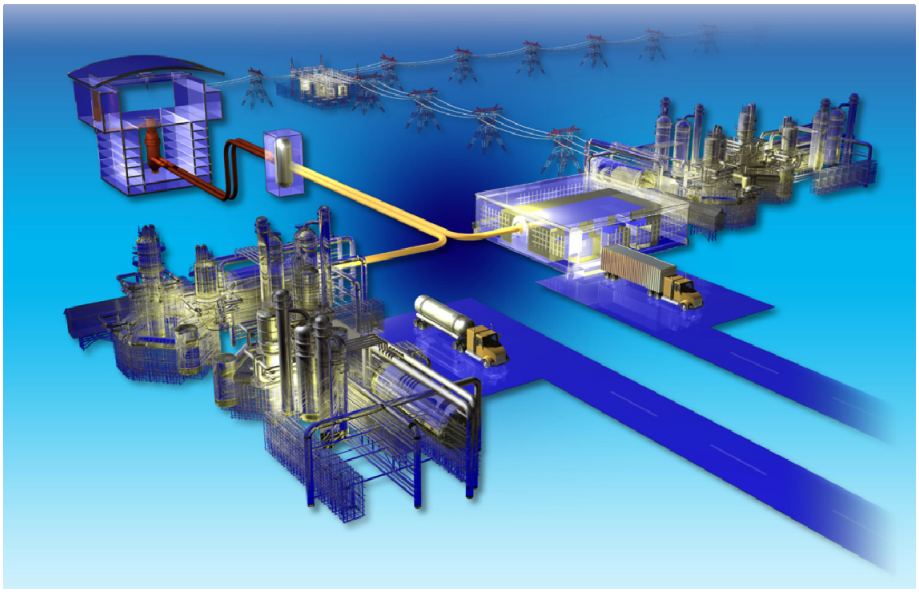
INL/EXT-10-19566

# Summary of Differences in Approach to Executing the NGNP Project

August 2010



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August 2010

Idaho National Laboratory
Next Generation Nuclear Plant Project
Idaho Falls, Idaho 83415

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**Next Generation Nuclear Plant Project**

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**August 2010**

**Approved by:**

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Date

# ABSTRACT

Differences exist between the DOE strategy for NGNP Project completion and that of the NGNP Industry Alliance. This document presents the significant differences and suggests that both parties engage in detailed discussions to reach agreement on an acceptable path forward.

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# Summary of Differences in Approach to Executing the NGNP Project

## 1. INTRODUCTION

In the April 2010 Department of Energy (DOE) Report to Congress[1] on the status of the Next Generation Nuclear Plant (NGNP) Project a cost estimate, cost share provisions and milestone schedule were presented for completing the Project. On November 30, 2009 the NGNP Industry Alliance, Ltd.[a] submitted a proposed Project Implementation Strategy to DOE Secretary Chu that also included cost estimates, cost share provisions, and a milestone schedule for completing the Project.[2] The Alliance strategy was emphasized in a subsequent letter to Secretary Chu in June 2010.[3] Although the DOE and Alliance submittals have the objective of initiating operation of a first-of-a-kind (FOAK) reactor module(s) by 2021 as required by the 2005 Energy Policy Act[4] (EPAct) there are significant differences in the detailed strategies proposed to achieve the objective.

## 2. SUMMARY OF DIFFERENCES

The major differences between the DOE strategy for project completion and that of the NGNP Industry Alliance are four fold:

- Decision making framework, including the authority for making the decisions:
  - The DOE strategy includes a recommendation to the Secretary whether to proceed. This recommendation will be partially informed by a review of the Nuclear Energy Advisory Council (NEAC). If the Project is to proceed, the DOE will initiate a competitive process to initiate Phase 2 of the Project in June 2011 with a decision to down-select one high temperature gas-cooled reactor (HTGR) design in Sep 2011.
  - The Alliance proposes to jointly develop with the DOE the functional & performance requirements for the HTGR plants based on end user needs and to continue with the several stages of design development and licensing as jointly decided by DOE and the Alliance for two reactor concepts – one based on a pebble bed reactor concept and one on the prismatic block reactor concept. Decisions on which design work to complete and which Combined License Applications (COLAs) will be prepared for the FOAK plant(s) would be determined by Owners of the plants in mid-2011 and decisions to construct by the future Owners and End Users in mid-2017.
- Schedule to proceed:
  - The DOE expects a cooperative agreement with a supplier in 2011 with COLA preparation September 2011 to September 2013. It is noted that the current DOE planning for design development does not support this schedule.
  - The Alliance proposes establishing the public-private partnership in the 4th Quarter of 2010, initiating full design activities and continuing licensing activities in parallel with forming the partnership, preparing Early Site Permit (ESP) applications starting in October 2010 and preparing COLAs for two sites starting mid-2011 to 2014.

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[a] The NGNP Industry Alliance Limited is an industry consortium formed with the assistance of the Idaho National Laboratory as directed by EPAct 2005 and the Battelle Energy Alliance contract with DOE. The Alliance members include energy end-users representing the petrochemical and petroleum industries, a nuclear owner/operator, nuclear system suppliers, a nuclear fuel and equipment vendor, and an architect-engineer/constructor.

- Scope of project:
  - DOE expects to down-select to one design in September 2011
  - The Alliance carries two designs through preparation of COLAs in mid-2014 with the Owners deciding whether to construct one or two plants in early 2017.
- Cost share model:
  - DOE cost share is 50/50 overall each year for all scope except applied research and development
  - The objective of the proposed Alliance cost share is a 50/50 cumulative overall cost split with the government share primarily through preliminary design and during the licensing stages. The private sector would fund all construction and operating costs. A more detailed comparison of cost sharing is presented in Section 3of this paper.

The above is summarized in Table 1.

Table 1. Summary of specific differences in the approaches to operating the NGNP Project.

| Summary Differences | DOE April 2010 Report to Congress | NGNP Industry Alliance Project Execution Strategy |
|---|---|---|
| Decision making framework, including decision authority | | Functional and performance requirements jointly determined by DOE and Alliance based on needs of customers/end-users (1st Qtr 2011)<br>Plant designs to fulfill requirements determined by nuclear system suppliers (ongoing)<br>Proceeding with various stages of the Project jointly decided by the DOE and the Alliance based on design/licensing maturity and economic viability assessment (ongoing)<br>DOE and Alliance select sites for which ESP applications will be prepared (late 2010)<br>Design(s) for which design work will be completed, COLAs prepared and FOAK plants potentially constructed determined by the owner(s) (Mid-2011),whether to construct, and the sites jointly decided by the owner(s) and the end-user(s) (early 2017) |
| | NEAC recommendation to Secretary of Energy on proceeding to Phase 2 of EPAct 2005 NGNP Project (Dec 2010)<br>Secretary of Energy announcement on path forward to Phase 2 (Jan 2011)<br>DOE initiates competitive process for Phase 2 award (Jan 2011)<br>DOE decides down-select to one HTGR design and awards cost-shared, cooperative agreement for final design and licensing (Sep 2011) | |
| Schedule to proceed | Cooperative agreement awarded (Sep 2011)<br>Complete conceptual design [Note: Cooperative agreement from Sep-09 FOA scope does not complete conceptual design]. Prepare COLA (Sep 30, 2011-Sep 30, 2013). [Note: Design is not sufficiently mature to initiate COLA at this time using DOE sequence of activities] | Public-private partnership formed via Technology Investment Agreement (4th Qtr 2010)<br>Design and licensing activities continue in parallel with forming public-private partnership<br>Prepare ESP applications (initiate Oct 2010)<br>Prepare COLAs for two sites (mid 2011-2014) |
| Scope of NGNP project | Down-select to one design in Sep 2011 | Complete conceptual design, preliminary design and partial final design for two designs to support two COLAs (mid-2014)<br>Complete ESP applications for up to four sites (mid-2013) |

| | | |
|---|---|---|
| | | Decide whether to construct one or two FOAK plants (early 2017) |
| Cost Share Model | 50/50 cost share, each year for all scope except applied research and development | 50/50 cost share overall; government cost share primarily up front with private sector independently constructing FOAK |

# 3. EXPANDED COST SHARE COMPARISON

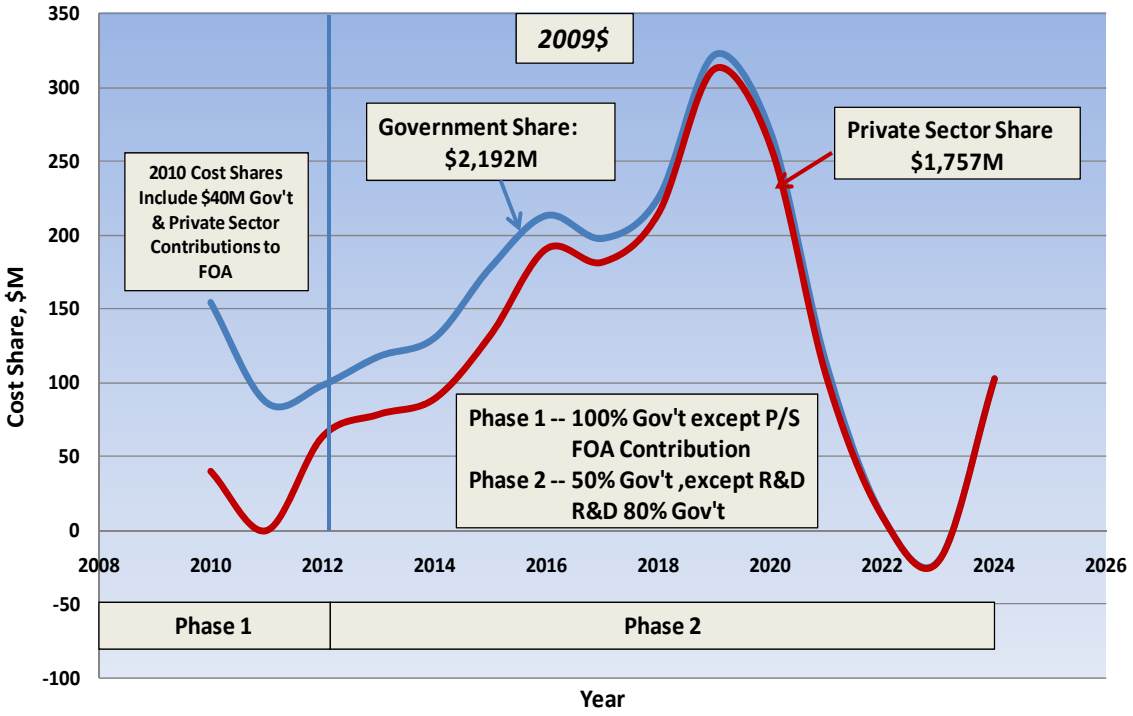
The results of analyses performed to compare the costs to the government and the private sector for each element of the NGNP Project is summarized in Table 2 with greater detail shown in Table 3. Figures 1 and 2 show the cost shares for each case by year and more detailed results of the analyses. In all cases, the results are shown in 2009$.

Table 2. Proposed public and private sector cost shares.

| One First-of-a-Kind Reactor Module | | | | Two First-of-a-Kind Reactor Modules | |
|---|---|---|---|---|---|
| DOE Report to Congress | | NGNP Industry Alliance PIS | | NGNP Industry Alliance PIS | |
| Gov't Share, $M | Private Sector Share | Gov't Share | Private Sector Share | Gov't Share | Private Sector Share |
| $2,192M | $1,757M | $1,633M | $2,645M | $1,732M | $4,950M |

Table 3. A comparison of the Government and Private Sector Cost Shares for the DOE Cost Estimate, Schedule and Strategy presented in the April 2010 Report to Congress with the cost estimate, cost share provisions and schedule in the NGNP Alliance Project Implementation Strategy submitted to Secretary Chu November 30, 2009.

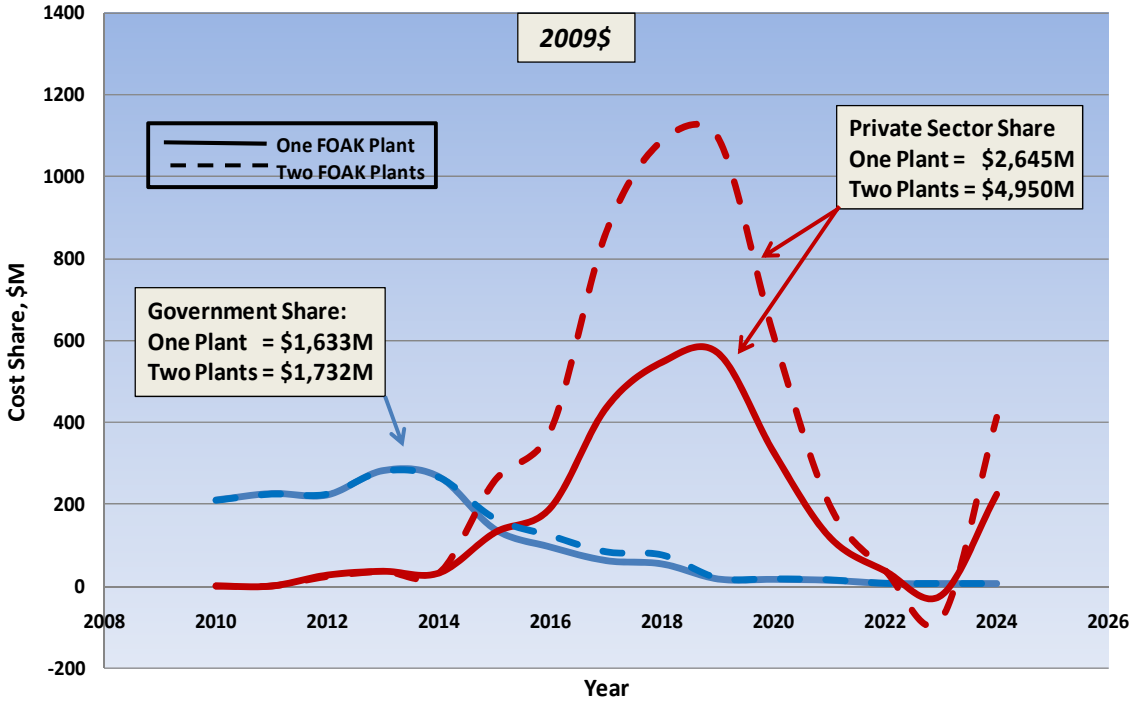
| Item | DOE Response to Congress | | | | | | Alliance Project Implementation Plan Letter to Secretary Chu 11/20/09 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | One FOAK | | | | | | One FOAK | | | | | | Two FOAK | | | | | |
| | 2009$ | | | Inflated$ | | | 2009$ | | | Inflated$ | | | 2009$ | | | Inflated$ | | |
| | Total | Gov't Share | Private Sector Share | Total | Gov't Share | Private Sector Share | Total | Gov't Share | Private Sector Share | Total | Gov't Share | Private Sector Share | Total | Gov't Share | Private Sector Share | Total | Gov't Share | Private Sector Share |
| Project Management / Owners' Cost | 279 | 148 | 131 | 357 | 187 | 169 | 311 | 167 | 145 | 384 | 192 | 192 | 434 | 193 | 241 | 549 | 225 | 323 |
| Research & Development | 517 | 438 | 79 | 609 | 513 | 96 | 533 | 533 | 0 | 628 | 628 | 0 | 533 | 533 | 0 | 628 | 628 | 0 |
| Design #1 -- thru Final | 686 | 354 | 332 | 845 | 433 | 411 | 582 | 252 | 330 | 700 | 279 | 421 | 582 | 252 | 330 | 700 | 279 | 421 |
| Design #2 -- thru Preliminary | 40 | 20 | 20 | 40 | 20 | 20 | 286 | 247 | 39 | 318 | 273 | 45 | 579 | 250 | 330 | 697 | 276 | 421 |
| Licensing | 277 | 145 | 131 | 340 | 178 | 163 | 413 | 220 | 194 | 542 | 257 | 285 | 464 | 289 | 175 | 598 | 346 | 251 |
| Procurement | 1,099 | 550 | 550 | 1,483 | 742 | 742 | 1,099 | 0 | 1,099 | 1,476 | 0 | 1,476 | 2,198 | 0 | 2,198 | 2,951 | 0 | 2,951 |
| Construction Labor | 628 | 314 | 314 | 890 | 445 | 445 | 628 | 0 | 628 | 855 | 0 | 855 | 1,256 | 0 | 1,256 | 1,711 | 0 | 1,711 |
| Startup Testing | 54 | 27 | 27 | 79 | 40 | 40 | 51 | 0 | 51 | 74 | 0 | 74 | 102 | 0 | 102 | 148 | 0 | 148 |
| Initial Operations (first three years) | 422 | 211 | 211 | 676 | 338 | 338 | 422 | 0 | 422 | 676 | 0 | 676 | 845 | 0 | 845 | 1,353 | 0 | 1,353 |
| Proposed Component Test Facility | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 4 | 0 | 4 | 4 | 0 | 4 | 4 | 0 | 4 | 4 | 0 |
| Income | -264 | -132 | -132 | -416 | -208 | -208 | -264 | 0 | -264 | -416 | 0 | -416 | -527 | 0 | -527 | -833 | 0 | -833 |
| Hydrogen Process Development | 210 | 117 | 93 | 258 | 141 | 117 | 210 | 210 | 0 | 258 | 258 | 0 | 210 | 210 | 0 | 258 | 258 | 0 |
| **Totals** | **3,949** | **2,192** | **1,757** | **5,161** | **2,829** | **2,332** | **4,278** | **1,633** | **2,645** | **5,500** | **1,891** | **3,609** | **6,681** | **1,732** | **4,950** | **8,765** | **2,017** | **6,748** |




**NGNP Project Summary of Cost-to-Complete 2010-2024 by Project Element with Government & Private Sector Cost Shares**
(2009$, based on DOE Cost estimate, strategy and cost share provisions in April 2010 Report to Congress)

| Item | Phase 1 (2010-2011) | | Phase 2 (2012-2024) | | Total | Total Gov't Share | Total Private Sector Share |
|---|---|---|---|---|---|---|---|
| | Total | Gov't Share | Total | Gov't Share | | | |
| Project Management (2009$) | 17 | 17 | 262 | 131 | 279 | 148 | 131 |
| Research & Development (2009$) | 124 | 124 | 393 | 314 | 517 | 438 | 79 |
| Selected Plant Design (2009$) | 61 | 41 | 625 | 312 | 686 | 354 | 332 |
| Non-Selected Plant Design -- thru FOA (2009$) | 40 | 20 | 0 | 0 | 40 | 20 | 20 |
| Licensing (2009$) | 14 | 14 | 262 | 131 | 277 | 145 | 131 |
| Procurement (2009$) | 0 | 0 | 1,099 | 550 | 1,099 | 550 | 550 |
| Construction Labor (2009$) | 0 | 0 | 628 | 314 | 628 | 314 | 314 |
| S/U Test (2009$) | 0 | 0 | 54 | 27 | 54 | 27 | 27 |
| Initial Operations (2009$) | 0 | 0 | 422 | 211 | 422 | 211 | 211 |
| Proposed Component Test Facility (2009$) | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Income during Initial Operations (2009$) | 0 | 0 | -264 | -132 | -264 | -132 | -132 |
| Process Heat Application (2009$) | 23 | 23 | 187 | 93 | 210 | 117 | 93 |
| | | | | | | | |
| Totals | 280 | 240 | 3,669 | 1,952 | 3,949 | 2,192 | 1,757 |

Figure 1. DOE strategy, scope, and cost share from Report to Congress, April 2010.




**NGNP Project Summary of Cost-to-Complete 2010-2024 by Project Element with Government & Private Sector Cost Shares**
(2009$, One First-of-a-Kind plant based on Alliance Project Implementation Plan Submitted to Secretary Chu 11/30/09)

| Item | Phase 1 (2010-2014) | | Phase 2 (2015-2024) | | Total | Total Gov't Share | Total Private Sector Share |
|---|---|---|---|---|---|---|---|
| | Total | Gov't Share | Total | Gov't Share | | | |
| Project Management / Owners' Cost (2009$) | 139 | 121 | 172 | 46 | 311 | 167 | 145 |
| Research & Development (2009$) | 331 | 331 | 203 | 203 | 533 | 533 | 0 |
| First Design Total -- thru Final (2009$) | 288 | 252 | 293 | 0 | 582 | 252 | 330 |
| Second Design Total -- thru Preliminary (2009$) | 286 | 247 | 0 | 0 | 286 | 247 | 39 |
| Licensing Total (2009$) | 141 | 141 | 273 | 79 | 413 | 220 | 194 |
| Procurement (2009$) | 0 | 0 | 1,099 | 0 | 1,099 | 0 | 1,099 |
| Construction Labor (2009$) | 0 | 0 | 628 | 0 | 628 | 0 | 628 |
| S/U Test & Init Ops Total (2009$) | 0 | 0 | 51 | 0 | 51 | 0 | 51 |
| Operations Total (2009$) | 0 | 0 | 422 | 0 | 422 | 0 | 422 |
| Proposed Component Test Facility*(2009$) | 4 | 4 | 0 | 0 | 4 | 4 | 0 |
| Total Income (2009$) | 0 | 0 | -264 | 0 | -264 | 0 | -264 |
| Hydrogen Plant Total (2009$) | 110 | 110 | 100 | 100 | 210 | 210 | 0 |
| | | | | | | | |
| Totals | 1,299 | 1,205 | 2,978 | 428 | 4,278 | 1,633 | 2,645 |

**NGNP Project Summary of Cost-to-Complete 2010-2024 by Project Element with Government & Private Sector Cost Shares**
(2009$, Two First-of-a-Kind plants based on Alliance Project Implementation Plan Submitted to Secretary Chu 11/30/09)

| Item | Phase 1 (2010-2014) | | Phase 2 (2015-2024) | | Total | Total Gov't Share | Total Private Sector Share |
|---|---|---|---|---|---|---|---|
| | Total | Gov't Share | Total | Gov't Share | | | |
| Project Management / Owners' Cost (2009$) | 138 | 120 | 296 | 73 | 434 | 193 | 241 |
| Research & Development (2009$) | 331 | 331 | 203 | 203 | 533 | 533 | 0 |
| First Design Total -- thru Final (2009$) | 288 | 252 | 293 | 0 | 582 | 252 | 330 |
| Second Design Total -- thru Final (2009$) | 286 | 250 | 293 | 0 | 579 | 250 | 330 |
| Licensing Total (2009$) | 136 | 136 | 328 | 153 | 464 | 289 | 175 |
| Procurement (2009$) | 0 | 0 | 2,198 | 0 | 2,198 | 0 | 2,198 |
| Construction Labor (2009$) | 0 | 0 | 1,256 | 0 | 1,256 | 0 | 1,256 |
| S/U Test & Init Ops Total (2009$) | 0 | 0 | 102 | 0 | 102 | 0 | 102 |
| Operations Total (2009$) | 0 | 0 | 845 | 0 | 845 | 0 | 845 |
| Proposed Component Test Facility(2009$) | 4 | 4 | 0 | 0 | 4 | 4 | 0 |
| Total Income (2009$) | 0 | 0 | -527 | 0 | -527 | 0 | -527 |
| Hydrogen Plant Total (2009$) | 110 | 110 | 100 | 100 | 210 | 210 | 0 |
| | | | | | | | |
| Totals | 1,293 | 1,203 | 5,388 | 529 | 6,681 | 1,732 | 4,950 |

Figure 2. Alliance Project Implementation Strategy, November 30, 2009.

The tables and figures show the government share is lower by ~$500M (2009$) for both of the Alliance strategies when compared with the DOE strategy. This stems from the fact that procurement and construction of the reactor module(s) constitute the largest percentage of Project costs and the Alliance strategy assumes that the private sector will fund all of these costs. This effect is shown in Figures 1 and 2, which show plots of the cost per annum for the Project and the tables associated with these plots. The plots in Figure 2 show that for the Alliance proposed strategy, the government portion of the cost share drops significantly relative to the private sector cost share as the Project progresses into construction and operation in the latter phases of the Project. This is not the case for the DOE strategy as shown in the plots of Figure 1.

# 4. CONCLUSION

These summary differences are not a comprehensive description of the results of a detailed gap analysis, but rather are those differences that warrant discussion in meetings between DOE executives and the private sector represented by the Alliance. In practical fact, the full range and content of the differences will not be understood until such time as detailed discussions are undertaken between the DOE and the Alliance to develop a mutually agreed-to path forward.

# 5. REFERENCES


1. DOE Report to Congress, April 2010
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4. Public Law 109-58, "Energy Policy Act of 2005," 109th Congress, August 8, 2005