THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION

1225 I Street NW, Suite 900
Washington DC 20005
+1 202.534.1600
www.theicct.org

Request for Proposal:

Heavy-duty vehicle and engine testing

Contact

Questions and submission responses to this request for proposal (RFP) should be addressed to Anup Bandivadekar (*anup@theicct.org*) or Ben Sharpe (*ben@theicct.org*).

Timeframe

Proposals are requested via email by May 3, 2016.

Background on the ICCT

The International Council on Clean Transportation (ICCT) is an independent nonprofit research organization whose mission is to support policymakers around the world in reducing energy consumption and conventional pollutant and greenhouse gas emissions, from transportation in order to improve air quality and human health, and mitigate climate change.

Proposed project elements

The ICCT is seeking proposals to test heavy-duty vehicles (HDVs) and engines in India. The testing data developed from this project will be used to support modeling in Autonomie[1], a dynamic vehicle simulation model, to capture the fuel consumption reduction potential of different engine, transmission, and vehicle technologies. The results of this proposed project would be used to simulate the effects of fuel-saving technologies on overall heavy-duty vehicle efficiency, and the relative energy loss mechanisms in the vehicle powertrain at various operation points. The simulations and data from vehicle testing will support the development of an ICCT spreadsheet-based lumped parameter tool to estimate the relative efficiency improvements from heavy-duty vehicle technology packages.

The project—which will consist of both engine-only and full vehicle testing—will have as many of the following testing elements as possible:

- Engine-level testing
  - Engine fuel consumption mapping
  - Engine energy audits
  - Engine dynamometer testing over various regulatory cycles
- Vehicle-level testing
  - Chassis dynamometer testing (including coastdown testing)
  - Portable emissions measurement system (PEMS) testing
  - Tire rolling resistance testing

Upon receiving the contractor's proposal, the ICCT will evaluate the costs of each potential testing area and then make a determination as to the scope of work for the project. For each of the six areas, Table 1 summarizes the various work elements. The contractor need not perform these five tasks sequentially, as they are listed in the table and ordered in this document.

[1] Autonomie is a modeling tool developed by Argonne National Laboratories. Autonomie is used to simulate a broad range of powertrain configurations operating over a range of driving conditions or duty cycles.

Table 1: Heavy-duty engine and vehicle testing scope of work

Task	Number of models tested	Description	Test cycles or test procedure
1. Baseline engine maps	3	• 2 BS III truck diesel engines (5.9-liter and 3.8-liter) (BS IV preferred) • 1 BS IV CNG bus engine (5.7-liter)	N/A – see "Task 1" section below
2. Engine energy audit	1	5.9-liter diesel BS III engine (BS IV preferred)	N/A – see "Task 2" section below
3. Engine dynamometer tests	3	Same engines as Task 1	ETC, ESC, WHTC, WHSC
4. Chassis dynamometer tests (includes coast down testing)	3	• Truck > 25 tonnes GVW • Truck 10-12 tonnes • Transit bus 12-16 tonnes	To be determined – see "Task 4"
5. PEMS testing	3	Same vehicles as in Task 4	To be determined – see "Task 5"
6. Tire rolling resistance testing	8-10	At least 4 representative tire models (2 radial and 2 bias) for each of the 3 vehicle models above (i.e., 12 tire models total), including the exact tire models used on the vehicles in Task 4.	ISO 28580:2009

PART 1. ENGINE-LEVEL TESTING

Task 1. Baseline engine maps

Task 1 will be performed for all three engines listed in Table 1. Together, these engine displacement sizes account for roughly 60% of all HDV sales in India. The contractor should procure the following engine models.

- Cummins 5.9-liter 134 kW (diesel)
- Tata 3.8-liter 92 kW (diesel)
- Tata 5.7-liter 96 kW (CNG)

According to our sales market data for fiscal year 2013-14, the Cummins 5.9-liter 134 kW is the best-selling truck engine and represents 30% of the prime mover (i.e., tractor-trailers 26 tonnes and greater) market. The Tata 3.8-liter 92 kW is the most popular engine model for smaller freight vehicles and accounts for 31% of sales in trucks between 6 and 16 tonnes. Finally, the Tata 5.7-liter 96 kW CNG engine is the top seller in the CNG market and is found in 55% of CNG buses sold in FY 2013-14. In the proposal, the contractor should describe in detail how they intend to procure the three engines. If the contractor is unable to procure one of these engine models, the contractor should submit a request to use another high-volume engine model. If the contractor would like to use an alternative bus engine model, it must be a CNG engine.

The engine maps generated from this Task will be used to create virtual engine fueling maps and initialization files to be run in Autonomie vehicle simulations. The engine fueling map should be presented in an Excel data file that defines a matrix with at least 100 torque-speed-fuel consumption points. The data file would include the fueling rate[2] (in units of grams of fuel per second, [g/s]) corresponding to a minimum of ten different engine speeds (in units of radians per second, [rad/s]) and ten different engine torques (in units of Newton meters, [Nm]). Besides the fueling map, the wide-open throttle, or full-load, speed-torque curve (with a minimum resolution of 10 points) and the closed throttle, or engine drag, speed-torque curve (with a minimum resolution of 10 points) would also be provided. Figure 1 shows a contour plot generated from hypothetical engine data that graphically illustrates the level of detail that would comply with the above characteristics.

It is expected that the researchers will provide details to ICCT on the engine's displacement, bore and stroke, peak brake thermal efficiency, peak injection pressure, turbocharging system, exhaust gas recirculation (EGR) strategy (if applicable), and a basic description of the aftertreatment emission control system that is utilized (if applicable).

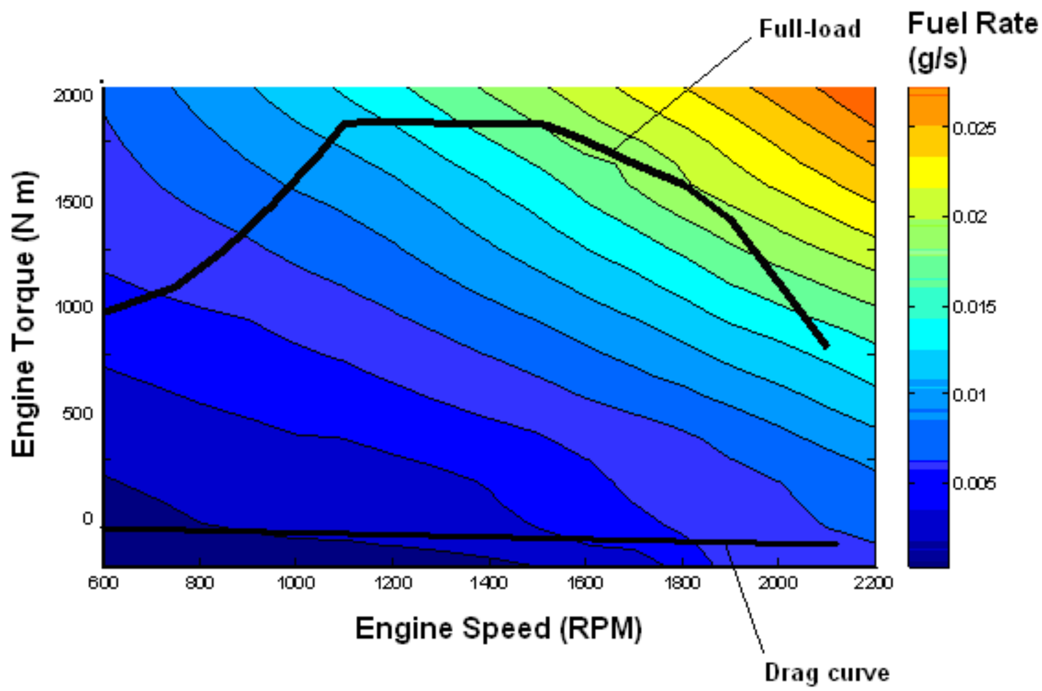

Figure 1. Hypothetical engine map illustration

<u>Note on testing fuel</u>: for Tasks 1 through 5, the diesel used in all project activities must be certified testing fuel, and in the proposal the contractor should specify the procedures in place to ensure proper fuel quality for all tasks.

Deliverables: Based on the above description, the Task 1 deliverables are (1a) a 1-2 page memo describing the features of the engines (e.g., displacement, bore and stroke, turbocharging system, aftertreatment (if applicable), measured values such as peak brake thermal efficiency and peak injection pressure, as well as specifications of the engine dynamometer; and (1b) Engine map data in Excel data file providing at least 100 torque, fuel

[2] In the proposal, the contractor should indicate how the fueling rate will be determined.

use, and engine speed data points and wide-open-throttle, and closed throttle curves for the three engines of Task 1a.

Task 2. Engine energy audit

Task 2 of the project's modeling effort is to provide a detailed "energy audit" for the energy losses and loads across a broad range of engine operational conditions for the baseline engine map of the 5.9-liter BS III diesel engine (BS IV preferred). As part of the modeling, the basic flows and losses of energy will be analyzed throughout the engine sub-systems. The energy audit will be used in future research to model, track, and bound the fuel consumption impacts from one or more additional engine technologies. In order to be able to simulate the effect that different engine technologies may have over the fueling map, the contractor will generate a complete energy audit that identifies the amount of energy (as a percentage of fuel energy) that is spent in the different energy loss mechanisms.

Figure 2 illustrates a hypothetical energy audit output figure for a complete vehicle. The loss mechanisms for an engine energy audit – and the ones applicable for this proposed project – correspond to the three first columns from left to right. The proportion of the fuel energy that gets converted into indicated work is a direct measure of the engine's fuel conversion efficiency. Factors that affect an engine's fuel conversion efficiency include irreversibilities in the combustion process, the amount of energy leaving the engine cylinder as heat, and the energy remaining in the exhaust at the end of the expansion process. These losses represent fuel energy that did not get converted into useful shaft work. Moreover, not all of the energy that was converted into work in the combustion process makes it to the final engine shaft output. Some of the energy gets used to overcome friction, some is used to pump air and fuel into the engine and the exhaust gases out of the engine, and some is used to power engine auxiliaries and accessories. The work that makes it to the drive axle(s) is used to overcome vehicle inertia, aerodynamic drag, and rolling resistance.

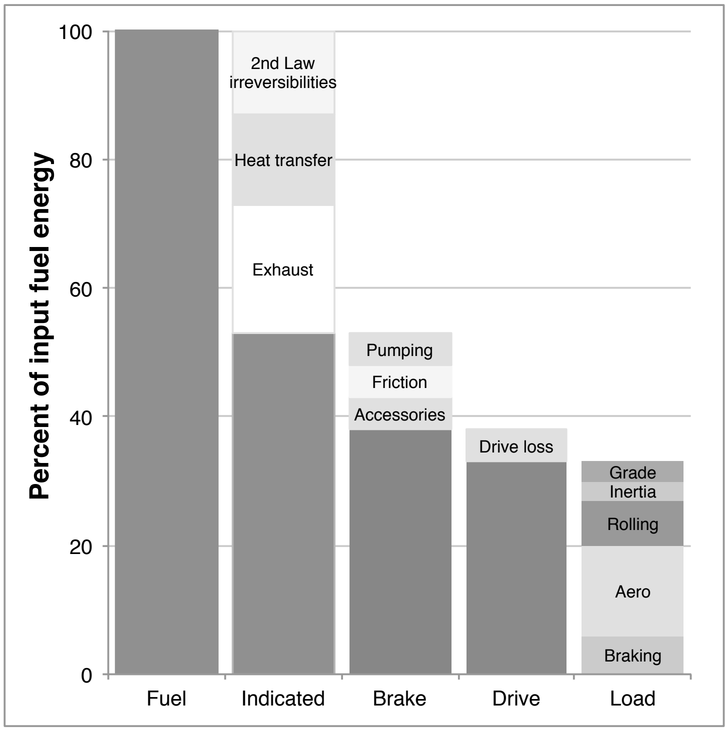

Figure 2. Illustration of vehicle energy audit output

The engine energy audit would be delivered in spreadsheet form and contain a detailed energy breakdown including the following parameters: thermodynamic 2nd Law and combustion irreversibility losses, heat loss to the cooling system, heat loss to the exhaust, engine pumping (intake and exhaust) losses, engine friction losses, engine auxiliary and accessory losses.

This energy breakdown would be provided for at least 25 (24 + idle) engine operational points. Figure 3 provides an illustration of operating points on the engine map that are chosen for energy audit in Task 2. The intent of the 25 operating points is to provide an approximately comprehensive representation of the full engine map, and therefore would capture points near the torque and engine speed edges as well as several central points within the map.

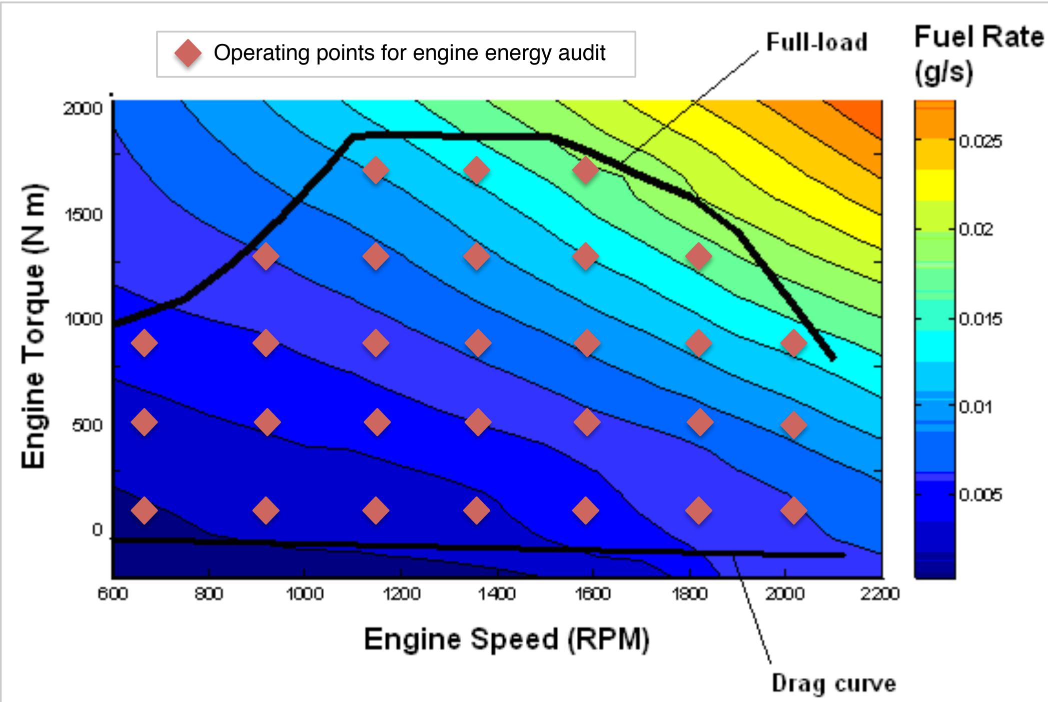

Figure 3. Illustration of operating points on engine map that are chosen for energy audit in Task 2

Table 2 illustrates the level of detail to be delivered to the ICCT for the Task 2 energy audit deliverable. The main objective of this energy breakdown is to be able to scale the original map based on the main loss mechanism affected by the technology under study. For example, if an optimized flow aftertreatment system provides a reduction of pumping losses of 10%, one can change the shape of the map only for the regions affected by that particular aftertreatment system (i.e. substract 10% from the "pumping losses map" only). This would be a more accurate way to estimate fuel consumption benefits than an alternative engine map scaling in which the entire map is scaled in proportion to the maximum efficiency. In order to be able to simulate energy recovery systems (e.g., waste heat recovery or turbocompounding systems), the associated exhaust and coolant average temperatures and mass flow rates for the different operational points are also required so that an estimation of exergy (i.e. energy availability) of the different waste heat streams can be made. Ideally, an even more detailed estimated energy breakdown would be desirable, for example, itemizing the energy required for the various auxiliaries and accessories like pumps (fuel, oil, and water), the engine cooling fan,[3] and the alternator. Other loss mechanisms could be examined further as applicable over the course of the project.

[3] Only if this device is covered in the fuel map. It is the intent to only include auxiliaries that are included in the engine test cycle from experimental data.

Table 1. Engine energy audit characteristics to be included in Task 2 deliverable

		Energy characteristics for given engine operating points						
		1	2	3	4	…	…	25
Fuel rate (g/s)		0.0131	…					
Torque (Nm)		700						
Engine speed (rpm)		900						
Estimated exhaust temperature (°C)								
Estimated exhaust mass flow rate (g/s)								
Estimated EGR temperature (°C)		…						
Estimated EGR mass flow rate (g/s)		…						
Estimated coolant temperature (°C)		…						
Estimated coolant mass flow rate (g/s)		…						
Energy breakdown (Percent of fuel rate energy input)	2nd Law, irreversibility	…						
	Heat loss engine coolant system	…						
	Heat loss exhaust system	…						
	Engine pumping (intake, exhaust)							
	Engine friction losses							
	Auxiliary pumps (e.g., fuel, water, oil pumps)							
	[Others accessories, as applicable]							

An example of the outputs from an energy audit is shown in Figure 4. In addition, the contractor should use Thiruvengadam, Delgado, et al. (2014) as a reference for energy audit research (http://www.theicct.org/heavy-duty-vehicle-diesel-engine-efficiency-evaluation-and-energy-audit).

Deliverables: Based on the above description and building on the results of Task 1, the Task 2 deliverables are (2a) a 3-5 page memo with description, data sources, methods, assumptions, technical rationale for energy audit of the 5.9-liter BS III/IV engines; (2b) Engine energy audit Excel data file providing energy characteristics for at least 25 engine operating points as specified above for the three engines.

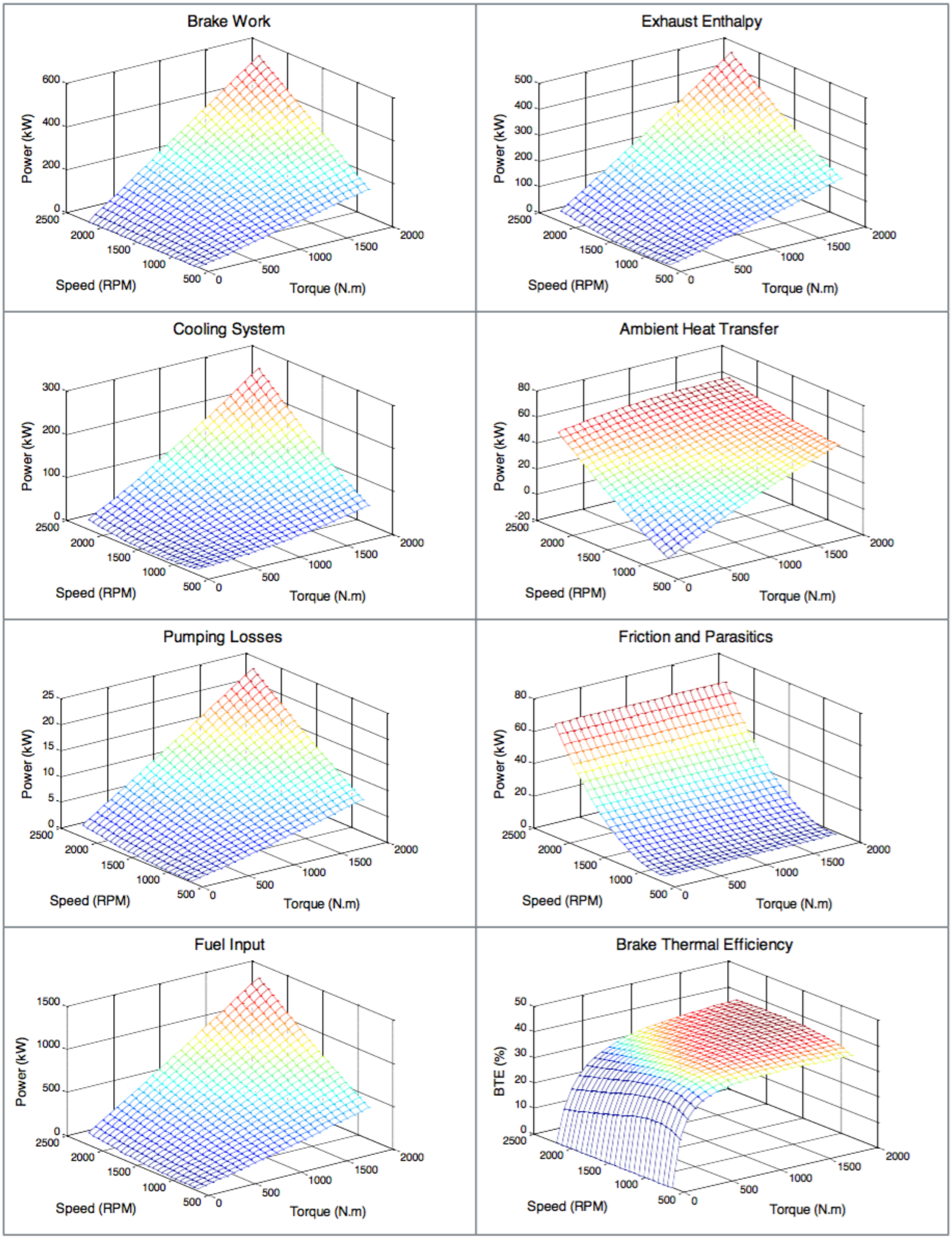

Figure 4: engine energy flows, fuel input, and brake-specific fuel efficiency

(http://www.theicct.org/us-tractor-trailer-efficiency-technology)

Task 3. Engine dynamometer testing

The project's Task 3 requires that the contractor exercise each engine over four regulatory test cycles (i.e., ETC, ESC, WHTC, and WHSC) and provide fuel consumption (in grams of fuel per kilowatt-hour, g/kWh), pollutant emissions (i.e., PM, NOx, THC, NH_3 and CO) results (in grams of pollutant per kilowatt-hour, g/kWh), and particle number count (# per-kWh). For the CNG engine, the contractor should measure methane (CH_4) and non-methane hydrocarbon (NMHC) emissions in g/kWh instead of THC. A minimum of one cold start test and three warm start tests must be performed for each cycle. Repeatability checks should be done for the three warm starts and should be within a coefficient of variation (COV) of 2%. In the proposal the contractor must specify all of the systems in place for quality assurance and control for <u>all of the project tasks</u>.

All testing should be done in line with UNECE Regulation No. 49 procedures. The contractor must identify any areas where they do not meet the UNECE procedures or laboratory testing requirements.

Deliverables: The Task 3 deliverables are the raw, second-by-second as well as the integrated fuel consumption and pollutant emissions results for each engine over all four regulatory test cycles.

PART 2. VEHICLE-LEVEL TESTING

Task 4. Chassis dynamometer testing

In Task 4 the contractor will exercise three HDVs on a chassis dynamometer and provide fuel consumption results (in liters of fuel per 100 kilometers, l/100 km), using the carbon balance method.

As part of the proposal, we request that the contractor also specify what the expense would be to include pollutant emissions: PM, NOx, HC, and CO (g/km). Coastdown tests must be performed on all three vehicles in order to determine the road load information that is needed for the chassis dynamometer programming. The coastdown tests should be performed according to the Society of Automotive Engineers J1263 procedure (http://standards.sae.org/j1263_201003/) or the IS 14785: 2000 (R 2005).

In the proposal the contractor should indicate what test cycles the laboratory has run in previous HDV testing projects. Upon reviewing the list of truck and bus cycles in the proposal, we will select what cycles will be used in the project. We expect to utilize 3-4 cycles, including the World Harmonized Vehicle Cycle (WHVC). As in Task 3, at least three test runs must be performed for each cycle with a COV of less than 5%. Also, the proposal should define the vehicle warm-up procedures.

Table 2. Fuel consumption (l/100 km) and emissions (g/km) over vehicle test cycles

	Test cycle		
	WHVC	Cycle 2	Cycle 3
Truck 1 (> 25 tonnes GVW)			
Truck 2 (10-12 tonnes GVW)			
Transit bus (12-16 tonnes GVW)			

As shown in Tables 1 and 3, we would like to test three different classes of HDV: a heavy-duty truck (> 25 tonnes GVW), a medium-duty truck (10-12 tonnes GVW), and a transit bus (12-16 tonnes GVW). The larger truck and the transit bus should have the same engine models (i.e., engine model year, displacement, power rating, calibration) as in Tasks 1 and 2, and the smaller truck should have the same 3.8-liter engine. Based on our sales data, these engine and vehicle size combinations are common in the Indian market.

In the proposal, the contractor should describe in detail how they intend to procure the vehicles.

Deliverables: Based on the above description, the Task 4 deliverables are (4a) the raw, second-by-second as well as the integrated fuel consumption and pollutant emissions results for each vehicle over all of cycles agreed upon by the ICCT and the contractor; and (4b) coastdown test results used to determine the road load settings for the chassis dynamometer for each vehicle—specifically, this should include coefficient of aerodynamic drag (C_D) determinations for each vehicle.

Task 5. PEMS testing

In the proposal, the contractor should describe its PEMS testing capabilities for both trucks and buses. This descritpion should include any PEMS testing conducted in the past on HDVs in India in terms of the measurement equipment utilitzed, route selection, data management and analysis, and project partners (if applicable). The proposal should present a testing plan for the vehicles as well as a cost estimate on a per-vehicle basis. The proposal should follow as a guideline the PEMS testing requiremetns set in the European *Conformity of In-Service Engines or Vehicles* regulation EU No 582/2011, Annex II.

Test Routes
The contractor shall provide a description of the methodology to select PEMS test routes or trips and deviations from the EU regulation. This includes a brief literature review (at least 2 sources) describing typical road driving conditions for HDVs in India (i.e., speed, idling times/shares, and other relevant parameters, on urban, extra-urban, and highway conditions). The test routes shall consist of urban driving followed by rural and motorway driving according to the shares specified in points 4.5.1 to 4.5.4, Annex II of EU 582/2011. The contractor should justify in the proposal any deviations from this order. Final test routes will be agreed upon between the Contractor and the ICCT after awarding the contract.

Vehicle Loading
For the purpose of PEMS testing the load may be reproduced with an artifical load. Empty and loaded weights should be recorded, and the proposal should describe the weight recording methods. The contractor should describe in the proposal the expected loading ranges of the vehicles selected for chassis and PEMS testing. In the absence of statistics to demonstrate that the test payload is representative for the vehicle, the vehicle payload shall be 50 to 60 % of the maximum vehicle payload.[4]

General requirements
PEMS testing **should be** carried out on the same three vehicles as are chassis dynamometer tested for Task 4.

The specific provisions for PEMS measurement are provided in Table 1, based on guidelines set in the European *Conformity of In-Service Engines or Vehicles* regulation EU No 582/2011, Annex II, Apendix 1. Note that NOx speciation (NO and NO2) and PM/PN are not part of the guidelines but highly desirable for this project.

A description of torque and road grade determination methods are expected in the proposal.

Table 3 - PEMS Test Parameters

Parameter	Unit	Source	Comments
THC concentration (1)	ppm	Analyzer	
CO concentration (1)	ppm	Analyzer	
NO_x concentration (1)	ppm	Analyzer	
CO_2 concentration (1)	ppm	Analyzer	
CH_4 concentration (1) – for CNG bus only	ppm	Analyzer	
NO/NO2 speciation concentration	ppm	Analyzer	Desirable
PM/PN	grams or #	PPS	Desirable, Particle counter
Exhaust gas flow	kg/h	EFM	
Exhaust temperature	K	EFM	
Ambient temperature(2)	K	Sensor	
Ambient pressure	kPa	Sensor	

JMS
Delet

[4] The maximum payload is the difference between technically permissible maximum laden mass of the vehicle and the mass of the vehicle in running order as specified in accordance to Annex I to Directive 2007/46/EC or its equivalent in India according to national vehicle regulations.

Parameter	Unit	Source	Comments
Ambient humidity	%	Sensor	
Engine torque(3)	Nm	ECU or Sensor	
Engine speed	rpm	ECU or Sensor	
Engine fuel flow	g/s	ECU or Sensor	
Engine coolant temperature	K	ECU or Sensor	
Engine intake air temperature(2)	K	ECU or Sensor	
Vehicle ground speed	km/h	GPS and ECU	
Vehicle latitude/longitude	degree	GPS	
Road grade	degree	TBD	Desirable
Head wind	km/h	TBD	Optional

Notes:

(1) Measured or corrected to a wet basis. Heated lines required for reducing HC condensation.

(2) Use the ambient temperature sensor or an intake air temperature sensor

(3) The recorded value shall be either (a) the net torque or (b) the net torque calculated from the actual engine percent torque, the friction torque and the reference torque, according to the SAE J1939-71 standard

Data processing

The data processing and analysis will follow the guidelines set by European *Conformity of In-Service Engines or Vehicles* regulation EU No 582/2011, Annex II, Apendix 1. This inlcudes time alignment, drift correction, wet-dry corrections, NOx corrections for temperature and humidity, and instantaneous emissions calculation (g/s). Route emissions, in mg/kWh will be calcualted using the Averaging Window method described in Apendix 1 of Annex II.

Deliverables: The Task 5 deliverable are 5a) A brief summary update test report (1-2 pages) after each testing day. This would include route emissions for each pollutant, and notes on general test conditions. This is intended to closely monitor the emissions from the test subjects and make test plan adjustments (i.e., additional PEMS test time) in case high deviations on route emissions are reported. 5b) PEMS raw data, uncorrected and corrected/final datasets for fuel consumption, CO_2 and pollutant emissions; 5c) Route emission results (g/kWh) for each vehicle over all of the routes agreed upon by the ICCT and the contractor.

Task 6. Tire rolling resistance testing

For this part of the project, a number of tire models will be tested to establish their coefficients of rolling resistance (C_{RR}) using the ISO 28580:2009 test protocol. For each of the three vehicle models from Task 4, the contractor should submit at least four tire models that are common in the market. In the proposal, the contractor should identify two radial tire models and two bias tire models for each of the three vehicle types. Thus, altogether, the proposal should include at least 12 potential tire models to be tested. An important stipulation is that as part of the set of tire models tested, the contractor must include the same tire models that are used on the vehicles in Task 4. By determining the C_{RR} values for the tire models used on the vehicles, the contractor will be able to more accurately calculate the coefficient of C_D values from the coastdown testing.

In the proposal, the contractor should report the costs on a per-tire model basis. After reviewing the proposal, the ICCT will determine the specific tire models that will be included in the project.

Deliverables: The Task 5 deliverable is a report summarizing the tire testing equipment and methodology, description of tire models, C_{RR} results, and QA/QC procedures.

Summary and project milestones

The overall objectives of the project are to deliver high quality engine maps and associated energy audit data as well as test results for engines and full vehicles. The data generated during this research project will allow the ICCT to validate its state-of-the-art engine and vehicle simulation modeling. The subtasks and milestones are arranged in five tasks in order to ensure the overall objectives are met. Table 5 below itemizes the major elements associated with the five project tasks. We request that the contractor fill in the expected completion dates in Table 5 and keep in mind that the tasks may be completed whatever order is most convenient, as long as the entire project is finished by **October 30th, 2016**. A project kick-off will be via teleconference. Short check-in phone meetings at 30-60 minutes each between the researchers and the ICCT at a two-week interval should be expected to help keep ICCT apprised of progress and help foresee any issues in meeting the project timeline.

Table 5. Project deliverables and deadlines

Area	Deliverables	Expected Date for Deliverables
Kick off	• Meeting (teleconference, video conference, or in-person) between researchers and ICCT heavy-duty vehicle team. • **Deliverable 0**: Powerpoint presentation to ICCT describing the engine and vehicle procurement strategy as well as the overall research plan.	Please fill in dates for each task, including the kick-off meeting.
Task 1: Engine map development	• **Deliverable 1a**: a 1-2 page memo describing the features of the engines (e.g., displacement, bore and stroke, turbocharging system, aftertreatment (if applicable), measured values such as peak brake thermal efficiency and peak injection pressure, as well as specifications of the engine dynamometer. • **Deliverable 1b**: Data file (Excel table) for three engine maps with fuel use, torque, and engine speed with resolution of at least 100 points each; wide-open throttle curve; closed throttle curve.	Update
Task 2: Engine energy audits	• **Deliverable 2a**: A 3-5 page memo with description, data sources, methods, assumptions, technical rationale for energy audits of the three baseline engines. • **Deliverable 2b**: Engine energy audit Excel data file providing energy characteristics for at least 25 engine operating points.	Update
Task 3: Engine dynamometer testing	• **Deliverable 3**: Data file (Excel table) for the three engines with fuel use, pollutant emissions (g/kWh), and particle number (#/kWh) for the ETC, ESC, WHTC, and WHSC test cycles. Raw, second-by-second results should be delivered as well.	Update
Task 4: Chassis dynamometer testing	• **Deliverable 4a**: Data file (Excel table) for three vehicle models with fuel use and pollutant emissions (l/100 km and g/km, respectively) for each test cycle. Raw, second-by-second results should be delivered as well. • **Deliverable 4b**: Coastdown test results and C_D determination for all three vehicle models.	Update
Task 5: PEMS testing	• **Deliverable 5:** Data file (Excel table) for three vehicle models with fuel use and pollutant emissions (l/100 km and g/km, respectively) for each test run. Raw, second-by-second results should be delivered as well.	Update
Task 5: Tire rolling resistance testing	• **Deliverable 5**: Report summarizing the tire testing equipment and methodology, description of tire models, CRR results, and QA/QC procedures.	Update

Proposal selection criteria

The bids will be evaluated primarily on their ability to deliver on the precise scope and itemized tasks listed above, and the detail with which they demonstrate precisely how they will accomplish the tasks described. After itemization of a scope that most closely matches the proposed research task above, selection criteria will include the demonstration of a refined project management plan with internal reviews for quality assurance and quality control, commitment to address ICCT input in the modeling methods and write-up on the work, and whether all the guidelines of this RFP were followed. Efforts to minimize of the proposed cost, shorten the project timeline from the one listed above, and add modeling features that go beyond the scope listed above all will receive extra weighting. See the attached “Guidelines for Proposal Submission” below for additional information about supporting information to be included in any proposal.

Guidelines for Proposal Submission

The RFP responses should include the following:

Transmittal letter

The transmittal letter shall be in the form of a standard business letter on the vendor's letterhead, signed by an individual authorized to legally bind the vendor, and shall include the name, title, address, email address and telephone number of the individual(s) who can be contacted for questions regarding the RFP response. Disclosure of any real or potential conflict of interest must be provided based on the firm's clients, proposals to pending clients, direct business or significant personal relationship with any ICCT council member, board member or staff member.

Methodology

- Provide a detailed methodology describing how your research group will perform the tasks detailed in this RFP, produce the requested deliverables, and achieve the overall RFP objectives.
- Provide a detailed list of laboratory equipment/specifications as well as quality control procedures.
- Describe the deliverables in detail in a manner that very closely matches those described above, and the extent to which they will differ from the elements.
- Provide a timeline for the development of the tasks.

Team and organization overview

- Describe your organization, its overall mission, customer service philosophy and culture, current staffing, and other pertinent resources related to this project.
- Provide resumes (including education and experience) of individuals that would be assigned to the ICCT project and their respective roles on the project
- Provide a separate listing of relevant analyses and reports that were conducted by the proposed researchers and are related to heavy-duty vehicle simulation modeling research as proposed in this RFP. With this listing or past work, the research group would describe how the researchers are in a position with the necessary tools, experience, and knowledge to efficiently carry out the proposed work
- Provide as separate attachments electronically up to 2 technical reports that are by the proposed researchers and most closely related to this project's deliverables.
- Provide a list of references that can attest to the researchers completion of heavy-duty vehicle simulation projects that are similar to this RFP's scope.

Project management process

- Describe your firm's process for managing the project and dealing with clients, including the frequency, and method of regular communications regarding project status with client.

- Describe your firm's process for quality assurance and quality control, project cost controls, and timeline adherence.

Fees

- Please provide a breakdown of all fee areas, hourly rates for individuals, and the breakdown of person-hours by major task and deliverable.
- Describe the frequency and timing of your preferred fee payment requirements.

Terms and conditions

The written RFP responses and any subsequent bids made during the procurement process will be considered binding commitments by the prospective vendors. The ICCT may request additional information or clarification of any obligation, if a contract is awarded.

The bidder agrees to be bound by this RFP response for a period of 45 calendar days from the RFP response due date during which the ICCT may request clarification of correction of the RFP response if necessary for the purpose of evaluation.

The cost of preparing the RFP response is the sole responsibility of the bidder, whether or not any award results from solicitation.

The ICCT reserves the right to add provisions to the contract consistent with the contractor's bid and to negotiate with the contractor other additions to, deletions from, and/or changes in the language in the contract — provided that such addition, deletion, or change in contract language would not, in the sole direction of the ICCT, affect the evaluation criteria set forth herein, or give any bidder a competitive advantage.