U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Hydrogen Infrastructure Research, Development, and Demonstration: Identifying project priorities to address deployment barriers

DATE: July 27, 2016

SUBJECT: Request for Information (RFI): DE-FOA-0001626

Description

The U.S. Department of Energy's (DOE) Fuel Cell Technologies Office (FCTO) seeks input on priority areas that will advance deployment of hydrogen fueling stations and delivery infrastructure and input on barriers and activities to pursue in both the near and longer-term.

Background

FCTO is a key component of the DOE's Energy Efficiency and Renewable Energy (EERE) portfolio. EERE seeks to provide clean, affordable, and reliable energy from diverse domestic resources, along with benefits of increased energy security, reduced criteria pollutants, and reduced greenhouse gas emissions; hydrogen and fuel cells are an important part of EERE's portfolio. FCTO funds activities addressing the barriers hydrogen fueling stations face today, including renewable hydrogen fuel cost, station and equipment cost, station reliability and performance, codes and standards development, manufacturing needs, and outreach and training needs.

This is a critical time for the hydrogen market in the United States, as we are in the early commercial phases for hydrogen fuel cell electric vehicles (FCEVs), hydrogen fueling stations and delivery infrastructure, and renewable production technologies. With independent data from over 6 million miles of driving FCEVs and over 163,000 kg of hydrogen dispensed, FCTO is obtaining important information to help identify key areas for further research and development and has identified specific challenges facing hydrogen infrastructure and fueling station components.

FCTO is committed to enabling successful initial commercial deployment of hydrogen fueling stations. In the recent past, FCTO has focused on increasing public-private partnerships to address immediate technical challenges, an effort that will continue through the Hydrogen Fueling Infrastructure Research and Station Technology (H2FIRST) project. H2FIRST leverages capabilities at the national laboratories to address the technology challenges related to hydrogen fueling stations. Outside of infrastructure projects funded through H2FIRST, FCTO is looking to identify other strategic research, development, and demonstration pathways to lower station costs and increase the overall utilization of hydrogen in the market.

FCTO wants to address some of the barriers facing hydrogen infrastructure research, development, and deployment in the near and longer-term, listed below. Note that the following list does not include all of the barriers, but it does include many identified by both FCTO and stakeholders during an Annual Merit Review Session.[1] Barriers to be addressed through this RFI include:

- Station and equipment cost
- Station footprint
- Station reliability and performance
- Station availability
- Lack of a domestic supply chain for equipment parts, and
- Lack of real-world business cases for FCEVs and hydrogen stations.

Purpose

The purpose of this RFI is to solicit feedback from industry, academia, research laboratories, government agencies, and other stakeholders on the research, development, and demonstration topics listed below, as well as any critical barriers and activities not addressed in this RFI:

I. Hydrogen fueling station system design and integration
II. Hydrogen infrastructure component manufacturing
III. Modular hydrogen station installation design guidelines
IV. Business case analysis for FCEV fleets
V. Co-location of hydrogen production with combined heat and power generation systems
VI. Delivery of hydrogen from stranded renewables
VII. Other

FCTO is interested in feedback, project ideas, and other guidance on the topics areas described below and through responses to the following questions (as applicable). ***Note*: stakeholders should feel free to respond only to those topics relevant to their expertise; it is not necessary to respond to all topics.**

Please be sure to provide your company/organization and any relevant background regarding your interest and/or involvement in hydrogen fueling infrastructure.

[1] http://energy.gov/eere/fuelcells/downloads/cross-cutting-hydrogen-station-infrastructure-review

I. **Hydrogen Fueling Station System Design and Integration:** As the market for hydrogen develops, hydrogen fueling stations with greater capacity, lower cost, and smaller footprint will be needed. Stations today typically dispense from 180-350 kg of hydrogen per day, and cost from about $1-$3 million.[2] A reduction in these costs and increase in capacity will require improvements in components themselves, as well as in the overall design, development, and operation of the stations. The footprint required for hydrogen stations continues to constrain their ability to be sited, especially in the case of liquid hydrogen stations. Furthermore, footprint remains a concern for siting in dense urban areas where first adoption is expected. Preliminary analysis performed by Sandia National Laboratories (SNL) indicates that only 20% – 40% of existing gasoline stations in regions in California have enough space to accommodate the inclusion of hydrogen fueling.[3] FCTO continues to fund projects that aim to improve materials and lower component-level costs; however, FCTO would also like to explore innovative techniques to integrate components that could lower system-level cost and decrease the required footprint.

Research and development must continue to drive station costs down, and in recent years some fueling station providers have been exploring unique approaches to improve station integration. Research, development, and demonstration concepts have included the use of thermal compression to eliminate mechanical compressors[4], innovative control algorithms to reduce compression requirements[5], installation of storage tanks vertically to lower footprint[6], integration of fire protection into stations-in-a-box to ease installation[6], installation of storage tanks on top of station canopies[7], installation of bulk storage underground[7], and optimization of dispenser footprint.[8] Research necessary to enable novel station designs includes system level station research and design, component development, as well as the performance of quantitative risk analyses (QRA) that characterize the risks of designs that are not currently compliant with NFPA-2. FCTO is interested in component development or systems-level research and design that can enable innovative stations at lower cost and decreased footprint.

[2] http://www.energy.ca.gov/2015publications/CEC-600-2015-016/CEC-600-2015-016.pdf; http://www.nrel.gov/docs/fy15osti/64107.pdf

[3] http://energy.sandia.gov/wp-content/gallery/uploads/SAND_2014-3416-SCS-Metrics-Development_distribution.pdf

[4] https://www.hydrogen.energy.gov/pdfs/review16/pd126_kriha_2016_o.pdf

[5] https://www.hydrogen.energy.gov/pdfs/review16/pd133_ainscough_2016_o.pdf, DOI: 10.1016/j.ijhydene.2014.10.030

[6] http://www.element-energy.co.uk/wordpress/wp-content/uploads/2015/07/Installing-accessible-HRS-best-practice-guide_July-2015_FV.pdf

[7] https://www1.eere.energy.gov/hydrogenandfuelcells/pdfs/2013_csd_workshop_report.pdf

[8] http://h2logic.com/products-services/h2station-car-200/

Furthermore, FCTO is interested in feedback on the following questions:

1. What are the station research and design areas which can most greatly impact the cost and footprint of stations? Please indicate in your response if you are considering near/mid-term station design, or longer-term “station of the future” concepts.
2. What technologies have the potential to lower station setback distances (e.g. coatings, insulating wraps, etc.)?
    a. Is the primary challenge to adoption of novel fire mitigation strategies a lack of experimentation on existing technologies or a lack of technologies?
    b. Would underground storage be beneficial to reduce station footprint and cost?
    c. What research is needed to enable underground storage?
    d. Would vertical station design be beneficial to reduce footprint and cost?
    e. What other technologies, approaches, or R&D areas should DOE consider in potential future funding opportunities?
3. What additional feedback related to this approach should DOE consider in potentially funding this concept?

II. **Hydrogen Infrastructure Component Manufacturing:** The lack of a mature supply chain remains a significant cost challenge for hydrogen fueling infrastructure today.[9] Most components used at the station (e.g., hoses, valves, couplings, and fittings) have fewer than five suppliers worldwide, and components produced by different suppliers are often custom-made and therefore are not interchangeable.[10] Additionally, some components have not been optimized for their intended application and are not reliable.

As a result, FCTO is interested in developing a domestic supply chain for critical hydrogen fueling station components such as hoses, valves, couplings, nozzles, fittings, breakaways, and chillers. To better align with industry needs, FCTO is interested in feedback on ways that manufacturing R&D can help develop this supply chain as well as lead to reduced component cost and improved reliability. Specifically, FCTO is interested in feedback on the following questions:

4. What manufacturing techniques are currently in use for the production of high-pressure hydrogen valves, fittings, and hoses?
    a. What are the limitations and cost drivers of these technologies?

[9] http://www.nrel.gov/docs/fy12osti/55961.pdf
[10] http://www.nrel.gov/docs/fy15osti/64107.pdf

   b. Would DOE-funded R&D on innovative manufacturing techniques for any of these components be of value? If so, please describe.

5. What are the barriers that U.S. manufacturers face in expanding their supply chains to include components for hydrogen stations (e.g., low sales volumes, capital investment in manufacturing equipment, expertise, competition from international suppliers)?
   a. Would DOE-funded R&D on the barriers you indicate be of value? If so, please describe.
6. Would additive manufacturing be of interest to industry as a means to enable rapid development of lower cost, higher reliability components and/or prototype parts?
   a. What components at hydrogen stations are most likely to benefit from additive manufacturing?
   b. Is additive manufacturing likely to provide a cost advantage over conventional techniques at high volume production? And for what components? Please be sure to define high volume production in your response.
   c. Would additive manufacturing be advantageous over conventional manufacturing to produce tooling? If so, please provide examples.
   d. Would DOE-funded R&D on additive manufacturing for key components be of value? If so, please describe.
7. What components at hydrogen stations would most benefit from the use of advanced composites?
   a. What aspects of composites manufacturing could be improved in hydrogen refueling stations (e.g., curing times, precursor development, etc.)?
   b. Would DOE-funded R&D on composites manufacturing be of value? If so, please describe.
8. What other novel manufacturing technologies have the potential to produce fueling station components that are cost-competitive with those produced by conventional techniques?
   a. What aspects of these technologies need to be further developed?
   b. Are there other "out-of-the-box" ideas where manufacturing R&D can help reduce component cost and improve reliability?
   c. Would DOE-funded R&D on any novel technologies be of value, or is industry already addressing this? If there is value, please describe.
9. What additional feedback related to this approach should DOE consider in potentially funding this concept?

III. **Modular Hydrogen Station Installation Design Guidelines:** Installing modular hydrogen stations, or "stations in a box", can reduce overall hydrogen fueling station cost by simplifying the installation process and construction costs. However, there remain issues for these modular stations during installation, including architecture and engineering, a lack of common process for installation, and a lack of template agreements and contracts. Costs for architecture and engineering can be reduced by sharing pre-designed foundation, trenches, utilities, and component specifications for installing a modular hydrogen fueling station. Furthermore, a step-by-step process and list of common and uncommon issues that may arise would help reduce the planning time, execution, and costs for construction and siting the modular station. Finally, the availability of template agreements and contracts may reduce the non-technical burden and soft costs of station installation, and expedite the process, as has been seen for solar installations.[11] Agreements include, but are not limited to, site access, architecture and engineering, construction and bonds, construction oversight, and operation and maintenance. Many of these agreements depend on the installation process and can be interrelated. Because these agreements have to be executed before much of the design and analysis for the station can begin, foresight into the process that comes from experience may be particularly valuable to new station developers.

FCTO has received stakeholder input that investment in developing guidelines for these agreements would be of value, and we seek feedback to start this process. The guidelines produced should cover a variety of potential scenarios that may exist at the site and cover a range of utility requirements for onsite production through electrolysis. FCTO seeks feedback on the following questions as well:

10. What aspects of site installation and/or design could be improved to reduce the cost of installation? For instance, innovative designs for fueling pads, foundational components, utility pipes and wiring, or overall modular station design can be considered. The cost of the change must be less than installation costs saved.
11. Are there designs that would reduce operational costs related to installation (e.g., strategies for protecting water pipes from freezing)? Ideas should include real data or referenceable assumptions justifying cost tradeoffs.
12. Are there other installation needs, not identified here, that increase the cost of modular hydrogen stations?

[11] http://energy.gov/sites/prod/files/2014/08/f18/2014SunShotPortfolio_SoftCosts.pdf; http://energy.gov/eere/sunshot/solar-energy-resource-center-0?Topic=Planning%2C%20Zoning%2C%20Permitting_and_Interconnection

13. Are there manufacturing and/or supply chain needs that would improve the installation process?
14. Are you aware of best practices/lessons learned and case studies to streamline and improve the overall process of station installation? If so, please provide.
15. More broadly, what is the DOE's role in assisting in this area?
    a. How can DOE best serve to enable sharing of key processes and information among industry competitors to enable the entire industry to succeed?
    b. Would DOE-funded R&D on modular hydrogen station installation processes be of value? If so, please describe.
16. What additional feedback related to this approach should DOE consider in potentially funding this concept?

IV. **Business Case Analysis for FCEV fleets:** In the United States, investment in hydrogen fueling stations has been made by public-private sector collaborations, with the majority of the station development occurring in the state of California. In California, 70-85% of station capital costs are typically subsidized by the California Energy Commission, and as mentioned previously, total installed costs for hydrogen stations (100-350 kg/day) range from around $1 -$3 million.[2] While R&D is necessary to lower station costs, innovative business models are also essential to lower the levelized cost of fuel, as well as to reduce the risk of investing in station infrastructure. Business model strategies that have been proposed, considered, and/or implemented to date include the development of stations around fleets of vehicles, partnerships between station developers and vehicle OEMs, the deployment of lower pressure infrastructure that allows fills that are lower cost but incomplete, and shared liability between the private and public sector (e.g., in case contaminated fuel is accidentally dispensed).

Several examples where FCEV fleet deployments have lowered the cost of hydrogen while also increasing the utilization of a station have been seen to date, such as the AC Transit bus fleet in California.[12] FCTO is interested in analyzing other types of fleet options, and locations where FCEV fleet deployments could produce a business case for hydrogen fueling stations, and we seek information on the following questions:

17. What are some barriers to fleet adoption of FCEVs?
18. What vehicle types (e.g. buses, taxicabs) and/or in what regions of the country would deployment of fleets be most attractive?
19. Is more R&D required for any of these applications or should the focus be on demonstration and deployment efforts?

[12] http://www.energy.ca.gov/2015publications/CEC-600-2015-016/CEC-600-2015-016.pdf

20. What outreach efforts can FCTO support to engage vehicle fleet owners in order to encourage the adoption of FCEVs?
21. Aside from funding stations, what role can FCTO or other government entities play in lowering the risk of station investment (e.g. loan programs, shared liability, consolidating orders for components to lower lead times)? Please be as specific as possible.
22. What cost and equipment data can stakeholders provide in order to encourage investment and improve the agreement between models used by academia and actual costs for installed stations?
23. FCTO has already developed tools (such as H2FAST) to help determine business cases for infrastructure. What more, if anything, should FCTO be involved with and/or fund to accelerate infrastructure deployment?
24. What additional feedback related to this approach should DOE consider in potentially funding this concept?

V. **Co-location of Hydrogen Production with Combined Heat and Power (CHP) Generation Systems:** There are more than 4,400 distributed combined heat and power (CHP) systems installed nationwide.[13] Distributed CHP systems typically use pipeline natural gas to make electricity and heat for buildings.[14] Pipeline-delivered methane could also be used as a feedstock for making hydrogen fuel for FCEVs as part of a CHP system. Methane reformation technology adapted and close coupled to a CHP system for making hydrogen could be dispensed at a CHP location. A steam methane reformer (SMR) could be designed and added to a CHP system for making hydrogen fuel resulting in high energy efficiency and low capital and operating costs. For this method of hydrogen fuel making, the risk of stranded investment capital is significantly lessened due to a revenue or value stream from the power and possible heat of the CHP system.[15] The SMR energy efficiency improvement could result in hydrogen production cost or around $2/kg. [16]

The purpose of this topic is to have stakeholders provide feedback and assess the potential of a hydrogen fuel generator added to a CHP generation system. FCTO is interested in feedback on the approach described above, and to the following questions:

[13] US Combined Heat and Power Installation Database: https://doe.icfwebservices.com/chpdb/
[14] Review of Small Stationary Reformers for Hydrogen Production: http://www.afdc.energy.gov/pdfs/31948.pdf
[15] https://www.epa.gov/sites/production/files/2015-07/documents/catalog_of_chp_technologies.pdf
[16] NREL Study, Table 1 and Figure 6: http://ac.els-cdn.com/S1876610212014853/1-s2.0-S1876610212014853-main.pdf?_tid=b2e1981e-4910-11e6-8110-00000aacb35d&acdnat=1468424855_5a6c73220d7fe9544649d5e2d6ec311e

25. What would be the energy efficiency of today's SMR technology using the CHP operated heat[15]? What is an appropriate target for this effort to make the approach competitively viable?
26. What would be the non-recurring engineering cost of designing and full-scale prototype testing of a SMR coupled with CHP?
27. What would be the capital cost of the designed SMR system?
28. What type of customers would be interested in this application (e.g., corporate facilities, industrial warehouses, other)?
29. What additional feedback related to this approach should DOE consider in potentially funding this concept for lower cost hydrogen production?

VI. Hydrogen Delivery from Stranded Renewables: As increasing amounts of renewable energy are added to the U.S. electric grid, scalable power-to-gas technologies that facilitate grid stability along with the low-cost production of fuels, such as hydrogen, are becoming increasingly important. Over-supply of power on the grid occurs when the demand for electricity falls below the amount of power being generated. In such cases, generators must "curtail" their output to prevent damage to the grid. Over-generation of variable renewable power is causing curtailment measures to be taken, which has already been seen in Texas[17] and Hawaii[18], and similar challenges have been forecast for California[19]. Additionally when the renewables are located far from areas of high population density they become "stranded". Not only is there excess power, there is no way to move the excess power to the point of use.

One option to address this issue is producing hydrogen from the excess energy using an electrolyzer and then moving the hydrogen to urban areas where it can be utilized. Currently, several demonstrations of electrolyzer integration with the grid to produce hydrogen are being developed in Europe and studied in the U.S. A remaining challenge to this approach, is the delivery of the renewable hydrogen that is produced to end users, such as to hydrogen fueling stations. Lack of delivery infrastructure can prohibit the sale of hydrogen produced from stranded renewable resources. This challenge may be addressable by using small-scale liquefaction plants with the ability to modulate their output to manage a variable gaseous hydrogen supply, or by hydrogen carrier systems. Due to the high density of hydrogen in these delivery pathways, delivery in this form may be economical even when the hydrogen is produced alongside stranded renewable resources located far from end users.

[17] http://www.eia.gov/todayinenergy/detail.cfm?id=16831
[18] http://www.hnei.hawaii.edu/sites/www.hnei.hawaii.edu/files/Hawaii%20RPS%20Study.pdf
[19] http://www.nawindpower.com/online/issues/NAW1412/FEAT_04_Renewable-Energy-Faces-Daytime-Curtailment-In-California.html

Conventional liquefaction technologies are too large in capacity to be co-located with electrolyzers alongside stranded renewable resources. The 10 hydrogen liquefaction plants in North America today range in size from 6-35 metric tons per day.[20] These plants rely on pre-cooling, as well as mechanical compression and expansion cycles that decrease in efficiency as plant capacity is reduced. FCTO is interested in novel technologies that can enable distributed hydrogen liquefaction at an energy consumption comparable to that of conventional commercial plants, or carrier technologies which could be used to move the hydrogen to a distribution center where it will be removed from the carrier and distributed locally via traditional methods. Technologies of interest include, but are not limited to, novel compressor components that minimize efficiency losses or increase durability, valve-less compression technologies, acoustic liquefaction technologies, and carrier systems. FCTO would like feedback on the following questions:

30. What technologies are currently available which could enable hydrogen liquefaction at less than one metric ton per day?
    a. What is the smallest daily throughput at which they are currently feasible?
    b. What is the current capital and operating costs of these technologies?
    c. What is the current efficiency of these technologies in kW/kg of hydrogen liquefied? Please indicate the hydrogen throughput.
31. What alternative technologies for liquefaction do you think have been insufficiently explored and what are their greatest technological barriers?
32. What are the biggest technological barriers to acoustic liquefaction?
33. What return on investment time frame would be acceptable to install a liquefaction plant, given the capital cost?
34. FCTO has recently funded low technology readiness level (TRL), innovative approaches to liquefaction, such as the use of magnetocaloric materials and Heisenberg vortices. What additional R&D (if any) should FCTO fund? Please be specific.
35. What carrier technologies could potentially be viable in this capacity?
    a. What is the potential efficiency of these carriers?
    b. What is the estimated cost?
    c. What research and development is needed to make them viable?
36. What additional feedback related to this approach should DOE consider in potentially funding this concept?

[20] https://www1.eere.energy.gov/hydrogenandfuelcells/pdfs/liquefaction_comp_pres_praxair.pdf

VII. **Other: Please provide any other input you consider valuable aligned with the intent of this RFI.** FCTO is particularly interested in other ideas to lowering barriers to station deployment, such as a novel station design for the future/long-term, or improving integration with existing renewable resources and credits. Furthermore, FCTO recognizes that critical barriers and challenges may vary in different regions. If there are regional barriers you are facing that FCTO could potentially address, please describe them as well as ideas for projects to address these barriers.

Disclaimer and Important Notes

This RFI is not a Funding Opportunity Announcement (FOA); therefore, EERE is not accepting applications at this time. EERE may issue a FOA in the future based on or related to the content and responses to this RFI; however, EERE may also elect not to issue a FOA. There is no guarantee that a FOA will be issued as a result of this RFI. Responding to this RFI does not provide any advantage or disadvantage to potential applicants if EERE chooses to issue a FOA regarding the subject matter. Final details, including the anticipated award size, quantity, and timing of EERE funded awards, will be subject to Congressional appropriations and direction.

Any information obtained as a result of this RFI is intended to be used by the Government on a non-attribution basis for planning and strategy development; this RFI does not constitute a formal solicitation for proposals or abstracts. Your response to this notice will be treated as information only. EERE will review and consider all responses in its formulation of program strategies for the identified materials of interest that are the subject of this request. EERE will not provide reimbursement for costs incurred in responding to this RFI. Respondents are advised that EERE is under no obligation to acknowledge receipt of the information received or provide feedback to respondents with respect to any information submitted under this RFI. Responses to this RFI do not bind EERE to any further actions related to this topic.

Proprietary Information

Because information received in response to this RFI may be used to structure future programs and FOAs and/or otherwise be made available to the public, respondents are strongly advised to NOT include any information in their responses that might be considered business sensitive, proprietary, or otherwise confidential. If, however, a respondent chooses to submit business sensitive, proprietary, or otherwise confidential information, it must be clearly and conspicuously marked as such in the response.

Responses containing confidential, proprietary, or privileged information must be conspicuously marked as described below. Failure to comply with these marking requirements may result in the disclosure of the unmarked information under the Freedom of Information Act or otherwise. The U.S. Federal Government is not liable for the disclosure or use of unmarked information, and may use or disclose such information for any purpose.

If your response contains confidential, proprietary, or privileged information, you must include a cover sheet marked as follows identifying the specific pages containing confidential, proprietary, or privileged information:

> Notice of Restriction on Disclosure and Use of Data:
> Pages [List Applicable Pages] of this response may contain confidential, proprietary, or privileged information that is exempt from public disclosure. Such information shall be used or disclosed only for the purposes described in this RFI [DE-FOA-0001626]. The Government may use or disclose any information that is not appropriately marked or otherwise restricted, regardless of source.

In addition, (1) the header and footer of every page that contains confidential, proprietary, or privileged information must be marked as follows: "Contains Confidential, Proprietary, or Privileged Information Exempt from Public Disclosure" and (2) every line and paragraph containing proprietary, privileged, or trade secret information must be clearly marked with double brackets or highlighting.

Evaluation and Administration by Federal and Non-Federal Personnel
Federal employees are subject to the non-disclosure requirements of a criminal statute, the Trade Secrets Act, 18 USC 1905. The Government may seek the advice of qualified non-Federal personnel. The Government may also use non-Federal personnel to conduct routine, nondiscretionary administrative activities. The respondents, by submitting their response, consent to EERE providing their response to non-Federal parties. Non-Federal parties given access to responses must be subject to an appropriate obligation of confidentiality prior to being given the access. Submissions may be reviewed by support contractors and private consultants.

Request for Information Response Guidelines
Responses to this RFI must be submitted electronically to FY16FCTONeedsandStrategies@ee.doe.gov no later than 5:00pm (ET) on August 26, 2016. Responses must be provided as attachments to an email. It is recommended that attachments with file sizes exceeding 25MB be compressed (i.e., zipped) to ensure message delivery. Responses must be provided as a Microsoft Word (.docx) attachment to the email, and no more than 5 pages in length, 12 point font, 1 inch margins. Only electronic responses will be accepted.

Please identify your answers by responding to specific questions and/or topics listed, as applicable. Respondents may answer as many or as few questions as they wish.

Please include the category that best describes your company/organization, for instance:

- Hydrogen station developer

- Original equipment manufacturer (OEM) for hydrogen station equipment
- Engineering/construction company with experience in hydrogen infrastructure installation
- Financial investor
- Utility or power generation company
- National laboratory
- Academia
- State or local government
- Trade association
- Codes and standards body
- Owner of personal FCEV
- Owner of FCEV fleet
- Other (please specify)

EERE will not respond to individual submissions or publish publicly a compendium of responses. A response to this RFI will not be viewed as a binding commitment to develop or pursue the project or ideas discussed.

Respondents are requested to provide the following information at the start of their response to this RFI:

- Company / institution name;
- Company / institution contact;
- Contact's address, phone number, and e-mail address.

On behalf of the DOE FCTO Infrastructure Team, thank you in advance for providing your input on this important topic and contributing to DOE FCTO's success in achieving its programmatic objectives