not Applicable (Agreement is with a CA State Entity or a membership/co-sponsorship)
 Public Resources Code 25620, et seq., authorizes the Commission to contract for the subject work. (PIER)
 The Services Contracted:
 are not available within civil service
 cannot be performed satisfactorily by civil service employees
 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 Services are of such an:
 urgent
 temporary, or
 occasional nature
 that the delay to implement under civil service would frustrate their very purpose.

Justification:**P) Payment Method**

- A. Reimbursement in arrears based on:
 Itemized Monthly Itemized Quarterly Flat Rate One-time
 B. Advanced Payment
 C. Other, explain:

Q) Retention

1. Is Agreement subject to retention? No Yes
 If Yes, Will retention be released prior to Agreement termination? No Yes

R) Justification of Rates



s) Disabled Veteran Business Enterprise Program (DVBE)

1. Exempt (Interagency/Other Government Entity)

2. Meets DVBE Requirements DVBE Amount:\$ 37,500.00 DVBE %: 3.125
 Contractor is Certified DVBE
 Contractor is Subcontracting with a DVBE: _____

3. Contractor selected through CMAS or MSA with no DVBE participation.

4. Requesting DVBE Exemption (attach CEC 95)

t) Miscellaneous Contract Information

1. Will there be Work Authorizations? No Yes

2. Is the Contractor providing confidential information? No Yes

3. Is the Contractor going to purchase equipment? No Yes

4. Check frequency of progress reports
 Monthly Quarterly _____

5. Will a final report be required? No Yes

6. Is the agreement, with amendments, longer than a year? If yes, why? No Yes

The Department of General Services has agreed to give the Commission blanket authority to execute multi-year contracts to support the Commission's RD&D Programs.

u) The following items should be attached to this CRF (as applicable)

1. Exhibit A, Scope of Work	<input type="checkbox"/> N/A	<input checked="" type="checkbox"/> Attached
2. Exhibit B, Budget Detail	<input type="checkbox"/> N/A	<input checked="" type="checkbox"/> Attached
3. CEC 96, NCB Request	<input type="checkbox"/> N/A	<input checked="" type="checkbox"/> Attached
4. CEC 30, Survey of Prior Work	<input checked="" type="checkbox"/> N/A	<input type="checkbox"/> Attached
5. CEC 95, DVBE Exemption Request	<input checked="" type="checkbox"/> N/A	<input type="checkbox"/> Attached
6. CEQA Documentation	<input type="checkbox"/> N/A	<input checked="" type="checkbox"/> Attached
7. Resumes	<input type="checkbox"/> N/A	<input checked="" type="checkbox"/> Attached
8. CEC 105, Questionnaire for Identifying Conflicts		<input checked="" type="checkbox"/> Attached

 Agreement Manager Date Office Manager Date Deputy Director Date

Exhibit A
SCOPE OF WORK

1
2
3 **TECHNICAL TASK LIST**
4

Task #	CPR	Task Name
1	N/A	Administration
2	N/A	Vehicle Platform Survey and Selection
3	X	Fuel Pressure Boost Compressor
4	N/A	Tank Design and Component Testing
5	X	Tank System Design and Integration
6	N/A	Initial Robustness, Reliability, and Safety Evaluations
7	X	Vehicle System Integration, Test, and Demonstration

5
6
7
8 **ACRONYM/TERM LIST**

9 *Acronyms and terms used throughout this work statement are listed below:*

Acronym	Definition
ANG	Adsorbed Natural Gas
ATMI	ATMI, Inc. (ATMI is not an acronym)
BrightBlack	A carbon adsorbent material manufactured by ATMI
CNG	Compressed Natural Gas
CPR	Critical Project Review
DOT	Department of Transportation
Energy Commission	California Energy Commission
GGE	Gasoline Gallon Equivalent (of natural gas)
HALT	Highly Accelerated Life Test
NGV	Natural Gas Vehicle
OEM	Original Equipment Manufacturer
PIER	Public Interest Energy Research
psi	Pounds per Square Inch
SRI	SRI International (SRI is not an acronym)
STP	Standard Temperature and Pressure
UCC.1	Uniform Commercial Code (Financing Statement)
V/V	Volume of a given mass of gas at STP / Volume of material adsorbing the same mass of gas

10
11 **Problem Statement**

12 Current compressed natural gas (CNG) solutions for light-duty vehicles are not viable
13 alternatives to petroleum due to the high cost of high-pressure CNG storage tanks and
14 the low availability of CNG refueling stations. A home refueling station adds several
15 thousand dollars to the initial vehicle cost. Without home refueling stations, however,

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1 the current low quantity of commercial CNG refueling stations dramatically limits
2 consumer convenience in vehicle usage patterns; consumers must tie their driving
3 pattern to a limited set of fixed refueling points.

4 The scarcity of refueling supply and the reduced competition in that marketplace further
5 erode the economic advantage that natural gas would otherwise enjoy. Combating this
6 “range anxiety” by providing substantial on-board natural gas storage necessitates
7 using a large fraction of the “free” space inside the vehicle for the bulbous CNG
8 pressure vessels. For example, at approximately one-fifth the energy density of
9 gasoline, a 20-Gasoline Gallon Equivalent (GGE) CNG tank will occupy approximately
10 100 gallons of volume which is almost the *entirety* of the trunk space of the 2014 Ford
11 Fusion, a car with generous trunk space. Furthermore, the cylindrical shape of the CNG
12 pressure vessels will effectively use only about 60 percent of the available volume,
13 meaning that the 116 gallons of trunk space in a 2014 Ford Fusion allows for a
14 maximum of less than 14 GGE of CNG storage.

15 Adsorbed natural gas (ANG) has long been considered a potential path to solving the
16 issues that CNG carries to the light-duty vehicle challenge, in part because of its
17 capability for a conformal tank geometry that can squeeze into “less useful” volumes in
18 a vehicle. Also, because ANG is stored at lower pressures (e.g., 500 psi) than CNG
19 (e.g., 3,600 psi), it makes home refueling more practical. Unfortunately, most prior ANG
20 solutions have suffered from high costs, low storage capacity, and significant sensitivity
21 to non-methane constituents (particularly odorants) contained in the natural gas
22 delivered by local distribution companies. The higher costs and lower storage capacity
23 of prior ANG solutions have exacerbated rather than solved the previously mentioned
24 CNG economic and convenience shortfalls.

26 **Goals of the Agreement**

27 The goal of this project is to demonstrate the viability of the Contractor’s nanoporous
28 carbon storage technology as a practical use-effective fuel tank system on a light-duty
29 natural gas vehicle.

31 **Objectives of the Agreement**

32 The objective of this Agreement is to design, develop, optimize, test, and demonstrate a
33 nanoporous carbon technology natural gas fuel tank system for a light-duty vehicle
34 meeting the following performance metrics:

- 35 • System level energy density of at least 6 MJ/liter at 500 psi pressure, with a
36 target of 7 MJ/liter;
- 37 • Projected fuel-tank system cost <\$200/GGE at a manufacturing volume of at
38 least 1000 units/month (5000 GGE/month);
- 39 • Demonstrated fill/refill cycle life of at least 100 cycles with greater than 80%
40 capacity retention using standard pipeline natural gas;
- 41 • Projected fill/refill cycle life of at least 1000 cycles with greater than 80% capacity
42 retention using standard pipeline natural gas;

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- 1 • Conformable shaping compatible with installation in the vehicle spare tire well or
2 other minimal impact use areas of the vehicle, with greater than 90% usage of
3 the excluded volume;
- 4 • Compatibility with the full range of vehicle engine operating requirements,
5 including idle to full acceleration and electrical system loading;
- 6 • Meeting initial safety and reliability objectives as demonstrated by burst, impact,
7 and bonfire testing of sub-scale tank systems.

8 For clarity, the objective of this project is to perform these characterizations,
9 measurements, and tests appropriate to an operating – but stationary – light duty
10 vehicle. Full characterization and qualification testing to storage safety (i.e. Natural Gas
11 Vehicle (NGV2), National Fire Protection Association, and Department of
12 Transportation/National Transportation Safety Board) standards required for on-road
13 vehicle operation is outside the scope of this project.

14 15 **Electronic File Format**

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

19
20 The following describes the accepted formats of electronic data and documents
21 provided to the Energy Commission as contract deliverables and establishes the
22 computer platforms, operating systems and software versions that will be required to
23 review and approve all software deliverables.

- 24
- 25 • Data sets shall be in Microsoft (MS) Access or MS Excel file format.
- 26 • PC-based text documents shall be in MS Word file format.
- 27 • Documents intended for public distribution shall be in PDF file format, with the
28 native file format provided as well.
- 29 • Project management documents shall be in MS Project file format.
- 30

31 **Software Application Development**

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

- 35
- 36 • Microsoft ASP.NET framework (version 3.5 and up) Recommend 4.0
- 37 • Microsoft Internet Information Services (IIS), (version 6 and up) Recommend 7.5
- 38 • Visual Studio.NET (version 2008 and up) Recommend 2010
- 39 • C# Programming Language with Presentation (UI), Business Object and Data
40 Layers
- 41 • SQL (Structured Query Language)
- 42 • Microsoft SQL Server 2008, Stored Procedures Recommend 2008 R2
- 43 • Microsoft SQL Reporting Services Recommend 2008 R2
- 44 • XML (external interfaces)

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1
2 Any exceptions to the Electronic File Format requirements above must be approved in
3 writing by the Energy Commission Information Technology Services Branch.
4

5
6 **TASK 1.0 ADMINISTRATION**

7
8 **MEETINGS**

9
10 **Task 1.1 Attend Kick-off Meeting**

11 The goal of this task is to establish the lines of communication and procedures for
12 implementing this Agreement.
13

14 **The Contractor shall:**

- 15 • Attend a “kick-off” meeting with the Commission Contract Manager, the Contracts
16 Officer, and a representative of the Accounting Office. The Contractor shall bring
17 their Project Manager, Contracts Administrator, Accounting Officer, and others
18 designated by the Commission Contract Manager to this meeting. The
19 administrative and technical aspects of this Agreement will be discussed at the
20 meeting. Prior to the kick-off meeting, the Commission Contract Manager will
21 provide an agenda to all potential meeting participants.
22

23 The administrative portion of the meeting shall include, but not be limited to, the
24 following:

- 25 • Terms and conditions of the Agreement
26 • CPRs (Task 1.2)
27 • Permit documentation (Task 1.8)
28

29 The technical portion of the meeting shall include, but not be limited to, the following:

- 30 • The Commission Contract Manager’s expectations for accomplishing tasks
31 described in the Scope of Work;
32 • An updated Schedule of Deliverables
33 • An updated Gantt Chart
34 • Progress Reports (Task 1.4)
35 • Technical Deliverables (Task 1.5)
36 • Final Report (Task 1.6)
37

38 The Commission Contract Manager shall designate the date and location of this
39 meeting.
40

41 **Contractor Deliverables:**

- 42 • An Updated Schedule of Deliverables
43 • An Updated Gantt Chart
44 • An Updated List of Permits
45

46 **Commission Contract Manager Deliverables:**

Exhibit A SCOPE OF WORK

- 1 • Final Report Instructions
2

3 **Task 1.2 CPR Meetings**

4 The goal of this task is to determine if the project should continue to receive Energy
5 Commission funding to complete this Agreement and if it should, are there any
6 modifications that need to be made to the tasks, deliverables, schedule or budget.
7

8 CPRs provide the opportunity for frank discussions between the Energy Commission
9 and the Contractor. CPRs generally take place at key, predetermined points in the
10 Agreement, as determined by the Commission Contract Manager and as shown in the
11 Technical Task List above and in the Schedule of Deliverables. However, the
12 Commission Contract Manager may schedule additional CPRs as necessary, and any
13 additional costs will be borne by the Contractor.
14

15 Participants include the Commission Contract Manager and the Contractor, and may
16 include the Commission Contracts Officer, the PIER Program Team Lead, other Energy
17 Commission staff and Management as well as other individuals selected by the
18 Commission Contract Manager to provide support to the Energy Commission.
19

20 **The Commission Contract Manager shall:**

- 21 • Determine the location, date and time of each CPR meeting with the Contractor.
22 These meetings generally take place at the Energy Commission, but they may take
23 place at another location.
24 • Send the Contractor the agenda and a list of expected participants in advance of
25 each CPR. If applicable, the agenda shall include a discussion on both match
26 funding and permits.
27 • Conduct and make a record of each CPR meeting. One of the outcomes of this
28 meeting will be a schedule for providing the written determination described below.
29 • Determine whether to continue the project, and if continuing, whether or not to
30 modify the tasks, schedule, deliverables and budget for the remainder of the
31 Agreement, including not proceeding with one or more tasks.
32 • Provide the Contractor with a written determination in accordance with the schedule.
33 The written response may include a requirement for the Contractor to revise one or
34 more deliverable(s) that were included in the CPR.
35

36 **The Contractor shall:**

- 37 • Prepare a CPR Report for each CPR that discusses the progress of the Agreement
38 toward achieving its goals and objectives. This report shall include
39 recommendations and conclusions regarding continued work of the projects. This
40 report shall be submitted along with any other deliverables identified in this Scope of
41 Work. Submit these documents to the Commission Contract Manager and any other
42 designated reviewers at least 15 working days in advance of each CPR meeting.
43 • Present the required information at each CPR meeting and participate in a
44 discussion about the Agreement.
45

46 **Contractor Deliverables:**

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- 1 • CPR Report(s)
- 2 • CPR deliverables identified in the Scope of Work

3

4 **Commission Contract Manager Deliverables:**

- 5 • Agenda and a List of Expected Participants
- 6 • Schedule for Written Determination
- 7 • Written Determination

8

9 **Task 1.3 Final Meeting**

10 The goal of this task is to closeout this Agreement.

11

12 **The Contractor shall:**

- 13 • Meet with the Energy Commission to present the findings, conclusions, and
- 14 recommendations. The final meeting must be completed during the closeout of this
- 15 Agreement.

16

17 This meeting will be attended by, at a minimum, the Contractor, the Commission

18 Contracts Officer, and the Commission Contract Manager. The technical and

19 administrative aspects of Agreement closeout will be discussed at the meeting,

20 which may be two separate meetings at the discretion of the Commission Contract

21 Manager.

22

23 The technical portion of the meeting shall present findings, conclusions, and

24 recommended next steps (if any) for the Agreement. The Commission Contract

25 Manager will determine the appropriate meeting participants.

26

27 The administrative portion of the meeting shall be a discussion with the Commission

28 Contract Manager and the Contracts Officer about the following Agreement closeout

29 items:

30

- 31 • What to do with any state-owned equipment (Options)
- 32 • Need to file UCC.1 form re: Energy Commission's interest in patented
- 33 technology
- 34 • Energy Commission's request for specific "generated" data (not already
- 35 provided in Agreement deliverables)
- 36 • Need to document Contractor's disclosure of "subject inventions" developed
- 37 under the Agreement
- 38 • "Surviving" Agreement provisions, such as repayment provisions and
- 39 confidential deliverables
- 40 • Final invoicing and release of retention
- 41 • Prepare a schedule for completing the closeout activities for this Agreement.

42

43 **Deliverables:**

- 44 • Written documentation of meeting agreements and all pertinent information
- 45 • Schedule for completing closeout activities

46

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1 **REPORTING**

2
3 **See Exhibit D, Reports/Deliverables/Records.**

4
5 **Task 1.4 Monthly Progress Reports**

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

8
9 **The Contractor shall:**

- 10 • Prepare progress reports which summarize all Agreement activities conducted by the
11 Contractor for the reporting period, including an assessment of the ability to complete
12 the Agreement within the current budget and any anticipated cost overruns. Each
13 progress report is due to the Commission Contract Manager within 10 working days
14 after the end of the reporting period. Attachment A-2, Progress Report Format,
15 provides the recommended specifications.

16
17 **Deliverables:**

- 18 • Monthly Progress Reports

19
20 **Task 1.5 Test Plans, Technical Reports and Interim Deliverables**

21 The goal of this task is to set forth the general requirements for submitting test plans,
22 technical reports and other interim deliverables, unless described differently in the
23 Technical Tasks. When creating these deliverables, the Contractor shall use and
24 follow, unless otherwise instructed in writing by the Commission Contract Manager, the
25 latest version of the PIER Style Manual published on the Energy Commission's web
26 site:

27
28 <http://www.energy.ca.gov/contracts/pier/contractors/>

29
30 **The Contractor shall:**

- 31 • Unless otherwise directed in this Scope of Work, submit a draft of each deliverable
32 listed in the Technical Tasks to the Commission Contract Manager for review and
33 comment in accordance with the approved Schedule of Deliverables. The
34 Commission Contract Manager will provide written comments back to the Contractor
35 on the draft deliverable within 10 working days of receipt. Once agreement has
36 been reached on the draft, the Contractor shall submit the final deliverable to the
37 Commission Contract Manager. The Commission Contract Manager shall provide
38 written approval of the final deliverable within 5 working days of receipt. Key
39 elements from this deliverable shall be included in the Final Report for this project.

40
41 **Task 1.6 Final Report**

42 The goal of this task is to prepare a comprehensive written Final Report that describes
43 the original purpose, approach, results and conclusions of the work done under this
44 Agreement. The Commission Contract Manager will review and approve the
45 Final Report. The Final Report must be completed on or before the termination date of
46 the Agreement. When creating these deliverables, the Contractor shall use and follow,

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1 unless otherwise instructed in writing by the Commission Contract Manager, the latest
2 version of the PIER Style Manual published on the Energy Commission's web site:

3
4 <http://www.energy.ca.gov/contracts/pier/contractors/>
5

6 The Final Report shall be a public document. If the Contractor has obtained confidential
7 status from the Energy Commission and will be preparing a confidential version of the
8 Final Report as well, the Contractor shall perform the following subtasks for both the
9 public and confidential versions of the Final Report.

10
11 **Task 1.6.1 Final Report Outline**

12
13 **The Contractor shall:**

- 14
- 15 • Prepare a draft outline of the Final Report.
 - 16 • Submit the draft outline of Final Report to the Commission Contract Manager for
17 review and approval. The Commission Contract Manager will provide written
18 comments back to the Contractor on the draft outline within 10 working days of
19 receipt. Once agreement has been reached on the draft, the Contractor shall submit
20 the final outline to the Commission Contract Manager. The Commission Contract
21 Manager shall provide written approval of the final outline within 5 working days of
22 receipt.

23 **Deliverables:**

- 24
- 25 • Draft Outline of the Final Report
 - 26 • Final Outline of the Final Report

27 **Task 1.6.2 Final Report**

28
29 **The Contractor shall:**

- 30
- 31 • Prepare the draft Final Report for this Agreement in accordance with the approved
32 outline.
 - 33 • Submit the draft Final Report to the Commission Contract Manager for review and
34 comment. The Commission Contract Manager will provide written comments within
35 10 working days of receipt.

36 Once agreement on the draft Final Report has been reached, the Commission
37 Contract Manager shall forward the electronic version of this report for Energy
38 Commission internal approval. Once the approval is given, the Commission
39 Contract Manager shall provide written approval to the Contractor within 5 working
40 days.

- 41
- 42 • Submit one bound copy of the Final Report with the final invoice.

43 **Deliverables:**

- 44
- 45 • Draft Final Report
 - 46 • Final Report

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MATCH FUNDS, PERMITS, AND ELECTRONIC FILE FORMAT

Task 1.7 Identify and Obtain Matching Funds

The goal of this task is to ensure that the match funds planned for this Agreement are obtained for and applied to this Agreement during the term of this Agreement.

The costs to obtain and document match fund commitments are not reimbursable through this Agreement. While the PIER budget for this task will be zero dollars, the Contractor may utilize match funds for this task. Match funds shall be spent concurrently or in advance of PIER funds during the term of this Agreement. Match funds must be identified in writing, and the associated commitments obtained before the Contractor can incur any costs for which the Contractor will request reimbursement.

The Contractor shall:

- Prepare a letter documenting the match funding committed to this Agreement and submit it to the Commission Contract Manager at least 2 working days prior to the kick-off meeting:
 1. If no match funds were part of the proposal that led to the Energy Commission awarding this Agreement and none have been identified at the time this Agreement starts, then state such in the letter.
 2. If match funds were a part of the proposal that led to the Energy Commission awarding this Agreement, then provide in the letter:
 - A list of the match funds that identifies the:
 - Amount of each cash match fund, its source, including a contact name, address and telephone number and the task(s) to which the match funds will be applied.
 - Amount of each in-kind contribution, a description, documented market or book value, and its source, including a contact name, address and telephone number and the task(s) to which the match funds will be applied. If the in-kind contribution is equipment or other tangible or real property, the Contractor shall identify its owner and provide a contact name, address and telephone number, and the address where the property is located.
 - A copy of the letter of commitment from an authorized representative of each source of cash match funding or in-kind contributions that these funds or contributions have been secured.
- Discuss match funds and the implications to the Agreement if they are significantly reduced or not obtained as committed, at the kick-off meeting. If applicable, match funds will be included as a line item in the progress reports and will be a topic at CPR meetings.
- Provide the appropriate information to the Commission Contract Manager if during the course of the Agreement additional match funds are received.
- Notify the Commission Contract Manager within 10 working days if during the course of the Agreement existing match funds are reduced. Reduction in match funds may trigger an additional CPR.

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1 Deliverables:

- 2 • A letter regarding Match Funds or stating that no Match Funds are provided
- 3 • Letter(s) for New Match Funds
- 4 • A copy of each Match Fund commitment letter
- 5 • Letter that Match Funds were Reduced (if applicable)

7 Task 1.8 Identify and Obtain Required Permits

8 The goal of this task is to obtain all permits required for work completed under this
9 Agreement in advance of the date they are needed to keep the Agreement schedule on
10 track.

11
12 Permit costs and the expenses associated with obtaining permits are not reimbursable
13 under this Agreement. While the PIER budget for this task will be zero dollars, the
14 Contractor shall show match funds for this task. Permits must be identified in writing
15 and obtained before the Contractor can incur any costs related to the use of the permits
16 for which the Contractor will request reimbursement.

18 The Contractor shall:

- 19 • Prepare a letter documenting the permits required to conduct this Agreement and
20 submit it to the Commission Contract Manager at least 2 working days prior to the
21 kick-off meeting:
 - 22 1. If there are no permits required at the start of this Agreement, then state such in
23 the letter.
 - 24 2. If it is known at the beginning of the Agreement that permits will be required
25 during the course of the Agreement, provide in the letter:
 - 26 • A list of the permits that identifies the:
 - 27 • Type of permit
 - 28 • Name, address and telephone number of the permitting jurisdictions or
29 lead agencies
 - 30 • Schedule the Contractor will follow in applying for and obtaining these
31 permits.
- 32 • The list of permits and the schedule for obtaining them will be discussed at the kick-
33 off meeting, and a timetable for submitting the updated list, schedule and the copies
34 of the permits will be developed. The implications to the Agreement if the permits
35 are not obtained in a timely fashion or are denied will also be discussed. If
36 applicable, permits will be included as a line item in the progress reports and will be
37 a topic at CPR meetings.
- 38 • If during the course of the Agreement additional permits become necessary, then
39 provide the appropriate information on each permit and an updated schedule to the
40 Commission Contract Manager.
- 41 • As permits are obtained, send a copy of each approved permit to the Commission
42 Contract Manager.

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- 1 • If during the course of the Agreement permits are not obtained on time or are
2 denied, notify the Commission Contract Manager within 5 working days. Either of
3 these events may trigger an additional CPR.
4

5 **Deliverables:**

- 6 • A letter documenting the Permits or stating that no Permits are required
7 • Updated list of Permits as they change during the Term of the Agreement
8 • Updated schedule for acquiring Permits as it changes during the Term of the
9 Agreement
10 • A copy of each approved Permit
11
12
13

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1 **TECHNICAL TASKS**

2
3 The Contractor shall prepare all deliverables in accordance with the requirements in
4 Task 1.5. Deliverables not requiring a draft version are indicated by marking “(no draft)”
5 after the deliverable name.

6
7 **Task 2 Vehicle Platform Survey and Selection**

8 The goal of this task is to select and acquire a light-duty NGV platform for use as the
9 focal point of the ANG fuel tank system development and demonstration effort. The
10 selected NGV platform is desired to be as representative as possible of those
11 characteristics expected to drive the broadest consumer adoption and beneficial impact
12 of the developed technology when it is projected to be available for commercial
13 introduction.

14 **The Contractor shall:**

- 15
- 16 • Survey and list available light duty NGVs for consideration as the development and
demonstration platform for this effort;
 - 17 • Contact NGV Original Equipment Manufacturers (OEMs) to assess their potential
18 cooperation to provide vehicle technical information that would be helpful in
19 designing an ANG fuel tank system installation, but is not available in publicly-
20 accessible documents;
 - 21 • Analyze the available NGVs with regard to the commonality of their key
22 characteristics and the extent to which they provide a representative NGV platform
23 for ANG fuel tank system demonstration;
 - 24 • Analyze the available NGVs with regard to potential ANG fuel tank installation
25 challenges associated with factors such as available installation space and
26 attachment and interface issues;
 - 27 • Rank the candidate NGVs in terms of the previously analyzed criteria, recommend
28 the NGV to be purchased, and document the survey and selection process in a
29 Survey and Selection Report;
 - 30 • Order the selected NGV, and receive, inspect, and accept vehicle when it is
31 delivered to Contractor;
 - 32 • Prepare a *Survey and Selection Report* that will include, but not limited to, the
33 above processes for surveying and selecting candidate NGVs for the ultimate
34 acquisition of a light-duty NGV platform.

35 **Deliverables:**

- 36
- 37 • Survey and Selection Report (draft and final)

38 **Task 3 Fuel Pressure Boost Compressor**

39 The goal of this task is to design, develop, test, and optimize a fuel pressure boost
40 compressor subsystem to match the pressure and flow characteristics of the ANG tank
41 to those required by the NGV selected in Task 2.

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1 **The Contractor shall:**

- 2 • Through communications with the NGV OEM or other means such as available
3 documentation or testing, determine pertinent NGV engine requirements such as
4 the range of fuel supply pressures, temperatures, and flow rates;
- 5 • Analyze the flow characteristics of BrightBlack nanoporous carbon adsorbent
6 materials in terms of the NGV engine requirements;
- 7 • Define and evaluate fuel pressure boost compressor design alternatives such as
8 utilization of a suitable commercial off the shelf compressor versus a custom-
9 designed compressor, electric motor driven versus NGV engine driven, control
10 strategies, and compressor location and mounting options;
- 11 • Select the best-suited design alternatives, complete a fuel pressure boost
12 compressor conceptual design, and prepare and provide a *Boost Compressor*
13 *Conceptual Design Report* that includes but is not limited to a review of the design
14 goals; key design constraints, and key regulatory requirements affecting the design
15 options; a summary of the design approaches considered; the key metrics used to
16 prioritize the design approaches suitable to the goals, constraints, and
17 requirements; and an initial feasibility analysis verifying that the selected design
18 approach(es) can meet or exceed goals and requirements.
- 19 • Complete a detailed design of the fuel pressure boost compressor, including
20 preparation of fabrication drawings;
- 21 • Fabricate one or more fuel pressure boost compressors;
- 22 • Prepare a *Boost Compressor Characterization Preliminary Test Plan* and carry out
23 preliminary characterization tests consistent with the plan;
- 24 • Refine the boost compressor design, fabricate one or more refined-design boost
25 compressors, and carry out characterization tests as required to establish
26 acceptable functionality;
- 27 • Prepare a *Boost Compressor Full-Range Functionality Test Plan* based on an
28 analysis of the anticipated spectrum of operating requirements in terms of
29 performance, environmental conditions, durability, and safety;
- 30 • Set up and conduct boost compressor tests consistent with the Full-Range
31 Functionality Test Plan;
- 32 • Analyze the boost compressor full-range functionality test data and document the
33 results in a *Boost Compressor Test Results Report*;
- 34 • Prepare a *First CPR Report* and participate in the first CPR.

35 **Deliverables:**

- 36 • Boost Compressor Conceptual Design Report (no draft)
- 37 • Boost Compressor Characterization Preliminary Test Plan (no draft)
- 38 • Boost Compressor Full-Range Functionality Test Plan (draft and final)
- 39 • Boost Compressor Test Results Report (draft and final)
- 40 • First CPR Report (no draft)

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Exhibit A SCOPE OF WORK

1 **Task 4 Tank Design and Component Testing**

2 The goals of this task are to demonstrate compatibility of the BrightBlack carbon
3 adsorbent with odorized natural gas and to design, develop, test, and optimize the ANG
4 fuel tank and its constituent components. This expressly includes the nanoporous
5 carbon monoliths that make up the adsorbent material structure, the internal tank
6 structure inclusive of monolith, and other structures that act as the gas flow manifold
7 and thermal conductance framework. This also includes the external mechanical
8 envelope and enclosure system that serves to encapsulate the carbon, acts as the
9 connective thermo-mechanical structure to the selected platform, and provides the
10 protective mechanical buffer for the requisite range of shock and vibration.

11 **The Contractor shall:**

- 12 • Design, test, and optimize the ANG carbon monolith system to demonstrate
13 compatibility with a representative odorized natural gas composition. This shall
14 include:
 - 15 ○ Determine the range of natural gas compositions (including odorant types and
16 concentrations) used by California natural gas utilities, and select a
17 representative odorized natural gas composition to be used for subsequent
18 testing;
 - 19 ○ Preparing and providing an *Odorized Natural Gas Compatibility Test Plan*,
20 which specifies adsorbent sample tests to demonstrate adsorbent uptake
21 capacity retention following multiple uptake-discharge cycles of a
22 representative odorized natural gas composition;
 - 23 ○ Fabricate a set of small-scale BrightBlack carbon adsorbent material samples
24 to be used for odorized natural gas compatibility testing;
 - 25 ○ Complete repeated odorized natural gas uptake-discharge cycle tests of the
26 BrightBlack carbon adsorbent material samples per the *Odorized Natural Gas*
27 *Compatibility Test Plan* as necessary to project success or failure to meet a
28 1,000-cycle 90% uptake capacity retention objective;
 - 29 ○ Refine and optimize the nanoporous BrightBlack carbon adsorbent material
30 design, fabrication of additional adsorbent material samples, and odorized
31 natural gas uptake-discharge cycle testing of those samples as required to
32 project 1,000-cycle 90% uptake capacity retention;
- 33 • Prepare an *Odorized Natural Gas Compatibility Test Results Report* summarizing
34 the above results from the cycle-testing of the adsorbent materials samples.
- 35 • Design, develop, test, and optimize the ANG carbon monolith and tank internal
36 structure to provide the conformal tank shape compatibility, gas flow capacity, and
37 thermal conductance characteristics necessary to address the target NGV platform
38 requirements. This shall include:
 - 39 ○ Modeling of the natural gas flow characteristics of the nanoporous carbon
40 adsorbent material and internal tank manifold structures using validated
41 simulation tools;

Exhibit A SCOPE OF WORK

- 1 ○ Modeling of the thermal response characteristics of the combined carbon
2 adsorbent material and tank structure considering natural gas charging (filling)
3 and discharging (outflow) using validated simulation tools;
- 4 ○ Application of the validated simulation tools to design an ANG fuel tank internal
5 structure that provides the gas flow and thermal conductance properties
6 necessary to support the full range of vehicle operational requirements;
- 7 ○ Design and fabrication of a sub-scale test article that possesses the key gas
8 flow and thermal conductance features associated with the previously
9 designed ANG fuel tank internal structure;
- 10 ○ Preparation of a Sub-Scale Tank Internal Structure Test Article Test Plan;
- 11 ○ Completion of sub-scale test article gas flow and thermal response tests
12 consistent with the Sub-Scale Tank Internal Structure Test Article Test Plan;
- 13 ○ Test data analysis and refinement and optimization of the ANG fuel tank
14 internal structure design as required to address system gas flow and thermal
15 response objectives;
- 16 • Prepare a *Tank Internal Structure Design Strategy and Sub-Scale Test Results*
17 *Report* summarizing the results of the above modeling, design, and test efforts.
- 18 • Design, develop, test, and optimize the ANG tank external mechanical envelope
19 and closure to enable the aggregate tank structure to meet requirements for
20 vibration, shock, and impact, and to enable lightweight and cost-effective
21 attachment and integration with the vehicle platform. This shall include:
 - 22 ○ Analysis of the requirements associated with the previously selected NGV
23 platform with regard to ANG fuel tank location, attachment, and integration;
24 identification the implications of these requirements on the tank external
25 envelope;
 - 26 ○ Characterization of the required ANG fuel tank vibration, shock, and impact
27 resistance in the context of the corresponding vehicle characteristics and the
28 placement and attachment of the tank within the vehicle;
 - 29 ○ Design of a tank envelope system meeting the previously identified
30 requirements;
 - 31 ○ Design of a full-scale tank and a sub-scale tank test article that incorporates
32 the previously developed internal structure and external envelope designs;
 - 33 ○ Developing and providing a *Sub-Scale Tank Test Article HALT Plan* that
34 enables projection of the full-scale tank capability to meet design requirements;
 - 35 ○ Fabrication of the sub-scale tank test article including the carbon adsorbent,
36 tank internal structures, and tank envelope system;
 - 37 ○ Completion of sub-scale tank test article tests consistent with the Sub-Scale
38 Tank Test Article HALT Plan;
 - 39 ○ Test data analysis, refinement and optimization of the full-scale tank and sub-
40 scale tank test article designs, and fabrication and testing as required to
41 ensure that the full-scale tank is projected to meet design requirements;
- 42 • Prepare a *Sub-Scale Tank Test Article HALT Results Report*.

43 **Deliverables:**

Exhibit A SCOPE OF WORK

- 1 • Odorized Natural Gas Compatibility Test Plan (draft and final)
- 2 • Odorized Natural Gas Compatibility Test Results Report (no draft)
- 3 • Sub-Scale Tank Internal Structure Test Article Test Plan (draft and final)
- 4 • Tank Internal Structure Design Strategy and Sub-Scale Test Results Report (no
- 5 draft)
- 6 • Sub-Scale Tank Test Article HALT Plan (draft and final)
- 7 • Sub-Scale Tank Test Article HALT Results Report (no draft)

8

9 **Task 5 Tank System Design and Integration**

10 The goal of this task is to design, develop, integrate, and perform initial
11 characterizations of a complete ANG fuel tank system, including the elements
12 necessary for the safe and secure integration of the tank system with the selected
13 vehicle platform.

14 **The Contractor shall:**

- 15 • Design, develop, test, and optimize valves and other plumbing elements to support
16 the input of natural gas to the tank, the flow of natural gas from the tank, and the
17 safe operation of the tank within its specified pressure limits. This shall include:
 - 18 ○ Determination and application of the safety design standards most nearly
19 applicable to a NGV 500-psi ANG fuel tank system. Where no applicable
20 vehicle standards exist, standards for residential or commercial use may be
21 applied;
 - 22 ○ Design of the ANG fuel tank valves and other plumbing elements that enable
23 tank refilling, regulated flow of gas to the pressure boost compressor or directly
24 to the vehicle engine (depending on the ANG tank pressure and engine fuel
25 supply pressure requirement), and controlled-rate gas discharge from the tank
26 to prevent tank rupture in over-pressure situations. This design shall be
27 consistent with the previously defined design standards.
 - 28 ○ Planning of appropriate performance tests for the ANG tank valves and other
29 plumbing elements, and preparing a *Flow Valve Test Plan*;
 - 30 ○ Assembly of the valves and other plumbing elements with the sub-scale tank
31 test article from Task 4, and completion of initial tests consistent with the Flow
32 Valve Test Plan;
 - 33 ○ Refinement and optimization of the ANG fuel tank valve and plumbing element
34 designs, and retesting of these refined designs with the sub-scale tank test
35 article, as required to demonstrate successful and safe functionality.
- 36 • Develop the detailed design of a full-scale ANG fuel tank system including all
37 elements, components, subsystems, and vehicle platform integration hardware and
38 processes;
- 39 • Prepare a *Second CPR Report* and participate in the second CPR;
- 40 • Fabricate, assemble, test, and optimize the full-scale ANG fuel tank system for
41 subsequent integration into the vehicle platform. This shall include:

Exhibit A SCOPE OF WORK

- 1 ○ Fabrication of a quantity of BrightBlack carbon adsorbent monoliths sufficient
- 2 to support a minimum of 10 GGE of natural gas storage at 500 psi;
- 3 ○ Fabrication of the flow manifold system, tank external envelope, and all
- 4 elements and components associated with the full-scale ANG fuel tank system;
- 5 ○ Assembly of one or more full-scale ANG fuel tank systems and integration of
- 6 these with the Task 3 fuel pressure boost compressor;
- 7 ○ Developing a *Full-Scale ANG Fuel Tank System HALT Plan*;
- 8 ○ Completion of full-scale ANG fuel tank system testing consistent with the Full-
- 9 Scale ANG Fuel Tank System HALT Plan;
- 10 ○ Test data analysis, refinement and optimization of the full-scale ANG fuel tank
- 11 system design, and fabrication and retesting as required to fulfill all objectives
- 12 defined in the Full-Scale ANG Fuel Tank System HALT Plan;
- 13 ○ Preparing a *Full-Scale ANG Fuel Tank System HALT Results Report* detailing
- 14 the construction of the fuel tank system as-tested, the HALT test conditions
- 15 (temperature, temperature rate of change, mechanical vibration, mechanical
- 16 shock) the system was exercised over, the performance of the fuel tank
- 17 system over the range of conditions, and any failures over the range of
- 18 conditions.

19 **Deliverables:**

- 20 • Flow Valve Test Plan (draft and final)
- 21 • Second CPR Report
- 22 • Full-Scale ANG Fuel Tank System HALT Plan (draft and final)
- 23 • Full-Scale ANG Fuel Tank System HALT Results Report (no draft)

25 **Task 6 Initial Robustness, Reliability, and Safety Evaluations**

26 The goal of this task is to measure and validate the core safety, robustness, and
27 reliability characteristics of the BlackPak ANG fuel tank system. These characterizations
28 consist of initial safety evaluations with sub-scale tank units, cyclic fill and discharge
29 testing of full-scale tank systems, and validation that the full tank systems meet or
30 exceed performance metrics over the full range of required environmental conditions.

31 **The Contractor shall:**

- 32 • Perform dynamic tests on sub-scale ANG tank units to determine the tank response
- 33 modes and provide temporal response data from service terminating events. The
- 34 test program will include a burst test, a bullet impact test, and a bonfire test. The
- 35 goal of these tests will be to gain an understanding of how the tanks could fail in
- 36 extreme loading environments. For each test, the tank damage mechanisms will be
- 37 examined and the tank blowdown rates will be measured. This shall include:
 - 38 ○ Preparing a *Tank Burst Test Plan*, *Tank Bullet Impact Test Plan*, and *Tank*
 - 39 *Bonfire Test Plan* prior to each test;
 - 40 ○ Analysis of the results of each test, and preparing a *Tank Burst Test Results*
 - 41 *Report*, *Tank Bullet Impact Test Results Report*, and *Tank Bonfire Test Results*
 - 42 *Report*. Each of these reports will detail any exceptions to the conditions

Exhibit A SCOPE OF WORK

1 specified in the respective Test Plan, the result of the test, the pass/fail
2 assessment of the tank unit versus the relevant threshold for the particular
3 safety specification, and photographic or video data files depicting tank units
4 before test, during test, and post-test.

- 5 • Perform repetitively cycle tests (at least 40 cycles) of a full-scale ANG tank system
6 from full pressure (approximately 500 psi) to empty (approximately 10 psi) and back
7 to full pressure at maximum fill and discharge rates per the vehicle system design.
8 The tank systems shall be monitored for capacity retention, fill rate, and flow rate as
9 a function of cycle number. This shall include:
 - 10 ○ Preparing a *Tank Fill-Discharge Cycle Test Plan*;
 - 11 ○ Preparing a *Tank Fill-Discharge Cycle Test Results Report* detailing the results
12 of exercising the tank according to the *Tank Fill-Discharge Cycle Test Plan*.
- 13 • Perform ANG tank environmental tests by exposing a tank system to the full range
14 of environmental extremes potentially experienced by vehicle fuel systems with the
15 intent of testing the tank system into inoperable conditions (vice failure). The tank
16 system shall be monitored for capacity retention, fill rate, flow rate, and any external
17 signs of mechanical or material degradation. This shall include:
 - 18 ○ Preparing a *Tank System Environmental Test Plan*;
 - 19 ○ Preparing a *Tank System Environmental Test Results Report* detailing the
20 results of exercising the Tank System according to the *Tank System*
21 *Environmental Test Plan*.

22 **Deliverables:**

- 23 • Tank Burst Test Plan (no draft)
- 24 • Tank Bullet Impact Test Plan (no draft)
- 25 • Tank Bonfire Test Plan (no draft)
- 26 • Tank Burst Test Results Report (no draft)
- 27 • Tank Bullet Impact Test Results Report (no draft)
- 28 • Tank Bonfire Test Results Report (no draft)
- 29 • Tank Fill-Discharge Cycle Test Plan (no draft)
- 30 • Tank Fill-Discharge Cycle Test Results Report (no draft)
- 31 • Tank System Environmental Test Plan (no draft)
- 32 • Tank System Environmental Test Results Report (no draft)

34 **Task 7 Vehicle System Integration, Test, and Demonstration**

35 The goal of this task is to integrate the full-scale ANG tank system with the vehicle
36 platform and then perform a series of tests with the vehicle remaining stationary in a
37 suitable test facility (i.e., the vehicle will not be road tested). The vehicle tests will be of
38 gradually increasing challenge and severity, and they will ultimately demonstrate the full
39 engine-on operating range of the vehicle platform.

40

41

Exhibit A
SCOPE OF WORK

1 **The Contractor shall:**

- 2 • Perform a detailed inspection of the NGV acquired in Task 2, make measurements,
3 and access other vehicle specification sources in order to support planning for the
4 installation of the ANG fuel tank system in the vehicle platform;
- 5 • Prepare an *ANG Fuel Tank System Installation Plan* that specifies the process for
6 installing the ANG fuel tank system in the vehicle platform including any necessary
7 vehicle modifications;
- 8 • Install the full-scale ANG fuel tank system in the vehicle as specified in the *ANG*
9 *Fuel Tank System Installation Plan*;
- 10 • Prepare an *ANG Vehicle Stationary Test Plan* that specifies a series of tests,
11 including initial tests with the vehicle ANG fuel tank supplying gas to a receiver
12 vessel (not the vehicle engine) and subsequent tests with the vehicle ANG fuel tank
13 supplying gas to the vehicle engine;
- 14 • Test the vehicle-installed ANG fuel tank system with the fuel tank supplying gas to
15 a receiver vessel (not the vehicle engine) over a range of conditions as specified in
16 the *ANG Vehicle Stationary Test Plan*;
- 17 • Test the vehicle-installed ANG fuel tank system with the fuel tank supplying gas to
18 the operating vehicle engine over a range of conditions as specified in the *ANG*
19 *Vehicle Stationary Test Plan*. This shall include:
- 20 o Engine idling tests;
- 21 o Engine operating with constant speed and load;
- 22 o Engine operating with variable speeds and loads;
- 23 o Engine operating with multiple ANG fuel tank full-to-empty-refill cycles.
- 24 • Prepare an *ANG Vehicle Stationary Test Results Report*;
- 25 • Prepare a *Third CPR Report* and participate in the third CPR.

26 **Deliverables:**

- 27 • ANG Fuel Tank System Installation Plan (no draft)
- 28 • ANG Vehicle Stationary Test Plan (draft and final)
- 29 • ANG Vehicle Stationary Test Results Report (no draft)
- 30 • Third CPR Report (no draft)
- 31
- 32

To: Office of Planning and Research
PO Box 3044, 1400 Tenth Street, Room 222
Sacramento, CA 95812-3044

From: California Energy Commission
1516 Ninth Street, MS-48
Sacramento, CA 95814

Project Title: Natural Gas Vehicle On-Board Storage

Project Location - Specific: 750 BATTERY ST STE 700

Project Location - City: SAN FRANCISCO, CA Project Location - County: San Francisco

Description of Project:

BlackPak, Inc. will develop laboratory-tested tank designs that are conformable, solid-state, lightweight, and store natural gas in adsorbed form by using carbon-activated briquettes, manufactured from spent corn cobs. BlackPak, Inc. will also design natural gas storage tanks that continue to reduce tank costs to a price that is considered competitive and viable. If commercialized, the conformable tank designs can reduce NGV costs and increase driving range, making NGVs a more attractive consumer choice. In addition, low-pressure tank designs will lower compressor requirements, reducing fueling-station costs for both public stations as well as home refueling appliances. To help bring this technology to market, this project will demonstrate the operational and manufacturing viability of the advanced natural gas fuel tank design in a vehicle.

Name of Public Agency Approving Project: California Energy Commission

Name of Person or Agency Carrying Out Project: BlackPak, Inc.

Exempt Status: (check one)

- Ministerial (Sec. 21080(b)(1); 15268);
Declared Emergency (Sec. 21080(b)(3); 15269(a));
Emergency Project (Sec. 21080(b)(4); 15269(b)(c));
[X] Categorical Exemption. State type and section number
Statutory Exemptions. State code number. 14 CCR Section 15306
[X] Common Sense Exemption. 15061(b)(3)

Reasons why project is exempt:

The project involves engine design and testing activities that will not result in a significant environmental impact.

Lead Agency

Contact Person: Pilar Magana Area code/Telephone/Ext: 916-327-2216

If filed by applicant:

- 1. Attach certified document of exemption finding.
2. Has a Notice of Exemption been filed by the public agency approving the project? Yes No

Signature: Date: Title:

[X] Signed by Lead Agency

[] Signed by Applicant

Date received for filing at OPR:

RESOLUTION NO:

STATE OF CALIFORNIA

STATE ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION - RE: BLACKPAK, INC.

RESOLVED, that the State Energy Resources Conservation and Development Commission (Energy Commission) adopts the staff CEQA findings contained in the CEC 94 Contract Request Form or CEC 270 Grant Request Form (as applicable).

RESOLVED, that the Energy Commission approves Agreement 500-13-010 with **BlackPak, Inc.** to develop and demonstrate an advanced natural gas on-board storage tank technology suitable for light-duty natural gas vehicles. The Agreement is for \$1,200,000 for a duration of 24 months.

FURTHER BE IT RESOLVED, that the Executive Director shall execute the same on behalf of the Energy Commission.

CERTIFICATION

The undersigned Secretariat to the Commission 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 California Energy Commission held on June 18, 2014.

AYE: [List of Commissioners]

NAY: [List of Commissioners]

ABSENT: [List of Commissioners]

ABSTAIN: [List of Commissioners]

Harriet Kallemeyn,
Secretariat