U.S. DEPARTMENT OF ENERGY
Washington, DC

NOT
MEASUREMENT
SENSITIVE

DOE G 413.3-12A
Approved 9-27-2023

SUBJECT: Front-End Planning and Project Definition Rating Index For Nuclear and Non-Nuclear Construction Projects

[This Guide describes acceptable, but not mandatory means for complying with requirements. Guides are not requirements documents and are not to be construed as requirements in any audit or appraisal for compliance with associated rules or directives.]

U.S. DEPARTMENT OF ENERGY
Washington, D.C. 20585

FOREWORD

This Department of Energy (DOE) Guide, for use by all DOE elements, assists with front-end planning and includes computing a project definition rating index, a numeric assessment / gap analysis of scope planning maturity and the environment for non-information technology (IT) capital asset projects.

This DOE Guide provides acceptable, but not mandatory, means for complying with requirements included in DOE O 413.3, *Program and Project Management for the Acquisition of Capital Assets*, current version. This DOE Guide does not impose, but may cite, requirements. Guides neither substitute for requirements nor replace technical standards that implement requirements. Send citations of errors, omissions, ambiguities, and contradictions found in this Guide to PMPolicy@hq.doe.gov.

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1 PURPOSE

This guide provides the Department of Energy (DOE) federal project directors (FPD) and integrated project teams (IPT) with the information, methodologies, and tools to perform effective front-end project planning before establishing a performance baseline (PB) at Critical Decision (CD)-2. This includes a discussion of tools to include in the Project Definition Rating Index (PDRI) to assess whether the IPT has developed key elements critical to a mature project scope definition. Within this guide, the acronym PDRI will be used generically for all tools, whether CII PDRI for Industrial Projects version 5.1 which incorporates the PDRI Maturity and Accuracy Total Rating System (PDRI MATRS), or DOE developed tools based on PDRI.

This document is intended to be foundational and will be modified periodically as the understanding of PDRI models and tools evolves to reflect current methodology within Construction Industry Institute (CII) and DOE programs. DOE continues to be a collaborative partner in the CII development of PDRI and participates actively to review changes of the PDRI tool. The updated PDRI tools in this guide continue to provide the FPD and IPTs with proven tools that are updated by CII and DOE. PDRI does not dictate appropriate consensus standards, such as most current sustainability requirements[1] and clean energy rules, however, PDRI does request users to ensure those standards are included. DOE programs can use this guide to develop their front-end planning (FEP) process per DOE O 413.3 (current version), which includes the mandatory use of PDRI for projects estimated to exceed $100 million. For projects less than $100 million, this guide recommends using these same tools such as new infrastructure projects housing first of its kind, or newly developed, process/manufacturing/technologies. The benefit is derived in maturing scope to minimize scope creep and change orders during a project. Using the PDRI periodically early in the project life cycle will inform efforts to mature the project. Tailoring can be done to support program-specific construction projects and technologies/processes by establishing a hybrid of the available tools to best align with the types of construction included in the project scope. This includes industrial, infrastructure, demolition, and buildings.

2 BASIS

FEP lays the foundation for predictable and efficient project delivery, helping organizations meet their project drivers while accomplishing mission priorities. The National Research Council highlighted the need for effective FEP for DOE projects (2001-2003)[2]. Research further indicates that well performed FEP reduces costs and variances, and increases likelihood of

[1] For further information see DOE G 413.3-6, *High Performance Sustainable Building*, current version.

[2] Front-end-planning was specifically identified by the National Research Council's Committee for Oversight and Assessment of the U.S. Department of Energy Project Management in the 2001, 2002, and 2003 assessment reports. In the 2003 assessment, the committee emphasized the need to perform effective front-end-planning, especially at CD-0 and CD-1 (National Research Council of the National Academies, *Progress in Improving Project Management at the Department of Energy, 2003 Assessment*, The National Academies Press, Washington D.C. 2004, p.28). In October of 2004, the American Society of Civil Engineers published a report on DOE by the Civil Engineering Research Foundation titled *Independent Research Assessment of Project Management Factors Affecting Department of Energy Project Success* which further stated, "Robust front-end planning with sufficient scope definition is necessary before reliable performance baselines can be established." (p. 29 and p. 35)

meeting project goals. Additionally, DOE conducted a root cause analysis (RCA) indicating the importance FEP has on project management performance (2008-2011)[3].

Failure to perform effective FEP leads to less than desired results. A 2017 CII study[4] showed that projects with a highly mature and accurate front-end engineering design (environment in which the project is being established) outperformed projects with low maturity and accuracy by 24 percent on cost performance. Additionally, this guide will outline a number of commercial and DOE developed tools to assist project teams in benefitting from the FEP processes, and industry sector best practices.

The use of commercially available and DOE developed PDRI tools for construction projects (including nuclear) in the DOE project management process is designed to increase the likelihood of project success by helping an IPT improve the project scope definition, specifically by identifying deficiencies and gaps in scope definition early in the projects life. This identification process can also provide a basis for decision support through a scoring assessment method. This score assists project reviewers in measuring the level of project definition at a given project phase. For the CII tools, the lower the score in this scale, the higher the level of project definition maturity (similar to golf scores, success is determined by the lower score). A CII study for heavy industrial projects in the mid-1990s showed that PDRI projects scoring below 200 versus those scoring above 200 at the time of project baselining[5] had on average a:

- cost savings for design and construction of 19 percent versus baselined cost;
- schedule reduction for design and construction of 13 percent versus baselined schedule; and
- two percent project change versus eight percent.

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[3] The Department conducted a root cause analysis (RCA) workshop on October 16-17, 2007, to identify the systemic challenges of planning and managing DOE projects. During the workshop participants singled out 143 issues, which they consolidated and prioritized. The Department published the results of the RCA workshop in an April 2008 DOE report entitled, *U.S. Department of Energy Contract and Project Management Root Cause Analysis*. Following the RCA report, the DOE published the *U.S. Department of Energy Contract and Project Management Root Cause Analysis Corrective Action Plan* (CAP) in July 2008. *The Root Cause Analysis and Corrective Action Plan Closure Report* presents a status of the Department's initiatives to address the most significant issues. (U.S. Department of Energy Contract and Project Management, Root Cause Analysis and Corrective Action Plan Closure Report, 2011, p. iii and iv).

[4] Research Summary 314a-1, *CII Front End Planning Tool: PDRI-Small Infrastructure Projects*.

[5] DOE specific tools have used an inverse scale – higher is better. This makes the spreadsheet tools hard to build and can lead to errors, as well as diverges from commercial understanding of the tools. In 2019, DOE supports using tools with CII scale of "Golf Scores" where lower is better in addition to the DOE specific reports. This allows elements which are "Not Applicable" equal zero points and not impact the outcome of the scoring, making it less likely to make a mistake in the tools use. In either case, focus on the gaps and appreciate the score for what it is.

More recent studies focused on all six of the CII FEP tools have shown similar results.[6] DOE produced tools also provide a comprehensive and effective framework for assessment of initial project planning.

As one of the corrective measures initially identified in 2001 and later mandated for projects over $100 million in DOE O 413.3 (current version), the use of FEP tools (specifically PDRI, to improve FEP within the DOE Project Management Process), are proven to help project teams better address key scope definition issues for industrial, infrastructure, building, as well as a myriad of other project types. Also, it is a key tool for ensuring project teams and stakeholders communicate during FEP.

2.1 WHAT IS A PDRI?

The PDRI tools used in this guide are easy-to-use mechanisms for measuring the degree of scope development for construction projects (nuclear and non-nuclear) within DOE. The PDRI tools offers comprehensive lists of 64 to 70 scope definition elements (depending on the large project tool) divided into three key areas for project planning: Basis of Project Decision, Basis of Design and Execution Approach. Each element is grouped within categories by topological similarities and is weighted based on its relative importance to the other elements. A scoring scheme through the project stages of development allows the users to evaluate the state of completeness of scope definition at any point prior to detailed design and construction; and where the scoring identifies gaps, it allows the project team to quickly predict factors impacting project risk. Since the PDRI score relates to risk, those areas (elements within the categories, such as Site Information) that need further work can easily be identified. CII empirical studies have shown that an overall score of 200 (300 or below for the small project tools), or less, prior to determining the project baseline can greatly increase the probability of a successful project. It is recommended that a scoring of 350 or less be used for the suitability of a project proceeding to CD-1 along with using the gap list to address identified issues to reach a score below 200 before CD-2.[7]

PDRI and other FEP tools encompass project activities from pre-conceptual design through approval of the PB. The preponderance of FEP takes place between CD-0, *Approve Mission Need*, and CD-1, *Approve Alternative Selection and Cost Range*. Between CD-1 and CD-2, *Approve Performance Baseline,* the tools provide a final gap list for the project team to address. CII studies show that mature and accurate FEP efforts can result in significant cost and schedule savings.

Each of these tools have been tailored to address a specific type of project and will be described in more detail later in the guide. They include:

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[6] Research Summary 331-1, *CII Assessing the Maturity and Accuracy of Front End Engineering Design* and Implementation Resource 113-2, Version 5, *CII Project Definition Rating Index- Industrial Projects, A Front End Planning and Accuracy Total Rating System*.

[7] In light of the research component of science projects, it is recognized that the DOE Science Programs have an alternate methodology and process to assess adequacy of project front-end planning, in place of PDRI, not discussed in this guide. The Office of Science uses its own specific methodology to assess the maturity of projects.

- PDRI-Industrial (CII IR 361)
  Originally developed in 1996, this tool focuses on large, complex, and heavy industrial projects that include process flows and large-scale equipment and control systems. The tool allows an IPT to assess 70 maturity elements and 27 accuracy (environmental) factors. The current version also includes a macro-enabled spreadsheet to assist facilitators and teams in the assessment process. Assessment using a trained facilitator generally takes 2.5 to 4 hours to complete.
- PDRI-Small Industrial (CII IR 314-2)
  Developed in 2015, this tool is framed for less-complex heavy industrial projects with a typical threshold ≤ $10 million. The tool also includes an integrated spreadsheet and generally takes 90 minutes or less to complete.
- PDRI-Infrastructure (CII IR 268-2)
  Developed in 2010, this tool is best used for large, complex horizontal projects such as pipelines, roadways, transmission, and distribution facilities. The tool also comes with an integrated spreadsheet for assessment and takes 2.5 to 4 hours with a skilled facilitator to complete.
- PDRI-Small Infrastructure (CII IR 314a-2)[8]
  Developed in 2016, this tool should be used for less complex horizontal projects with a typical threshold ≤$20 million. The tool also comes with an integrated spreadsheet for assessment and takes 90 minutes or less with a skilled facilitator to complete.
- PDRI-Buildings (CII IR 155-2)
  Developed in 1999 for conventional building projects, including low and mid-rise offices, research and development laboratories, multi-family housing, and call centers, this assessment tool, using a trained facilitator and macro-enabled spreadsheet, generally takes 2.5 to 4 hours to complete.
- DOE – Office of Environmental Management (EM) Critical Decision Assessment Tool (CDAT). This tool allows the EM field offices to perform self-assessment and the EM Office of Project Management to assist independent project review (IPR) teams in determining the readiness to achieve critical decision gates. This tool uses a "higher is better" scoring mechanism.
- DOE/NNSA PDRI for Traditional Construction Project (Nuclear, Non-nuclear). This is a version of PDRI based on CII Industrial established in 1999 by DOE. It has not been updated, maintained or supported and will be sunset in the next major revision of this guide. It remains available, but it is recommended the IPT use an improved CII tool best fit to the project. This tool uses a "higher is better" scoring mechanism. The scoring for this tool is provided in Appendix D of this guide.

The CII PDRI tools referenced in this guide (such as the ones listed above) allow the project team to assess a project maturity using a scoring index from a low of 70 to a maximum of 1000 points, with a lower score indicating a higher level of maturity. DOE's three tools are set up with a higher score indicating higher planning maturity.

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[8] Implementation Resource 314a-2, *Project Definition Rating Index, Small Industrial Projects*.

While it is a useful rough index, the score is not the most important outcome of an assessment. Experience has shown that the alignment gained amongst team members and the gap list that results from the assessment can shine a light on a successful project pathway. This guide introduces the PDRI concept for DOE construction projects as it can be used to measure the degree of scope definition through the different progressive phases in the FEP process and to assist in identifying areas of risk consideration. One key aspect though is PDRI assessments should be done in a group setting, coming to consensus on each element and factor, to ensure the crosstalk between IPT members occurs during the assessment.

The PDRI Industrial tool version 5 includes an accuracy dimension for FEP. This is new for CII and found to be effective. The accuracy component of this tool can be run for all FEP assessments and takes about 1.5 hours to complete. CII has committed to adding the accuracy component to their PDRI products over the next several years, making a two-dimensional assessment the new standard. The intent is for the project to set up a resourced FEP team that follows a specific process to gain accuracy. An assessment score and gap list help identify problem areas in terms of accuracy. The accuracy component in PDRI Industrial can also be run by itself or in tandem with other CII and DOE developed tools.

2.2 WHEN TO USE THE PDRI

PDRI can be used during the FEP process to ensure alignment, conformance to organizational procedures, and a continual focus on project priorities. The tool can be used both during and at the conclusion of the planning process. Most projects would want to apply the tool at least twice. Regardless of the timing, the assessment will provide the IPT an understanding of planning gaps. As shown in Figure 1, CII recommends up to four time periods to use the PDRI tool and label these as PDRI 1, 2, 2i, and 3 (tailor as appropriate). At CD-2 these can be used as a final checklist to ensure a mature scope. Please note, the milestones depicted below, 0 to 3 are CII FEP milestones and not DOE Critical Decisions. These are referenced in Figure 2, depicting the Front-end planning phase as it relates to project controls.

PDRI application points

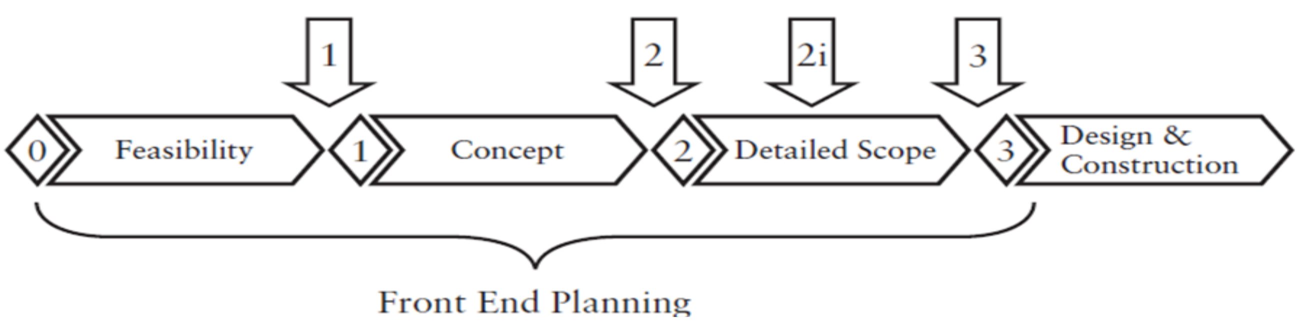

Figure 1. Employing PDRI and Front-End Engineering Design Maturity and Accuracy Total Rating System (FEED MATRS), Application Points

Figure 2 below, provides a visual view of this Figure 1 process in relation to the project management process in DOE O 413.3 (current version) as well as other processes such as safety basis. With goals of improving up-front planning, including integration of safety early into the design process, there is a major emphasis on the extent of project definition in the conceptual design phase of the project that includes CD-1. The tools are also useful leading to CD-2 as the project completes preliminary design by providing a list of gaps to address before the Project Management Executive (PME) approves the project PB. For projects over $100 million, DOE O 413.3 (current version) requires independent validation of FEP via PDRI. The importance of a well defined project scope at CD-2 is highlighted by the DOE O 413.3 (current version) expectation that the approved PB for technical scope, cost and schedule will not be exceeded at project completion.

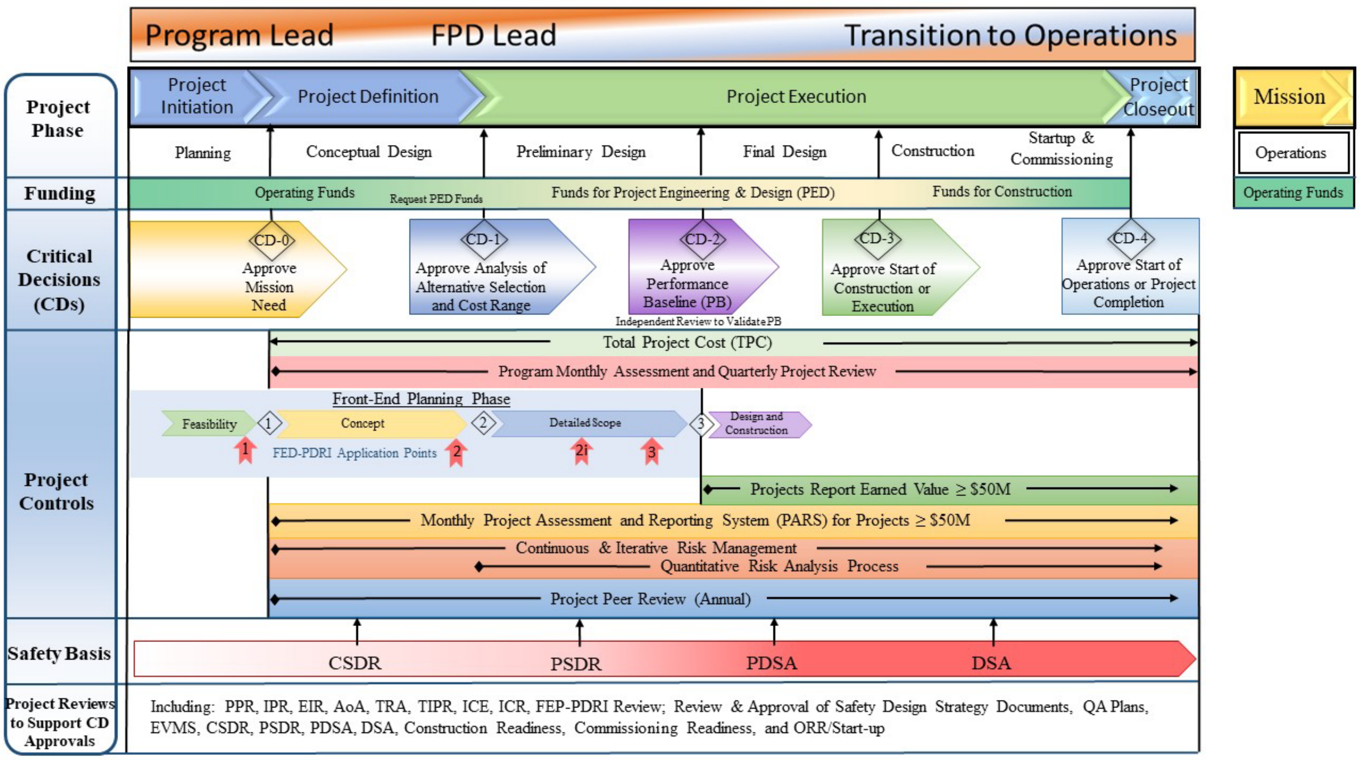

Figure 2. DOE O 413.3 Project Management Process showing FEP

Table 1 provides a recommended timing for PDRI use along with recommended tool illustrating the scoring method. DOE projects should consider a minimum of two PDRI events and may well benefit from as many as four such assessments. The initial PDRI for CD-0 sets up the expectations and verifies the right team and resources are in place to conduct FEP. The assessment just prior to CD-1 will serve to double-check the analysis of alternatives (AoA) and verify the conceptual design includes all major elements of the scope. Between CD-1 and CD-2 a PDRI will assess the preliminary design progress and the assessment just prior to CD-2, required for projects over $100 million. The external independent review (EIR) validates the work breakdown structure (WBS) and confirms the design includes all necessary activities to reach baseline. The table values represent potential score, but these are a rough order of magnitude index. The real benefit is to understand the gaps leading to a mature and well defined scope.

CII FEP Application Point	CD	Threshold Guidance To Move Forward (CII PDRI tools for Large Projects – where lower score is better)	Threshold Guidance To Move Forward (small project PDRI's – where lower score is better)
1	CD-0	650-850	650-850
2	CD-1	350-450	450-550
2i	Between CD-1 & CD-2	150-350	250-450
3	pre-CD-2	150-200	250-300

Table 1. PDRI Application Points Corresponding to CD Stage for Small and Large Projects Based on CII Tools

Table 1, additionally shows a tailored use of PDRI tools for small industrial and small infrastructure projects for example, minor construction. These are not subject to DOE O 413.3 (current version), but the process is still recommended as a best practice.[9] As each site and plant uses different names for their gated systems, these are identified in terms of critical decision equivalents. For each of the CII tools, there is a detailed research report identifying the statistical basis supporting assigned weights and ranges shown here.

CII has found over time, the use of PDRI tools by a project team will result in an ability to perform project functions more effectively, thoroughly, and faster than could be expected of teams who do not use the tools. The team that regularly uses PDRI tools to ensure scope is defined may develop better scores than listed in the threshold tables.

In addition to maturity, the accuracy component of PDRI is beneficial to the project when it is 76% or higher. Culture, people, resources, and practices need to be in place for effective scope definition as identified in PDRI.

Appendix C includes a matrix to compare DOE and CII developed maturity elements. Appendix E includes a table to compare DOE and CII scoring methods.

2.3 BENEFITS OF USING THE PDRI TOOLS

Effective FEP improves project performance in terms of both cost and schedule, reinforcing the importance of early scope definition and its impact on project success. A significant feature of the PDRI is that it can be utilized to fit the needs of almost any individual project, small, or large. CII research team recommends PDRI for small infrastructure and industrial projects. PDRI small infrastructure and industrial tool measures project scope definition for completeness. PDRI small infrastructure project tool focuses on infrastructure projects less than $20 million in total cost and durations between six to twelve months. PDRI small industrial project tool focuses on industrial projects less than $10 million in total cost and durations between three to six months. Elements

[9] DOE O 413.3, _Program and Project Management for the Acquisition of Capital Assets_, current version, appendix C, paragraph 23 (c) (4).

that are not applicable to a specific project can be marked N/A and have their weighting factor reduced to zero. The CII spreadsheet tools automatically take N/A elements into account in the final tally.[10] The DOE spreadsheets need additional effort to ensure N/A elements do not skew the results when using the higher is better construct. These easily used "best-practice" PDRI tools can provide numerous benefits to the evaluators, including:

- A checklist that can be used for determining the steps to follow in defining the project scope.
- A standardized terminology of elements that comprise the scope definition for the project under evaluation.
- An industry standard for rating the completeness of the project scope definition to facilitate risk assessment and prediction of escalation, and evaluation of the potential for disputes.
- A means to monitor progress at various stages during the FEP effort and to focus efforts in high-risk areas that need definition.
- A tool that aids in communication and promotes alignment between the owners, design contractors, leadership (ESAAB/PMRC) and other key stakeholders by highlighting maturity level and poorly defined areas in a scope definition package to evaluate risks in the project.
- A means for project team participants to reconcile their differences using a common basis for project evaluation.
- A benchmarking tool for interested parties to use in evaluating the completion of scope definition versus the probability of success on future projects.

The PDRI can benefit owners such as DOE, as well as designers and constructors. DOE programs and planners can use it as an assessment tool for establishing a comfort level at which they are willing to move forward with projects.

3 BACKGROUND

At the direction of Congress, DOE requested the National Research Council in 1999 to conduct an independent external review of the DOE structure and process for managing projects. In their findings, the lack of up-front planning was identified as a principal concern of DOE's project management efforts. To improve our FEP, DOE has employed various PDRI tools.

2000 DOE EM produced a tailored PDRI tool for conventional construction projects, environmental restoration projects, and facility disposition projects.

2008 National Nuclear Security Administration (NNSA) developed its own tailored version of the CII PDRI tool, like the EM effort.

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[10] The DOE spreadsheets for the EM and NNSA versions of PDRI which are replaced with this Guide, did not resolve elements which were N/A. The lower is better option can make these 0 and the score can reflect the N/A whereas in a higher is better option, this does not work. Additional calculations must be done to ensure elements which are N/A do not impact the scoring.

The EM and NNSA tools did not follow the commercial tool's CII development process, nor were they rigorously tested in the commercial world. The NNSA version has become obsolete and is utilized more as a final audit checklist rather than part of the FEP process. This tool is no longer maintained and will be sunset in the next major revision of this guide. The EM tool continues to be maintained, updated, and utilized.

Prior to DOE employment of PDRI tools, CII developed the initial commercial PDRI tool for industrial projects in 1996, followed by four additional tailored versions in subsequent years. These commercially available PDRI's have been tested and used successfully on thousands of projects globally, including nuclear, non-nuclear, and demolition. These tools are fully available and recommended for use by DOE.

The Front-End Engineering Design Maturity and Accuracy Total Rating System (FEED MATRS) was developed in 2017 and has since been integrated into the CII PDRI-Industrial tool. FEED-MATRS has added significant functionality to the PDRI by adding objectivity and consistency to the scoring, and a new accuracy dimension to evaluate contextual factors for the environment in which FEP is being conducted.

4 ROLES AND RESPONSIBILITIES

4.1 PHILOSOPHY OF USE – WHO PERFORMS THE PDRI?

The PDRI rating should be performed by the project team inclusive of federal and contractors. Many of the PDRI tools work best in conjunction with a third-party facilitator. The facilitator is often an individual with experience in the technical details of FEP of similar projects, is versed in facilitation techniques using the PDRI and is independent of the project at hand. A project team can conduct a PDRI without a third-party facilitator but general CII observation is that optimism bias will lead to elevated scores. Ideally, the project team and facilitator conduct a PDRI evaluation at various points in the project. The facilitator provides objective feedback to the team and controls the pace of the assessment session. Alternatively, key individuals can evaluate the project separately, then evaluate it together, ultimately agreeing on a final evaluation. Even using the PDRI from an individual standpoint provides a method for project evaluation. The PDRI assessment may be done in conjunction with other DOE O 413.3 (current version) required independent assessments at different project phases for different sized projects.

Users' experience (CII, private entities, and other Federal Agencies) has shown that the PDRI is best used as a tool to help project managers (as well as project coordinators and project planners) organize and monitor progress of the FEP effort. In many cases, a planner may use the PDRI prior to the existence of a team to understand major risk areas. Using the PDRI early in the project life cycle will providing a roadmap for the FEP effort to identify areas that are weakly defined and need more focused attention.[11]

Used in early team meetings the PDRI provides a means for the team to align itself on the project and organize its work. Experienced PDRI users see that the final PDRI score is less important than the process used to arrive at that score. The PDRI also can provide an effective means of

[11] FPDs can take courses through Project Management Career Development Program (PMCDP).

handing off the project to other entities or helping maintain continuity as new project participants are added to the project.

If the organization has FEP procedures, execution standards, and deliverables in place, many PDRI elements may be partially defined when the project begins FEP. An organization may want to standardize many of the PDRI elements to improve cycle time of planning activities.

PDRI scores may change on a day-to-day or week-to-week basis as team members realize some elements are not as well defined as initially assumed. It is important to assess both content and quality of the elements in an honest unbiased manner (the score sheet should not be used as a simple checklist of completed documentation). The maturity level of relevant project documentation should be assessed as part of the element rating. Any changes that occur in assumptions or planning parameters need to be reconciled with earlier planning decisions. The target score may not be as important as the assessment and the team's progress over time in resolving issues that harbor risk.

With a range of tool choices, the appropriate PDRI can be selected to assess the project; guidance is provided in the tool documentation to assist in choosing the appropriate tool, based on the projects relative complexity, cost and scope of work. A variety of tools are available to address all projects, regardless of complexity. The facilitator can work with the project team leader to choose the most appropriate tool.

Each program/organization is encouraged to develop an appropriate threshold range of scores for the particular phase of FEP after some experience using the PDRI. The threshold is dependent upon the size, type, and complexity of the project, to include specific energy efficiency, safety, health, and security considerations (For example, a standard cooling tower with chiller units may not need a CII PDRI score of 200 before going to procurement/construction if the functional and performance requirements fall within the commercially available ranges of performance or boiler plate designs). The operative approach for using the PDRI in these situations is common sense. An experienced facilitator can help in this regard.

Experience (lessons learned) from users has shown that successful implementation of the PDRI process requires training. Several facilitators can be trained, the number will vary by organization and the projects that will require its use to assist decision making (such as authorization for CDs). It is recommended that every project has access to a trained facilitator in a timely manner, when required and appropriate. The facilitator should not be a member of that project team. In many organizations, project managers are trained as facilitators for their peers' projects.

In addition to a cadre of trained facilitators, all participants in a PDRI review process should understand the PDRI model, background, and process. In most cases, this can be accomplished with just-in-time training. The facilitator will brief the participants on the purpose and their role to make the session a success, and then the facilitator will comment on specific behaviors as they progress through the assessment session.

For information on becoming a trained facilitator, it is recommended you contact the Office of Project Management at email address PMpolicy@hq.doe.gov.

4.2 SENIOR LEADERS AND THE USE OF FEP ASSESSMENTS

The tools described in this guide are designed to help the FPD ensure a mature and accurate FEP effort is completed. Accuracy works to define the environment in which the project is planned and conducted. Senior leadership at DOE, project management, and operating contractors, use gated processes for project initiation, development, design, and execution. The assessment of FEP is an indicator to support these decisions, whether for general plant projects, capital asset projects or programs comprised of like projects, generally managed as a mega-project at DOE. The scores resulting from the assessments are indicators of future project outcome, but of greater value than the score is the gap list produced and how the FPD with the IPT have addressed these gaps prior to approving the PB for a project. As the project management process moves forward, the maturity of the project definition improves. Between initiation and concept development, the FPD or project manager uses these tools to work the gaps towards a mature and accurate FEP effort. Approaching CD-1 or the equivalent, this is a good place for the senior leadership to verify the efficacy of current FEP progress using the score as an index in conjunction with the projects identified gaps and how they impact project definition. Between CD-1 and the PB (CD-2 or equivalent) the resolution of gaps and target scores are a good indicator that the project is ready for approval of a PB. This is a risk informed and resourced decision, between the project team and all stakeholders that have a vested interest in locking the scope along with producing a cost estimate and schedule.

5 SCHEDULE OF DELIVERABLES

Though this guide describes four advantageous times to conduct the PDRI during the FEP process, the first three instances are optional. DOE O 413.3 (current version) requires only the final instance be conducted prior to establishing the PB. A recommended timeline for PDRI usage is depicted in Table 2, indicating specifications and deliverables to ensure a mature scope definition.

PRE		CRITICAL DECISION	POST	
Action or Deliverable	Basis		Action or Deliverable	Basis
Conduct PDRI (PDRI 1).	Optional Best Practice (CII)	0	Align the IPT to complete FEP.	
Conduct PDRI (potential for 2 instances, PDRI 2 and 2i).	Optional Best Practice (CII)	1	Identify gaps at the end of conceptual design to address in preliminary design. Ensure all members of the IPT are able to communicate risks and identify a forward path.	
Conduct a Project Definition Rating Index Analysis for projects with a TPC greater than or equal to $100M. PM will complete as part of the EIR. (Refer to DOE G 413.3-12, current version) Also, recommended for projects less than $100M (PDRI 3).	DOE O 413.3B (required)	2 or 2/3	N/A	
(if Baseline Change Proposal (BCP) should consider).		3	N/A	

Table 2. Schedule

6 DELIVERABLES

6.1 PERFORM COMPREHENSIVE FEP

Table 3 identifies the actions or deliverables associated with a PDRI through the project CD-gate life cycle as required by the DOE O 413.3 (current version).

FEP	
Source: DOE O 413.3 (current version), Appendix A, Table 2.2; Appendix C.17; Appendix C.23; and Appendix D, Table 3	Applies to:
Conduct a Project Definition Rating Index Analysis, as appropriate, for projects with a TPC ≥ $100M. PM will review as part of the EIR. (Refer to DOE G 413.3-12, current version) The project team will perform comprehensive front-end project planning to an appropriate level before establishing a PB at CD-2. The PDRI model assists the IPT in identifying key engineering and design elements critical to project scope definition. PDRI is to be implemented and used for projects with a TPC of $100M or greater, as appropriate. This will be accomplished by the FPD. While not mandated, it is strongly encouraged for use by Programs for projects with a TPC less than $100M. See DOE G 413.3-12 (current version) for additional information.	Pre-CD-2

Table 3. Deliverable

6.2 PDRI DESCRIPTION OF SCORING SYSTEM

For project types other than large industrial, all the tools follow a similar look and feel. This includes paper versions and spreadsheets for assisting in the assessment of a project. All tools are available at PM MAX[12] in a DOE FEP tool kit. This includes research reports and summaries, implementation resources, and Excel based tools.

All CII PDRI versions are divided into three Sections that frame the project opportunity in terms of scope. These are: (1) Basis of Decision, (2) Basis of Design, and (3) Execution Approach. For each of the project planning sections, there are various categories that are further subdivided into elements that are the building blocks of the FEP process. DOE's tools are based on these sections but have been customized to meet the needs of specific programs. In total, these elements provide a good indication of project planning maturity at each early stage of the project as empirically proven by the CII research. If some of the elements are not applicable to a project the score will need to be normalized (see Section 6.7 for an explanation of the scoring mechanics). Table 4 provides a summary of the number of elements in the PDRI-Industrial projects.

Sections	Categories for Construction Projects	Elements for Construction Projects
I. Basis of Decision	5	22
II. Basis of Design	6	33
III. Execution Approach	4	15
Totals	**15**	**70**

Table 4. Number of Elements for Industrial Construction Projects

A complete list of the PDRI-Industrial's three sections, 15 categories and 70 elements of the scope definition rating criteria is shown in Figure 3 (these are also the specific elements for DOE nuclear and non-nuclear industrial construction projects). There are different number of elements for PDRI infrastructure (68 elements) and PDRI building (64 elements) tools. Generally, the infrastructure and building PDRI tools have a reduced and tailored number of elements that focus on the work of these types of projects. Many of the elements are similar between the PDRI tools but are customized to focus between buildings, infrastructure, and industrial.

[12] MAX.gov shared services is planned to sunset in December 2023. Alternative site will be assessed.

I. BASIS OF DECISION

A. Manufacturing Objectives Criteria
A1. Reliability Philosophy
A2. Maintenance Philosophy
A3. Operating Philosophy
B. Business Objectives
B1. Products
B2. Market Strategy
B3. Project Strategy
B4. Affordability / Feasibility
B5. Capacities
B6. Future Expansion Considerations
B7. Expected Project Life Cycle
B8. Social Issues
C. Basic Data Research & Development
C1. Technology
C2. Processes
D. Project Scope
D1. Project Objectives Statement
D2. Project Design Criteria
D3. Site Chars. Available vs. Required
D4. Dismantling & Demolition Req'mts
D5. Lead / Discipline Scope of Work
D6. Project Schedule
E. Value Engineering
E1. Process Simplification
E2. Design & Material Alternatives Considered / Rejected
E3. Design For Constructability Analysis

II. BASIS OF DESIGN

F. Site Information
F1. Site Location
F2. Surveys & Soil Tests
F3. Environmental Assessment
F4. Permit Requirements
F5. Utility Sources with Supply Conds.
F6. Fire Prot. & Safety Considerations
G. Process / Mechanical
G1. Process Flow Sheets
G2. Heat & Material Balances
G3. Piping & Instrmt. Diags. (P&ID's)
G4. Process Safety Mgmt. (PSM)
G5. Utility Flow Diagrams
G6. Specifications
G7. Piping System Requirements
G8. Plot Plan
G9. Mechanical Equipment List
G10. Line List
G11. Tie-in List
G12. Piping Specialty Items List
G13. Instrument Index
H. Equipment Scope
H1. Equipment Status
H2. Equipment Location Drawing
H3. Equipment Utility Requirements
I. Civil, Structural, & Architectural
I1. Civil / Structural Requirements
I2. Architectural Requirements
J. Infrastructure
J1. Water Treatment Requirements
J2. Loading / Unloading / Storage Facilities Requirements
J3. Transportation Requirements
K. Instrument & Electrical
K1. Control Philosophy
K2. Logic Diagrams
K3. Electrical Area Classifications
K4. Substation Requirements/ Power Sources Identified
K5. Electric Single Line Diagrams
K6. Instrument & Electrical Specs.

III. EXECUTION APPROACH

L. Procurement Strategy
L1. Identify Long Lead / Critical Identify Long Lead /
L2. Procurement Procedures & Plans
L3. Procurement Resp. Matrix
M. Deliverables
M1. CADD / Model Requirements
M2. Deliverables Defined
M3. Distribution Matrix
N. Project Control
N1. Project Control Requirements
N2. Project Accounting Req'mts
N3. Risk Analysis
P. Project Execution Plan
P1. Owner Approval Requirements
P2. Engr. / Constr. Plan & Approach
P3. Shut Down/Turn-Around Req'mts
P4. Pre-Commissioning Turnover Sequence Requirements
P5. Startup Requirements
P6. Training Requirements

Figure 3. PDRI Sections, Categories and Elements, CII PDRI-Industrial

Figure 4 gives a hierarchy of the tool set up.

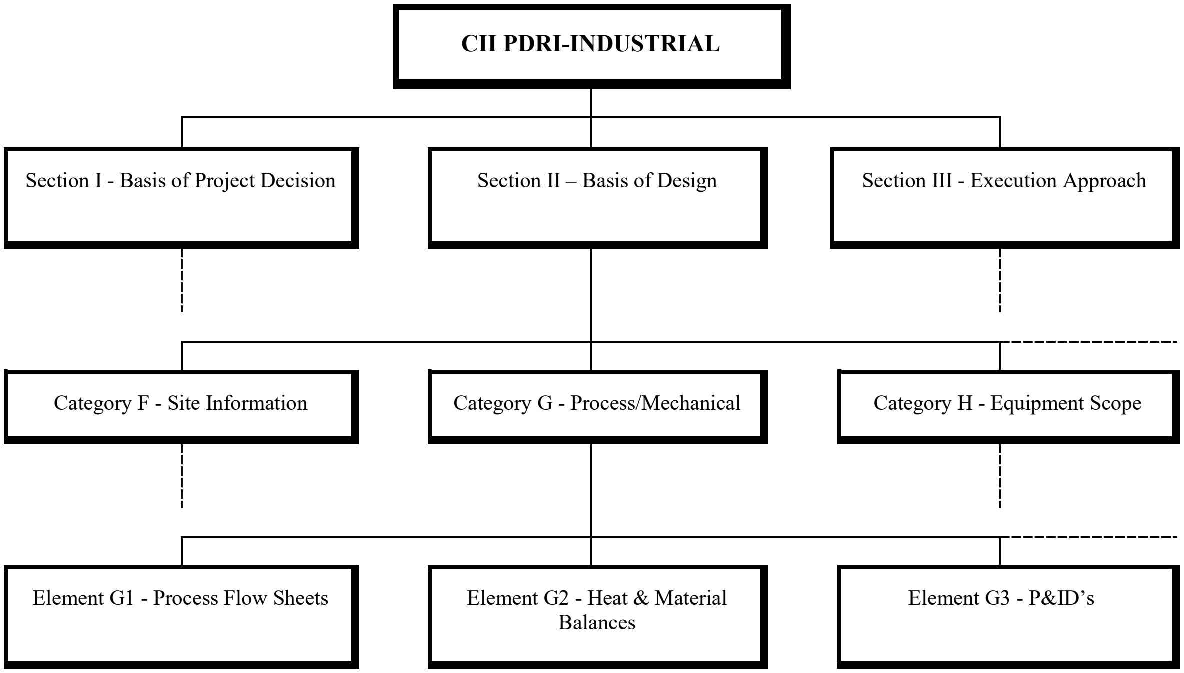

Figure 4. CII PDRI-Industrial Hierarchy, Example

A project can conduct both a CII and DOE PDRI, however the report must articulate the relevant scoring scale associated with the outcome. Both use a 1000-point total and if both are used, the team using it must understand and explain that a project with 350 points on a CII scale aligns to around 600 to 700 on the DOE tool scale. It is possible to use both, but the user must take care to correctly interpret the ascension and descension scales of output. In addition, the intent of a PDRI tool is a maturity measure on Scope development. In some of the DOE PDRI tools, schedule quality and cost estimate quality are also assessed. While these additional items are important for deciding if a project should move past CD-1 and CD-2, they are not the focal point of PDRI, which works to ensure Scope is sufficiently defined to reduce future changes.

6.3 ELEMENT DESCRIPTIONS

Key elements are grouped together into categories. Associated with each element is a description that provides the basis for evaluating the score or maturity rating (see the implementation resource associated with each Spreadsheet (Excel) tool in the FEP toolkit on PM Max for the CII Element definitions and *Project and Contract Baseline Assessment Tools* for EM specific tools). The elements are best assessed subjectively by the IPT with the help of a facilitator. If not using a facilitator, be careful to avoid group think and optimism bias. Appendix C provides a crosswalk between DOE developed and CII developed tools.

As with most decision support systems, it is difficult to provide a completely comprehensive list that is applicable to all scenarios. In general, the descriptions provided in the PDRI tools establish a basis for determining that a category/element is fully matured and, just as importantly, that the element demonstrates a high degree of planning quality. It is important to note that maturity values discussed in the next section are meant only to measure the degree of completeness and the extent that a Category or element meets the requirement for an adequate scope definition.

6.4 CII PDRI DEFINITION LEVELS

The CII PDRI Definition Level provides a numerical rating system (from 0 to 5) based upon the level of definition of each element, as compared to the element definition description which provides the ideal end state. With the lower is better scoring approach, a "0" value effectively means that the criteria embodied in the element definition is not applicable (N/A) to the project; a value of "5" means an incomplete or poorly defined element. For some DOE projects, particular element criteria may not be applicable. In that case, an "N/A" should be entered as the maturity value on the PDRI score sheet and a comment as to why it is not applicable should be entered. A value of "1" means the element definition is complete. With this scoring scheme, a lower score is a better outcome. In general, Definition Levels should be ascertained by applying both the qualitative and quantitative criteria in Figure 5 to the element levels of definitions. (Note: Ultimately, as explained later, the definition level scores are added to obtain an overall PDRI score). It is important to evaluate each individual element in terms of how well defined it is at the point in time of the assessment. Point totals for each element are not changed, only the level of definition may be different.

The project management term phase gate 3 is to be complete by DOE's CD-2, with most already complete by CD-1. Outside of DOE, many industrial organizations approve the PB at phase gate 3 with an Association for the Advancement of Cost Engineering (AACE International) Class 3 cost estimate. At DOE, many of our projects are matured to either 60% to 90% design before approval of the PB, especially for nuclear and one-of-a-kind projects. The rule of thumb should be to target a 2 for most elements by CD-1 and work these to a total score of 200 or less to ensure a mature scope definition before moving into design and then establishing a PB. For small projects, the target score is 300 using the small project tools. Figure 5 outlines a method of assessing the level of definition of an element.

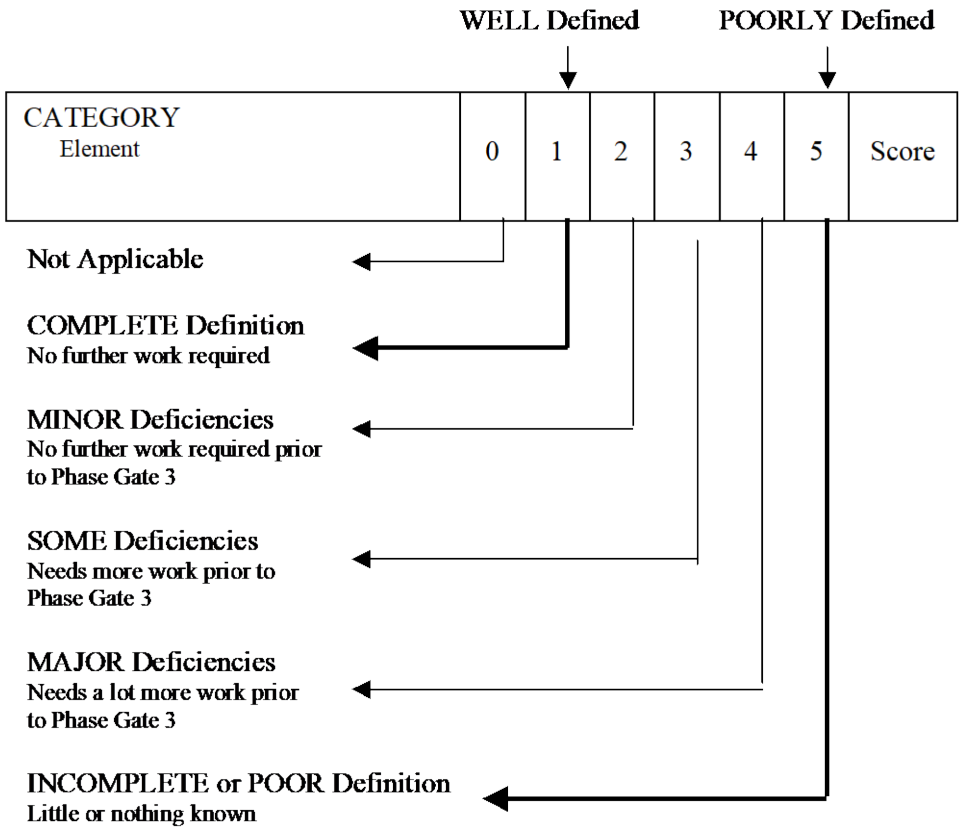

Figure 5. Meanings of the Six Definition Levels

For those elements that are completely defined, no further work is needed during FEP. Similarly, for those elements with minor deficiencies, no further work is needed during the FEP phase, and the issue will not impact cost and schedule performance; however, the minor issues identified will need to be tracked and addressed as the project proceeds into the design phase. Incomplete elements, assessed as having some, or major, deficiencies, will require further FEP work prior to CD-1.

A PDRI element's level of definition is generally relative to its importance to the project at hand. As such, PDRI flexibility allows the project team some leeway in assessing individual element definitions. For instance, if the scope documentation deficiencies of a particular PDRI element are integral to project success (and reduction of risk), the team perhaps may rate the issue at a definition level "three" or "four" or even "five." On a different project, the absence of definition of these same issues within a PDRI element may not be of concern and the team might decide to rate the element as a definition level "two."

Where a subcontractor is responsible for providing critical project documents (e.g., health and safety plan, quality assurance plan (QAP), etc.) after the bid award (such as with design-build (D-B) projects) a maturity rating of “three" is acceptable, provided that the requirements are fully and completely communicated in the contracting documents (e.g., special conditions, drawings, specifications, etc.).

6.5 DOE-EM CDAT DEFINITION LEVELS

The EM Project CDAT was developed by an EM team as a successor to the EM PDRI (which has been successfully used to assist project planning and as CD assessment tools for well over a decade) for use on EM's projects. The CDAT is designed to help measure EM project maturity levels and, most importantly, to assess and/or self-assess readiness for achieving each of the four DOE CD levels. The CDAT incorporates the lessons learned over the years through its continuous use (as the EM PDRI) on EM projects. The EM-CDAT tool uses the full range of project elements grouped by cost, schedule, scope, technical, management, planning/control and safety. These elements and their associated rating criteria encompass and are in conformance with most current version of applicable DOE Orders, Standards, Guides, EM policies and federal regulations.

Three CDAT sets were developed for use with the full range of EM project types, tailored to the specific requirements of each of the three main types of EM projects: 1. Construction; 2. Environmental Restoration (CERCLA/RCRA); and 3. Facility Deactivation and Decommissioning (Non-CERCLA D&D projects). The user makes project maturity level determinations by assigning numerical scores for each element based on a measure of how well each element meets its specific associated criteria. The overall total score indicates the entire projects level of maturity and degree of success in achieving each CD level.

The EM CDAT tool contains the full range of Cleanup Contract Baseline elements. These elements and their associated rating criteria encompass the requirements to conform to applicable EM policies, DOE Orders, Standards, Guides, and Federal regulations. The user makes maturity level determinations by assigning numerical scores for each element based on a measure of how well each element meets its specific associated criteria. The overall total score indicates the entire baseline’s level of maturity and degree of success in achieving the objectives of the cleanup contract and Departmental/EM requirements.

6.6 ASSESSING THE PROJECT

To assess an element, read its corresponding description (examples in column 3 of Tables 5 and 6 below). Some elements contain a list of items to be considered when evaluating their levels of definition. These lists may be used as checklists. Additional issues may be applicable for renovation projects. All elements have five possible scores, one for each of the five possible levels of definition.

Choose one definition level (1, 2, 3, 4, or 5) based on the perception of how well that element has been addressed. If this element is non-applicable select “0.” This determination is best accomplished through open discussion among IPT members with a trained facilitator helping the team in its consensus decision making. In considering the completeness of the PDRI elements, the FEP team needs to take into account the desired operating performance alongside the cost and schedule outcomes. Ensure understanding of the element issues by all participants and promote a common understanding of the work required to achieve complete definition. It is important to ensure the most knowledgeable team members contribute (for example, storm water issues are deferred to the civil and environmental discipline leads), while respecting the concerns of the other team members. As the discussion unfolds, capture action items or "gaps." Examples of action item (gap) lists are shown in Table 5 and 6.

PDRI V5 – Low Definition Maturity Elements, Refinery Oil Separation, December X, 20xx						
Section	**Element**	**Element Description**	**Level**	**Comments**	**Assigned to:**	**Target date:**
I	A1.	Reliability Philosophy	3	Define reliability philosophy and prepare report for review	John Doe	January 15, 20xx
II	G9	Mechanical Equipment List	3	Most equipment purchased in phase 4; finalize list for review	Jane Doe	January 30, 20xx
II	G13	Instrument Index	3	Manufacturer identified in phase 4	Mike Doe	January 30, 20xx
And so on….						

Table 5. Example Gap List for CII PDRI Industrial V5 Maturity Elements

PDRI V5 – Low Definition Accuracy Factors, Refinery Oil Separation, December X, 202x						
Area	**Factor**	**Factor Description**	**Level**	**Comments**	**Assigned to:**	**Target date:**
3	3e	Adequate process for coordination between key disciplines	Needs Improvement	Conduct a cross-discipline coordination meeting	Sally Doe	January 15, 20xx
II	3h	Review and acceptance of FEED by appropriate parties	3	Set up review meeting	Jill Doe	January 30, 20xx
And so on….						

Table 6. Example Gap List for CII PDRI Industrial V5 Accuracy Factors

Once the team has chosen the appropriate definition level for the element, enter the chosen value that corresponds to the level of definition score in the "Level" column. Do this for each of the 70 elements making up PDRI-Industrial in the Project Score Sheet.

6.7 CII ASSESSMENT EXAMPLE

Consider, for example, that you are a member of a FEP team responsible for developing the scope definition package for a retrofit to an existing chemical plant. Your team has identified major milestones throughout FEP at which time you plan to use the PDRI to evaluate the current level of "completeness" of the scope definition package. Assume that at the time of this hypothetical evaluation the scope development effort is underway but not yet complete.

Your responsibility is to evaluate how well the project infrastructure requirements have been identified and defined to date. This information is covered in Category J of the PDRI as shown in Table 7 and consists of three elements: "J1. Water Treatment Requirements," "J2. Loading / Unloading / Storage Facilities Requirements," and "J3. Transportation Requirements." It is recommended one uses the unweighted assessment sheet when evaluating a project in a team setting.

CATEGORY Element	**Definition Level**						**Score**
	0	**1**	**2**	**3**	**4**	**5**	
J. INFRASTRUCTURE							
J1. Water Treatment Requirements							
J2. Loading / Unloading / Storage Facilities Requirements							
J3. Transportation Requirements							

Definition Levels
0 = Not Applicable | 2 = Minor Deficiencies | 4 = Major Deficiencies
1 = Complete Definition | 3 = Some Deficiencies | 5 = Incomplete or Poor Definition

Table 7. CII Assessment Example

To fill out Category J, Infrastructure, follow these steps:

Step 1: Read the description for each Category J element. Some elements contain a list of items to be considered when evaluating their levels of definition. These lists may be used as checklists.

Step 2: Collect all data that you may need to properly evaluate and select the definition level for each element in this category. This may require obtaining input from other individuals involved in the scope development effort.

Step 3: Select the definition level for each element as described below (and as shown in Table 8).

Element J1: Requirements for treating process and sanitary wastewater have been well defined. However, procedures for handling storm water runoff and treatment have not been identified. You feel that this element has some *minor deficiencies* that should be addressed prior to authorization of the project. **Definition Level = 2**.

Element J2: Your team decides that this element is *not applicable* to your particular project. **Definition Level = 0**.

Element J3: Although your team plans to specify methods for receiving and shipping materials within the facility, it has not yet been done. The team is particularly concerned about coordination of equipment and material movement with existing operation. It is *incomplete*. **Definition Level = 5**.

CATEGORY Element	**Definition Level**						**Score**
	0	**1**	**2**	**3**	**4**	**5**	
J. INFRASTRUCTURE							
J1. Water Treatment Requirements			X				
J2. Loading / Unloading / Storage Facilities Requirements	X						
J3. Transportation Requirements						X	

Definition Levels
0 = Not Applicable 2 = Minor Deficiencies 4 = Major Deficiencies
1 = Complete Definition 3 = Some Deficiencies 5 = Incomplete or Poor Definition

Table 8. CII Assessment Example

Be sure to capture action items/comments as the discussion progresses for reference in Step 6 (as shown in Table 9). This list is referred to as a "gap" list, in that it identifies those issues that need to be addressed to move the project forward and identifies a gap in the planning activities.

Gap List, Chemical Project, December X, 20xx						
Section	**Element**	**Element Description**	**Level**	**Comments**	**Assigned to:**	**Target date:**
II	J1.	Water Treatment Requirements	2	Procedures for handling storm water runoff and treatment need to be developed	Carlos Ortega	January 15, 20xx
II	J3	Transportation Requirements	5	Address transportation requirements	Joan Cart	January 30, 20xx
And so on….						

Table 9. CII Assessment Example

Step 4: For each element, enter the score that corresponds to its level of definition in the "Score" column (as shown in Table 10**)**. If the team feels that any or all of the elements were not applicable for this project, they would have had a definition level of "0" and been zeroed out. The weighted score sheet is given below with the elements circled for the chosen definition levels.

Step 5: Add the element scores to obtain a category score (as shown in Table 10**).** Repeat this process for each element in the PDRI. In this example, the category has a total score of 8. Add category scores to obtain section scores. Note that the available spreadsheet for this tool automatically performs these tasks.

CATEGORY Element	Definition Level 0	1	2	3	4	5	Score
J. INFRASTRUCTURE (Maximum Score = 25)							
J1. Water Treatment Requirements	0	1	(3)	5	7	10	**3**
J2. Loading / Unloading / Storage Facilities Requirements	(0)	1	3	5	7	10	**0**
J3. Transportation Requirements	0	1	2	3	4	(5)	**5**
CATEGORY J TOTAL							**8**

Definition Levels
0 = Not Applicable
1 = Complete Definition
2 = Minor Deficiencies
3 = Some Deficiencies
4 = Major Deficiencies
5 = Incomplete or Poor Definition

Table 10. CII Assessment Example with weighted scores

Step 6: Take Action. In this example, Category J has a total score of 8 (the least desirable rating would be the maximum of 25 total points and the best rating would be a total of 3 points) and probably needs more work particularly for element J3. Use the gap list to identify issues that need additional attention. If elements are considered N/A, normalization of the score will be necessary.[13]

Each of the element scores within a category should be added to produce a total score for that category. The scores for each of the categories within a section should then be added to arrive at a section score. Finally, the three section scores should be added to achieve a total PDRI score. CII PDRI tools[14] are designed to walk you through the process described above.

6.8 SCORING SYSTEM BASES

The PDRI, in its various forms, has been used on hundreds of projects representing billions of dollars in investment. Projects with PDRI scores under 200 (again, a lower score is better) outperformed projects with a PDRI score above 200 in terms of cost, schedule, and change orders using the large or complex project CII PDRI tools. These data are for PDRI scores just prior to the beginning of detailed design; at approximately 30 percent design complete with the comparisons of estimates made at that point versus final performance. Using the small project PDRI tools, projects with scores under 300 showed similar results. If the PDRI is used earlier in the FEP process (say CD-0), the scores will be higher as more uncertainty exists and requirements are less well defined.

At completion of the Preliminary Design Phase, the CII total target score should typically be around 200 points out of 1000 (300 if it is a small or less complex project and the “small project” tool is used). The PDRI target score is set at this maturity level to ensure that the planning and preliminary design effort will provide a more accurate PB which will include a rigorous assessment of project risks and associated cost and schedule contingency.

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[13] An additional resource for further information is the 2022 AACE® International Technical Paper, PM-3796, *An Adaptable and Comprehensive Project Assessment Tool.*
[14] CII PDRI Industrial Excel Tool V5.

For EM's CDAT tool as well as the older DOE specific tool for Nuclear and Non-Nuclear projects, 1000 is considered better, so the inverse of scoring is better.

6.9 DESIGN-BUILD (D-B) PROJECTS

It should be noted that the score sheets and the definitions do not adequately account for the differences encountered in a D-B acquisition strategy (AS). This is because in D-B acquisitions (as opposed to the more conventional Design/Bid/Build), the subcontractor is responsible for the creation of many of the important project documents after the bid has been awarded. The PDRI target score (200 or 300) assumes that most of these documents will be generated before the bidding process and, therefore, scores for D-B projects may indicate lower maturity than typical for moving into the design phase. The PDRI can be used effectively in conjunction with the D-B team to finalize the project scope before the project moves into detailed design and construction. These differences should be fully understood prior to the PDRI review. This is also true for components procured through a "performance specification." Note that FEP must be effectively performed no matter when the procurement occurs. The actual design should be completed after the FEP is mature.

6.10 NOT APPLICABLE ELEMENTS

Certain elements may not be completed (or even started) at early stages of a project. For these elements, the rating should be based on the current level of definition, which may be "5." Not applicable elements apply where the particular activity or requirement is truly not part of the scope of the project. An example may be element "D4. Dismantling and Demolition Requirements." If the project is a "green field" effort and no demolition is required, then this element is rated "0" or "N/A."

Prior to using a PDRI system for a specific project, all elements should be reviewed for applicability to the project. If a particular element is not applicable (N/A) for the specific project through all phases, it should be so noted; the tool's spreadsheet will normalize the score of the project taking this into consideration. Ratings cells should not be left blank. The team and facilitator should be able to rate every element, or when in doubt assign a rating with a gap needing additional information.

6.11 CII PDRI INDUSTRIAL V5

This section focuses on the CII PDRI Industrial V5 tool structure, associated elements and factors.[15] The maturity portion of this tool only applies to large industrial projects, but the accuracy portion can be applied to most any project as it focuses on the environment that leads to successful FEP. While all tools are useful, this one is the latest from CII and has some unique differences. This tool can execute a full maturity PDRI – for all 70 elements of a large industrial project as well as assessment of the second dimension, accuracy (degree of confidence in the maturity rating for that requirement). Another significant improvement is use of descriptive attributes to define the difference between 1, 2, 3, 4, and 5. In older versions and DOE produced

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[15] Additional CII PDRI Industrial V5 tool resources are located on PM-MAX.

versions, defining what is best and the differences between 2, 3, 4, or 5 are subjective and ambiguous, resulting in too much variability.

The CII PDRI Industrial V5 tool is an extension of the PDRI for Industrial Projects (PDRI-Industrial) and was created to help the stakeholders of large industrial projects assess the maturity of front-end engineering design (FEED) for all essential design elements. Maturity of front-end engineering design is defined as "the degree of completeness of the FEED deliverables to serve as a basis for detailed design at the end of detailed scope (phase 3)." Specifically, 46 elements reflecting the engineering deliverables associated with FEED were adapted from the PDRI-Industrial and used in the maturity assessment tool. The tool can be used to just look at the FEED elements if appropriate for the needs of the IPT.

The maturity tool is organized into three sections: I - The Basis of Project Decision; II - The Basis of Design; and III - The Execution Approach. Each section is then organized by category and by elements within those categories reflecting the typical engineering design deliverables of FEED; these elements are also given a score for each definition level. A total of 46 elements constitutes the FEED deliverables in the maturity tool. Each element can receive a definition level from 0 to 5. Table 11 depicts the typical layout of a maturity element showing how the maturity of each definition level is graded. It should be noted that each element also contains additional technical details unique to each.

Basic descriptions of the corresponding definition levels with potential impacts are outlined in the list below:

- A definition level of 0 indicates that the element is not required for the project and thus will not affect the overall maturity assessment.

- A definition level of 1 indicates that the element is completed, documented, and approved by key stakeholders for FEED design, minimizing uncertainty, and will not affect cost and schedule estimates when moving to detailed design.

- A definition level of 2 indicates that the element is mostly complete with minor issues, and should not adversely affect cost and schedule estimates when moving to detailed design.

- A definition level of 3 indicates that the element is somewhat addressed, with holds for deficiencies, and will more than likely affect cost and schedule estimates through further development.

- A definition level of 4 indicates that for this element, only initial thoughts have been applied to the design effort, and little or no meeting time or design/consulting hours have been expended. It is expected that elements with definition level 4 have high levels of uncertainty and will impact cost, schedule, and operational characteristics of the project.

- A definition level of 5 indicates that work on this element has not been started thus significantly affecting uncertainty around cost, schedule, and operational characteristics of the project.

SECTION	Definition Level					
	N/A	Best	Medium			Worst
CATEGORY	**0**	**1**	**2**	**3**	**4**	**5**
Element *Element description*	**Not required for project.**	All element descriptions are satisfied and approved by key stakeholders as a basis for detailed design.	Most element descriptions are documented and under review, but not yet approved. There may be minor deficiencies.	Some element descriptions have been defined with holds for deficiencies.	Some initial thoughts have been applied to this element; however, little to no meeting time or design hours have been expended and little has been documented.	**Not yet started.**
****Renovation and Revamp**** *R&R description*		Items related to R&R have been documented and approved by key stakeholders.	Most items related to R&R have been documented and are under review, but not yet approved.	Some items related to R&R have been identified and are being assessed.	Little or no meeting time or design hours have been expended on R&R items.	

Table 11. Structure of FEED Maturity Elements

The accuracy assessment tool is meant to help stakeholders assess 27 factors affecting the quality of FEP. Accuracy is defined as "the degree of confidence in the measured level of maturity of FEP deliverables to serve as a basis of decision at the end of detailed scope (Phase Gate 3 / CD-1). Accuracy involves the people, teams and resources that create the environment where a mature FEED can be developed."

The accuracy tool structure uses four factors: 1) the project leadership team; 2) the project execution team; 3) project management processes; and 4) project resources. Each factor type contains six to eight accuracy attributes related to the environment that supports the development of FEED. Table 12 illustrates how each of the accuracy factors is assessed. The assessor can choose one of five levels ranging from Not Acceptable to High Performing for each of the factors in terms of its description at the time of the assessment.

N/A	High Performing	Meets Most	Meets Some	Needs Improvement	Not Acceptable
Not required for project.	Rating a factor *High Performing* indicates the factor's criteria are fully met within the context of their respective category, e.g., project leadership, execution,	Rating a factor *Meets Most* indicates that the factor's criteria are consistently met and understood with minor deficiencies.	Rating a factor *Meets Some* indicates that the factor's criteria are partially met and without improvement, project success could be in jeopardy.	Rating a factor *Needs Improvement* indicates that the factor's criteria are not consistent in meeting project expectations and without improvement, the	Rating a factor *Not Acceptable* indicates that the factor's criteria are consistently below expectations and current performance is unacceptable. Project success

	management, or project resources.			project is at risk. Substantial action to meet expectations is required.	cannot be achieved in this current state and actions are required to improve.

Table 12. Structure of FEED Accuracy Factor Assessment

Figure 6 reflects the list of 27 accuracy factors ranked by their order of importance under each type. In the factors below, stakeholders may include contractor, operations, maintenance, key design leads, project manager, and customer/sponsor.

	1. PROJECT LEADERSHIP TEAM
1.a	Leadership team's previous **experience executing** a project of similar size, scope, and/or location, including FEED
1.b	**Stakeholders** are appropriately represented on the project leadership team
1.c	Project **leadership** is defined effective and accountable
1.d	**Leadership team and organizational** culture fosters trust, honesty, and shared values
1.e	Project leadership team's attitude toward **change**
1.f	Key personnel **turnover** (e.g., how long key personnel stay with the leadership team)
	2. PROJECT EXECUTION TEAM
2.a	**Technical capability and relevant training/certification** of the execution team
2.b	**Contractor/Engineer's team experience** with the location, with similar projects, and with the FEED process
2.c	**Stakeholders** are appropriately represented on the project execution team
2.d	Level of **involvement** of design leads or managers in the engineering process
2.e	Key personnel **turnover** including the **stability/commitment** of key personnel on the owner side through the FEED process
2.f	**Co-location** of execution team members to one another
2.g	Team culture or history of the execution team **working together**
	3. PROJECT MANAGEMENT PROCESS
3.a	**Communication** within the team is open and effective; a communication plan with stakeholders is identified
3.b	**Priority** between cost, schedule, and required project features is clear
3.c	Organization implements and follows **a front end planning** process (e.g., phase gates, clear requirements) and a **formal structure** or process to prepare FEED
3.d	Significant **input of construction knowledge**
3.e	Adequate process for **coordination** between key disciplines
3.f	**Alignment** of FEED process with **available project information**, including the existence of peer reviews and a standard procedure for updating FEED
3.g	**Documentation** of information used in preparing FEED
3.h	**Review and acceptance** of FEED by appropriate parties.
	4. PROJECT RESOURCES
4.a	**Commitment** of key personnel on the project execution team
4.b	**Calendar time** allowed for preparing FEED
4.c	**Quality** and level of detailed of engineering data available
4.d	**Amount of funding** allocated to perform FEED
4.e	**Local knowledge** (e.g., institutional memory, understanding of laws and regulations, understanding of site history.
4.f	**Availability of standards and procedures** (e.g., design standards, standard operating procedures, and guidelines)

Figure 6. FEED Accuracy TYPES and Factors

6.12 PDRI VERSION 5 TOOL SCORES[16]

The PDRI Industrial V5 tool provides a PDRI score for large industrial projects, but also presents data in terms of a maturity and accuracy matrix with an x and y axis. This tool provides a target quadrant for the front-end engineering design component of FEP.

As part of this latest PDRI development, the tool was tested on 33 completed industrial projects (worth a total of $8.83 billion), each of which represents a typical industrial project. These included several project types such as chemical plants, refineries, pharmaceutical manufacturing facilities, food manufacturing plants, power plants, pipelines and compression facilities.

A high maturity score (>80) represents a FEED that is well defined and, in general, corresponds to an increased probability for project success. Lower scores indicate that certain elements within the FEED lack adequate definition. Similarly, a high accuracy score (>76) represents a FEED where the accuracy factors related to the project leadership team, execution team, project management processes, and project resources are all aligned. Similarly, lower scores indicate that there are signs of misalignment and potential risk in the quality of FEED.

Table 13 shows the results of the team's comparison of project performance among the sample of projects. This data shows the mean performance for the projects versus the execution estimate for design and construction, and the absolute value of changes as a percentage of TPC at Phase Gate 3 / CD-1. Projects in the high maturity high accuracy (HMHA) quadrant outperformed projects in the other two quadrants by a significant margin in terms of cost and changes. The remaining quadrant, low maturity high accuracy (LMHA) had a few in progress projects and none that were complete during research and no differences could be observed. Note that schedule performance showed no significant differences between any of the established quadrants.

Performance	**Maturity Score and Accuracy Score**		
	HMHA M>80, A>76	**HMLA M>80, A<76**	**LMLA M<80, A<76**
Cost* (N=32)	2% below budget (N=11)	6% above budget (N=9)	22% above budget (N=12)
Change Orders* (N=31)	4% of budget (N=12)	9% of budget (N=8)	16% of budget (N=11)

Table 13. Project Performance Based on Maturity Score and Accuracy Scores

Legend: HMHA: High Maturity High Accuracy; HMLA: High Maturity Low Accuracy; LMLA: Low Maturity Low Accuracy
*NOTE: The sample included 32 and 31 completed cost and change order projects, respectively

[16] Adapted from CII Project Definition Rating Index -Industrial Projects, *A Front End Planning Maturity and Accuracy Total Rating System* Implementation Resource 113-2, current version, July 2019

PDRI Industrial V5 was also tested on 11 projects worth a total of $5.1 billion in expenditures during real-time planning exercises. In general, the feedback from these users was extremely positive. The tool performed very well in identifying critical risk issues during the FEP process, and it spurred important conversations about elements not yet considered by the project teams. PDRI Industrial V5 also indicated, for management, changes to be made to the project teams to improve accuracy. As one user stated: “The tool is simple and effective - it not only helped to assess the quality and adequacy of the technical documentation required, but also provided an opportunity to check the organization’s readiness before making a capital investment decision. Both our project execution team and project leadership were quick to see the value and decided to use it going forward in our projects.”

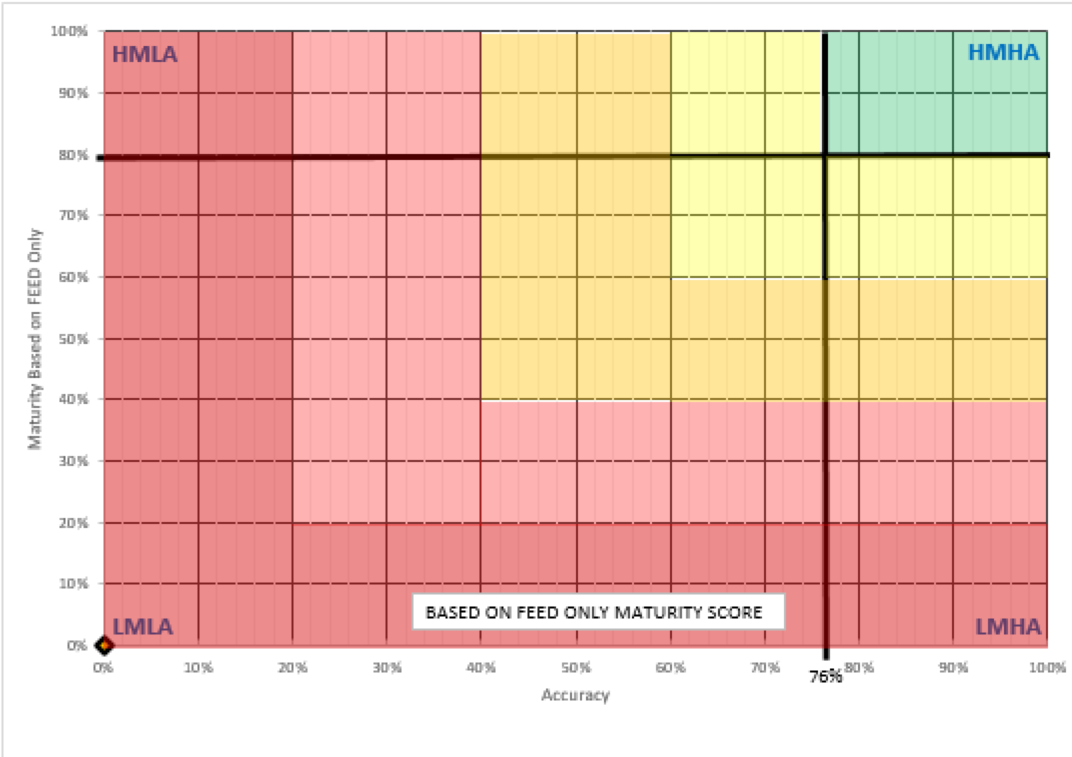
6.13 ANALYZING PDRI SCORES - WHAT TO LOOK FOR?

The PDRI is of little value unless the user acts based on the analysis and uses the score in managing the project. Among the potential uses when analyzing the PDRI score are the following:

- Track the project progress during FEP using the overall PDRI score as a macro-evaluation tool. Categories and individual elements can be tracked as well. It is recommended that the method of scoring the project over time (whether individual or team-based) should be consistent because of the subjective nature of the rating.
- Compare project-to-project scores over time to review trends in developing scope definition within your organization.
- Compare different types of projects (e.g., laboratory vs. manufacturing vs. office; or new vs. renovation, etc.) and determine an acceptable PDRI score for those projects and identify critical success factors from that analysis.
- Determine a comfort level (PDRI score) at which the team is willing to recommend authorization for the project to move towards preliminary / final design.

The gap list generated during the assessment is the most valuable output of the effort. This gap list can provide a path forward for the project team as it continues to define the project. Look at weak areas in the project at the category level or element level over time. By adding the category or elements’ PDRI scores, one can see how much risk they bring to the project relative to the total score. This provides an effective method of risk analysis since each element and category is weighted relative to each other in terms of potential risk exposure. Use the PDRI score to redirect effort by the project team.

PDRI Industrial V5 Scoring – 2 X 2 matrix (example below) where the user wants to be in the HMHA quadrant before establishing the PB.



Legend:
High Maturity = HM
High Accuracy = HA
Low Maturity = LM
Low Accuracy = LA

Your Rating = ◆

The upper graph is a plot of the 70 maturity elements from a full PDRI for Industrial Project and the 27 accuracy factors. The lower graph is a plot of the 46 maturity FEED elements for an Industrial Project and the 27 accuracy factors.

When reporting Full PDRI Scores the target is to be 200 points or less at Baseline Definition/Project Authorization (i.e. FEP 3)

The PDRI MATRS targets are to achieve an accuracy greater than 76% and maturity greater than 80%. Research by the Construction Industry Institute identify that organizations which reach these levels in Front End Planning, set the project up to succeed in terms of meeting scope, cost and schedule at completion.

Figure 7. PDRI Industrial V5 Scoring

The individual element scores can be used to highlight the "critical few" for team focus – either through segregating by element score or definition level. *Each project may have unique requirements that should be met, therefore examine the level of definition in detail because the score may not be reflective of the projects complexity or makeup.*

Program requirements or other pressures to reduce project cycle times may force a team to begin design and construction of projects with underdeveloped definition. In these instances, the amount of time available for defining the scope of the project decreases. Thus, the ability to predict factors that may impact project risk becomes critical. To minimize the possibility of problems during detailed design, construction, and commissioning phases of a project, the FEP effort should focus on the critical few elements that, if poorly defined, can have the greatest potential to negatively impact project performance.

6.14 POTENTIAL PDRI SCORE APPLICATIONS

The Project Management Office (PMO) may want to keep their own database of PDRI scores for various project sizes and types. As more projects are completed and scored using the PDRI, your ability to accurately predict the probability of success for future projects should improve. The PDRI (to include the gap list) may serve as a gauge for the PMO or PME in deciding whether or not to move forward with preliminary/final design and construction of a project. You may also wish to use it as an external benchmark for measurement against the practices of other industry leaders.

Once a PDRI score is obtained, it is important to correlate the score to a measurement of project success. The measurements of project success used by all CII development efforts suggested critical performance factors in the execution and operation of a capital facility. In general, lower PDRI scores represent scope definition packages that are well defined and correspond to higher project success. Higher PDRI scores, on the other hand, may signify that certain element in the scope definition package lack adequate definition and, if the project moves forward with development of construction documents, can result in poorer project performance and lower success. If DOE Developed PDRI is used, higher scores are considered better.

The program element may want to track the project estimates minus contingency when plotting them versus the PDRI scores. The original estimates are then compared to the final outcome of the project to evaluate its success versus these goals. The program may plot these estimates to develop a curve for reviewing the adequacy of the contingency allowance on future similar projects.

6.15 LESSONS LEARNED USING THE PDRI

Specific lessons learned using the PDRI process includes:

- The PDRI should be used a minimum of two times during project planning.
- In addition to guiding the discussion to consensus, a facilitator serves as a neutral party to help maintain consistency when scoring projects.
- Using the tool is an excellent way to align a project team.
- Because of project pressures, it may be difficult to get the right project participants together to score a project, but the results are worthwhile.
- The tool provides an excellent mechanism to identify specific problems and assign actions.
- The team or individual scoring the project should focus on the scoring process, rather than the final score, to honestly identify deficiencies.
- Use the PDRI initially on pre-selected pilot projects to gain proficiency with using the tool.

- Train individuals in the PDRI model, background, and process to improve consistency.
- The PDRI is effective even when used very early in the planning process. Individual planners can use the tool at this point to identify potential problems and to organize their work effort.

Care should be taken when determining level of definition of the elements such as maintenance philosophy or operating philosophy to maintain (within field element/site) consistency of scoring due to existence of internal standards in many organizations. It is hard to compare the level of definition of one project to another if there is no consistency.

6.16 OTHER COMMERCIALLY AVAILABLE TOOLS FOR FEP

The unique nature of the planning and execution of construction during shutdowns, turnarounds, outages (STO), or any temporary stoppage of a facility's operation requires an integrated approach. These compressed and intense construction periods necessitate a higher level of planning and coordination. STO is a unique circumstance in which multiple projects converge at one point in time at an existing facility, resulting in a "time-constrained," integrated, and often rapid-schedule execution of one or more projects. Time, money, safety, and quality all require detailed, focused attention that includes consideration of scheduled plant maintenance and discovery of unplanned work scope.

To help the industry better handle STO situations, CII developed the shutdown turnaround alignment review (STAR) tool to support the planning of these intense periodic efforts. An analysis tool similar to the PDRI, the STAR tool uses a compilation of industry knowledge on outage execution to prompt project teams to consider all elements of STO. It then rates the team's use of this best practice, providing an index to measure planning performance and readiness for the event. The STAR tool promotes a collaborative working environment and can be utilized for refinery shutdowns, power plant outages, or even for building space revamps.

Alignment among key stakeholders is a critical factor in the planning and execution of a successful project. It is present when appropriate project participants are working within acceptable tolerances to develop and meet a uniformly defined and understood set of project objectives. These project objectives must meet business requirements and follow the overall corporate strategy, and they must be formed in the early stages of project development. The research identified four key areas that must be addressed to achieve alignment: culture, execution processes, information, and tools. These four areas include the following ten critical alignment issues:

- appropriate representation of stakeholders
- effective leadership
- clear project priorities
- effective communication

- productive team meetings
- team culture and shared values
- adequate funding and resources
- reward and recognition systems
- teamwork and team building programs
- effective use of planning tools.

The Alignment Thermometer is designed to check the team's alignment "temperature" at periodic intervals. It consists of questions assessing the level of alignment within the team. Alignment must be maintained through each phase of the planning process, as well as in design and construction. This is particularly important as the project transitions from one phase to another, or as key stakeholders change.

The Alignment Thermometer tool includes a spreadsheet that automatically converts individual scores into a combined alignment score. This whole-team approach gives project management the information necessary to start taking corrective action to bring the team members back into alignment. Available tools are located on PM-MAX.

7 ACRONYMS AND ABBREVIATIONS

AACE International	Association for the Advancement of Cost Engineering International
AoA	analysis of alternatives
AS	acquisition strategy
BOD	basis of design
CD	critical decision
CDAT	critical decision assessment tool
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CII	Construction Industry Institute
D-B	design-build
DOE	U.S. Department Of Energy
EIR	external independent review
EM	Office Of Environmental Management
FEED	front-end engineering design
FEED MATRS	front-end engineering design maturity and accuracy total rating system
FEP	front-end planning
FPD	federal project director
HMHA	high maturity high accuracy
ICE	independent cost estimate
ICR	independent cost review
IPR	independent project review
IPT	integrated project team
IT	information technology
LMHA	low maturity high accuracy
MNS	mission need statement
N/A	not applicable
NAPA	National Environmental Policy Act
NASA	National Aeronautics and Space Administration
NNSA	national nuclear security administration

PB	performance baseline
PDRI	project definition rating index
PEP	project execution plan
PM	Office Of Project Management
PME	project management executive
PM-MAX	Project Management-MAX
PMO	Project Management Office
QA	quality assurance
QAP	quality assurance plan
RCRA	Resource Conservation and Recovery Act
SDD	system design description
STAR	shutdown turnaround alignment review
STO	shutdowns, turnarounds, outages
TPC	total project cost
WBS	work breakdown structure

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APPENDIX A - PROJECT DEFINITION RATING INDEX – MATURITY TOTAL RATING SYSTEM FOR INDUSTRIAL PROJECTS EXAMPLE

The CII PDRI MATRS for Industrial Projects is a tool that measures the degree of maturity and accuracy of scope development during front end planning. Accuracy consists of the environmental factors that the maturity side of scope definition operates in as shown in Appendix B. This maturity component of the tool uses a scale where a lower score is better for PDRI rating in the same manner as prior industrial PDRI tools but adds a two axis Maturity and Accuracy rating based on the front-end engineering elements of the PRDI maturity and the accuracy ratings plotted on a two-by-two matrix using a scale of 0 to 100 percent. In this case, high is better for both the X and Y axis. Everywhere a score is applied, it is important to note the objective evidence reviewed/planned as the basis for the score.

CATEGORY Element (**Blue Font with * = FEED Element**)	Maturity Definition Level / Weights								
PDRI Maturity **(Use Hyperlinks below to start facilitation mode)**	**0**	**1**	**2**	**3**	**4**	**5**		***Make your selection in this Column using the Drop Down List or Type 0-5***	**Comments**
Section I - BASIS OF PROJECT DECISION									
A. MANUFACTURING OBJECTIVES CRITERIA									
A1. Reliability Philosophy*								1	
A2. Maintenance Philosophy*								1	
A3. Operating Philosophy*								2	
B. BUSINESS OBJECTIVES									
B1. Products*								1	
B2. Market Strategy	0							0	
B3. Product Strategy								2	
B4. Affordability/Feasibility								2	
B5. Capacities*								1	
B6. Future Expansion Considerations*								3	Future Expansion has not been fully defined by Senior Leaders. Site design to support 40 units

CATEGORY Element (**Blue Font with * = FEED Element**)	Maturity Definition Level / Weights								
PDRI Maturity **(Use Hyperlinks below to start facilitation mode)**	**0**	**1**	**2**	**3**	**4**	**5**		***Make your selection in this Column using the Drop Down List or Type 0-5***	**Comments**
									per year with potential to move to 60. This is not confirmed as true long-term goal
B7. Expected Project Life Cycle*								1	
B8. Social Issues								3	Social Media and Organized Groups oppose effort. Work to define benefit is lagging.
C. BASIC DATA RESEARCH & DEVELOPMENT									
C1. Technology*								4	At TRL 2 but needs to reach TRL 4 for CD-1
C2. Processes*								3	Experimental process still needs full documentation and pilot at TRL 7 before CD-2
D. PROJECT SCOPE									
D1. Project Objectives Statement								1	
D2. Project Design Criteria*								1	
D3. Site Characteristics Available vs. Required*								3	Additional GPR survey required on Brownfield Site
D4. Dismantling and Demolition Requirements*	0							0	
D5. Lead/Discipline Scope of Work								2	Construction is tied in early with Engineering. Need all others to join in - Ops, Maint, Site
D6. Project Schedule								3	Immature Schedule is being refined now as the project gets ready to move into Preliminary Design
E. VALUE ENGINEERING									
E1. Process Simplification								2	
E2. Design & Material Alternatives Considered/Rejected								2	

CATEGORY Element (**Blue Font with * = FEED Element**)	Maturity Definition Level / Weights								
PDRI Maturity **(Use Hyperlinks below to start facilitation mode)**	**0**	**1**	**2**	**3**	**4**	**5**		***Make your selection in this Column using the Drop Down List or Type 0-5***	**Comments**
E3. Design for Constructability Analysis								3	Just starting reviews now.
SECTION II – BASIS OF DESIGN									
F. SITE INFORMATION									
F1. Site Location								1	
F2. Survey & Soil Tests*								3	Additional GPR survey required on Brownfield Site
F3. Environmental Assessment*								1	
F4. Permit requirements*								1	
F5. Utility Sources with Supply Conditions*								2	
F6. Fire Protection & Safety Considerations*								3	Will be finished in Preliminary Design. Mature for Conceptual Design.
G. PROCESS / MECHANICAL									
G1. Process Flow Sheets*								2	
G2. Heat & Material Balances*								2	
G3. Piping & Instrumentation Drawings*								2	
G4. Process Safety Management*								1	
G5. Utility Flow Diagrams*								2	
G6. Specifications*								2	
G7. Piping System Requirements*								2	
G8. Plot Plans*								2	
G9. Mechanical Equipment List*								2	

CATEGORY Element (**Blue Font with * = FEED Element**)	Maturity Definition Level / Weights								
PDRI Maturity **(Use Hyperlinks below to start facilitation mode)**	**0**	**1**	**2**	**3**	**4**	**5**		***Make your selection in this Column using the Drop Down List or Type 0-5***	**Comments**
G10. Line List*								2	
G11. Tie-in List*								2	
G12. Piping Specialty Items List*								1	
G13. Instrument Index*								2	
H. EQUIPMENT SCOPE									
H1. Equipment Status*								3	Still working on new technical design for specific… press.
H2. Equipment Location Drawings*								3	Need to finalize when preliminary design is complete.
H3. Equipment Utility Requirements*								2	
I. CIVIL / STRUCTURAL / ARCHITECTURAL									
I1. Civil / Structural requirements*								2	
I2. Architectural requirements*								2	
J. INFRASTRUCTURE									
J1. Water Treatment Requirements*								1	
J2. Loading, Unloading, Storage*								1	
J3. Transportation Requirements*								1	
K. INSTRUMENT & ELECTRICAL									
K1. Control Philosophy*								2	
K2. Logic Diagrams*								2	

CATEGORY Element (**Blue Font with * = FEED Element**)	Maturity Definition Level / Weights								
PDRI Maturity **(Use Hyperlinks below to start facilitation mode)**	**0**	**1**	**2**	**3**	**4**	**5**		***Make your selection in this Column using the Drop Down List or Type 0-5***	**Comments**
K3. Electrical Area Classification*								2	
K4. Substation Requirements / Power Sources Identified*								2	
K5. Electrical Single Line Diagram*								2	
K6. Instrument & Electrical Specifications*								3	Not yet defined
SECTION III – EXECUTION APPROACH									
L. PROCUREMENT STRATEGY									
L1. Identify Long Lead/Critical Equipment and Materials								3	Gloveboxes will need to LL items
L2. Procurement Procedures and Plans								2	
L3. Procurement Responsibility Matrix								1	
M. DELIVERABLES									
M1. CADD/Model Requirements								1	
M2. Deliverables Defined								1	
M3. Distribution Matrix								2	
N. PROJECT CONTROLS									
N1. Project Control Requirements								2	
N2. Project Accounting Requirements								2	
N3. Risk Analysis								3	Need to move from Qual to Quant…

CATEGORY Element (**Blue Font with * = FEED Element**)	Maturity Definition Level / Weights								
PDRI Maturity **(Use Hyperlinks below to start facilitation mode)**	**0**	**1**	**2**	**3**	**4**	**5**		***Make your selection in this Column using the Drop Down List or Type 0-5***	**Comments**
P. PROJECT EXECUTION PLAN									
P1. Owner Approval Requirements								1	
P2. Engineering/Construction Plan Approach								1	
P3. Shut Down/Turn-Around Requirements								1	
P4. Pre-Commissioning Turnover Sequence Requirements*								3	Still working to develop
P5. Startup Requirements*								1	
P6. Training Requirements								2	

APPENDIX B - PROJECT DEFINITION RATING INDEX – ACCURACY TOTAL RATING SYSTEM FOR INDUSTRIAL PROJECTS EXAMPLE

Type Factor	Accuracy Definition Level / Weights						Review Accuracy Level	Don't Show Scores	Show Scores
PDRI Accuracy	High Performing (1)	Meets Most (2)	Meets Some (3)	Needs Improvement (4)	Not Acceptable (5)		*Make Your Selection in the Next Column Using the Drop Down List (1-5) 1 = High Performing 5 = Not Acceptable*		**Comments**
1. Project Leadership Team									Total Type 1 -->
1 a. Leadership team's previous **experience planning, designing and executing** a project of similar size, scope, and/or location, including FEP							**Meets Some**	**3**	**New team formed after Contractor Change. Needs to continue to grow**
1 b. ***Stakeholders*** are appropriately represented on the project leadership team							**High Performing**	**1**	
1 c. Project **leadership** is defined, effective, and accountable							**High Performing**	**1**	
1 d. **Leadership team and organizational culture** fosters trust, honesty, and shared values							**Meets Most**	**2**	
1 e. Project leadership team's attitude is **able to adequately manage change**							**Meets Most**	**2**	
1 f. **Key personnel turnover,** e.g., how long key personnel stay with the leadership team							**Meets Some**	**3**	**New team is starting to come together over past three months and can mature to level of readiness**
2. Project Execution Team									
2 a. **Technical capability and relevant training/certification** of the execution team							**Meets Most**	**2**	

Type Factor	Accuracy Definition Level / Weights						Review Accuracy Level	Don't Show Scores	Show Scores
PDRI Accuracy	High Performing (1)	Meets Most (2)	Meets Some (3)	Needs Improvement (4)	Not Acceptable (5)		*Make Your Selection in the Next Column Using the Drop Down List (1-5) 1 = High Performing 5 = Not Acceptable*		**Comments**
2 b. **Contractor/Engineer's team experience** with the location, with similar projects, and with the FEP process							**High Performing**	**1**	
2 c. **Stakeholders** are appropriately represented on the project team (e.g., contractor, operations and maintenance, key design leads, project manager, sponsor) and have a clear understanding of the project scope							**Meets Most**	**2**	
2 d. Level of **involvement** of design leads or managers in the engineering process							**High Performing**	**1**	
2 e. Key personnel **turnover** including the **stability/commitment** of key personnel on the owner side through the FEP process							**Meets Most**	**2**	
2 f. **Co-location** of execution team members							**Meets Most**	**2**	
2 g. **Team culture** or history of the execution team **working together**							**Meets Some**	**3**	**While long-time members of site, new leadership can impact this project.**
3. Project Management Processes									
3 a. **Communication** within the team is open and effective; a communication plan with stakeholders is identified							**High Performing**	**1**	

Type Factor	Accuracy Definition Level / Weights						Review Accuracy Level	Don't Show Scores	Show Scores
PDRI Accuracy	High Performing (1)	Meets Most (2)	Meets Some (3)	Needs Improvement (4)	Not Acceptable (5)		*Make Your Selection in the Next Column Using the Drop Down List (1-5) 1 = High Performing 5 = Not Acceptable*		**Comments**
3 b. Organization implements and follows a **front end planning** process (e.g., phase gates, clear requirements), has a **formal structure** or process to prepare PDRI/FEP, and implements **planning tools** (e.g., checklists, simulations, and work flow diagrams) that are used effectively.							High Performing	1	
3 c. **Priority** between cost, schedule, and required project features is clear							Meets Most	2	
3 d. Significant **input of construction knowledge** into the FEP process							Meets Most	2	
3 e. Adequate process for **coordination** between key disciplines							Meets Most	2	
3 f. **Alignment** of FEP process with **available project information**, including the existence of peer reviews and a standard procedure for updating FEP							Meets Most	2	
3 g. **Documentation** of information used in preparing FEP							Meets Most	2	
3 h. **Review and acceptance** of FEP by appropriate parties							Meets Most	2	
4. Project Resources									
4 a. **Commitment** of key personnel on the project team							Meets Some	3	

Type Factor	Accuracy Definition Level / Weights						Review Accuracy Level	Don't Show Scores	Show Scores
PDRI Accuracy	**High Performing (1)**	**Meets Most (2)**	**Meets Some (3)**	**Needs Improvement (4)**	**Not Acceptable (5)**		***Make Your Selection in the Next Column Using the Drop Down List (1-5) 1 = High Performing 5 = Not Acceptable***		**Comments**
4 b. **Calendar time** allowed for preparing FEP and **Management tools** available including technology/software							**Meets Most**	**2**	
4 c. **Local knowledge** (e.g., institutional memory, understanding of laws and regulations, understanding of site history) and **access** to visit and **evaluate** the site							**High Performing**	**1**	
4 d. **Quality** and level of detailed engineering data available							**Meets Most**	**2**	
4 e. **Amount of funding** allocated to perform FEP							**Meets Most**	**2**	
4 f. **Availability of standards and procedures** (e.g., design standards, standard operating procedures, and guidelines)							**High Performing**	**1**	

APPENDIX C - COMPARISON OF DOE TO CII SCORING EXAMPLE

In terms of DOE developed vs CII developed PDRI, the CII version was started in early 1990s and DOE's PDRI tools were based on the CII effort in early 2000s. The DOE tools include items checked in independent cost review's (ICRs), independent cost estimate's (ICEs), or EIRs and works to score them for maturity. The CII products and the PDRI tools from EM are updated while the older DOE tools were last updated in 2009. The CII tools cover the areas to help determine if scope is well defined, the primary purpose of PDRI. As the CII tools are current and now support a 2nd dimension of Accuracy (Environment) these are recommended.

The following figures provide a cross walk from DOE Tools to CII Tools as well as from CII to DOE. (Note: N/A signifies the element is not scored within the tools)

Figure 8 is DOE to CII and Figure 9 is CII to DOE.

Figure 8. DOE to CII Maturity Elements

DOE Developed PDRI Maturity Elements		CII Industrial Maturity Elements	
A1	Cost Estimate	N/A	Part of ICR / ICE / EIR rather than PDRI
A2	Cost Risk/Contingency Analysis	N/A	Part of ICR / ICE / EIR rather than PDRI
A3	Funding Requirements/Profile	N/A	Part of ICR / ICE / EIR rather than PDRI
A4	Independent Cost/Schedule Review	N/A	Part of ICR / ICE / EIR rather than PDRI
A5	Life Cycle Cost	N/A	Part of ICR / ICE / EIR rather than PDRI
A6	Forecast Cost at Completion	N/A	Part of ICR / ICE / EIR rather than PDRI
A7	Cost Estimate for Next Phase Work Scope	N/A	Part of ICR / ICE / EIR rather than PDRI
B1	Project Schedule	D6	Project Schedule
B2	Major Milestones	D6	Project Schedule
B3	Resource Loading	D6	Project Schedule
B4	Critical Path Management	D6	Project Schedule
B5	Schedule Risk/Contingency Analysis	D6	Project Schedule
B6	Forecast of Schedule at Completion	D6	Project Schedule
B7	Schedule for Next Phase Work Scope	D6	Project Schedule
C1	Systems Engineering/System Design Descriptions	A1	Reliability Philosophy
C1	Systems Engineering/System Design Descriptions	A2	Maintenance Philosophy
C1	Systems Engineering/System Design Descriptions	A3	Operating Philosophy
C2	Alternative Analysis	D3	Site Characteristics Available vs Required
C2	Alternative Analysis	E2	Design & Material Alternatives Considered/Rejected
C3	Functional and Operational Requirements	B1	Products
C3	Functional and Operational Requirements	B2	Market Strategy
C3	Functional and Operational Requirements	B3	Product Strategy
C3	Functional and Operational Requirements	B5	Capacities

DOE Developed PDRI Maturity Elements		CII Industrial Maturity Elements	
C3	Functional and Operational Requirements	B6	Future Expansion Considerations
C3	Functional and Operational Requirements	B7	Expected Project Life Cycle
C3	Functional and Operational Requirements	D1	Project Objectives Statement
C3	Functional and Operational Requirements	H1	Equipment Status
C4	Design Basis (How)	D2	Project Design Criteria
C5	Design Criteria/Design Margins (How to)	D2	Project Design Criteria
C6	Technology Needs Identified	C1	Technology
C7	Technology Needs Demonstrated	C1	Technology
C7	Technology Needs Demonstrated	C2	Processes
C8	Trade-Off Optimization Studies	E2	Design & Material Alternatives Considered/Rejected
C9	Site Location	B8	Social Issues
C9	Site Location	F1	Site Location
C9	Site Location	F5	Utility Sources with Supply Conditions
C10	Plot Plan	G8	Plot Plans
C11	Process Flow Diagrams (PFDs)	G1	Process Flow Sheets
C11	Process Flow Diagrams (PFDs)	H3	Equipment Utility Requirements
C12	Natural Phenomena	F3	Environmental Assessment
C13	Layout Drawings and Equipment List	G9	Mechanical Equipment List
C13	Layout Drawings and Equipment List	G10	Line List
C13	Layout Drawings and Equipment List	G11	Tie-in List
C13	Layout Drawings and Equipment List	G12	Piping Specialty Items List
C13	Layout Drawings and Equipment List	G13	Instrument Index
C13	Layout Drawings and Equipment List	H2	Equipment Location Drawings
C14	Piping & Instrumentation Diagrams (P&ID)	G3	Piping & Instrumentation Drawings
C14	Piping & Instrumentation Diagrams (P&ID)	G5	Utility Flow Diagrams
C15	Mechanical (Piping)	G6	Specifications
C15	Mechanical (Piping)	G7	Piping System Requirements
C16	Instrument & Electrical	K1	Control Philosophy
C16	Instrument & Electrical	K2	Logic Diagrams
C16	Instrument & Electrical	K3	Electrical Area Classification
C16	Instrument & Electrical	K4	Substation Requirements / Power Sources Identified
C16	Instrument & Electrical	K5	Electrical Single Line Diagram
C16	Instrument & Electrical	K6	Instrument & Electrical Specifications
C17	Site Characterization (Including Surveys & Soil Tests)	D4	Dismantling and Demolition Requirements
C17	Site Characterization (Including Surveys & Soil Tests)	F2	Survey & Soil Tests
C18	Waste Characterization and Disposition	D4	Dismantling and Demolition Requirements

DOE Developed PDRI Maturity Elements		CII Industrial Maturity Elements	
C19	Pollution Prevention & Waste Minimization	D4	Dismantling and Demolition Requirements
C20	Waste Storage, Packaging and Transportation	D4	Dismantling and Demolition Requirements
C20	Waste Storage, Packaging and Transportation	J3	Transportation Requirements
C21	NEPA Documentation	F3	Environmental Assessment
C22	Long Lead/Critical Equipment & Material List	L1	Identify Long Lead/Critical Equipment and Materials
C23	Design Completion	P2	Engineering/Construction Plan Approach
C24	Design Reviews	P1	Owner Approval Requirements
C25	Interface Planning and Control	D5	Lead/Discipline Scope of Work
C25	Interface Planning and Control	N1	Project Control Requirements
C26	Operating, Maintenance & Reliability (OMR) Concepts	P2	Engineering/Construction Plan Approach
C27	Safeguards and Security	F6	Fire Protection & Safety Considerations
C27	Safeguards and Security	I1	Civil / Structural requirements
C27	Safeguards and Security	I2	Architectural requirements
C28	Heat and Material Balances	G2	Heat & Material Balances
C29	Reliability, Availability, Maintainability & Inspectability (RAMI) Analysis	P2	Engineering/Construction Plan Approach
C29	Reliability, Availability, Maintainability & Inspectability (RAMI) Analysis	P3	Shut Down/Turn-Around Requirements
C30	Materials Loading/Unloading/Staging	J2	Loading, Unloading, Storage
C31	Constructability and Construction Planning	E3	Design for Constructability Analysis
C32	Sustainable Design	I2	Architectural requirements
C33	Transition and Startup Planning	P4	Pre-Commissioning Turnover Sequence Requirements
C33	Transition and Startup Planning	P5	Startup Requirements
C34	Operations Plans and Procedures	P5	Startup Requirements
C34	Operations Plans and Procedures	P6	Training Requirements
D1	Mission Need Statement	B1	Products
D2	Acquisition Strategy Plan	P2	Engineering/Construction Plan Approach
D3	Key Project Assumptions	N/A	Part of ICR / ICE / EIR rather than PDRI
D4	Project Execution Plan (PEP)	P2	Engineering/Construction Plan Approach
D5	Integrated Project Team/Project Organization	P2	Engineering/Construction Plan Approach
D6	Conceptual Design Report (CDR)	P1	Owner Approval Requirements
D7	Baseline Change Control	N1	Project Control Requirements
D8	Project Control	N1	Project Control Requirements
D9	Project Work Breakdown Structure (WBS)	P2	Engineering/Construction Plan Approach
D10	Resources Required (People/Material) for Next Phase	N/A	Part of ICR / ICE / EIR rather than PDRI
D11	Configuration Management	N1	Project Control Requirements
D12	Project Risk Management Plan/Assessment	E1	Process Simplification

DOE Developed PDRI Maturity Elements		CII Industrial Maturity Elements	
D13	Quality Assurance Program	N/A	Part of ICR / ICE / EIR rather than PDRI
D14	Value Engineering	B4	Affordability/Feasibility
D15	Procurement Packages	L2	Procurement Procedures and Plans
D15	Procurement Packages	L3	Procurement Responsibility Matrix
D16	Project Acquisition Process	P2	Engineering/Construction Plan Approach
D17	Integrated Regulatory Oversight Program	P2	Engineering/Construction Plan Approach
D18	Inter-Site and On-Site Coordination	M3	Distribution Matrix
D19	Stakeholder Program	M3	Distribution Matrix
D20	Funds Management	N2	Project Accounting Requirements
D21	Reviews/Assessments	P1	Owner Approval Requirements
E1	Hazard Analysis/Safety Documentation	G4	Process Safety Management
E2	Integrated Safeguards and Security Planning	F6	Fire Protection & Safety Considerations
E3	ES&H Management Planning (Including ISM)	P2	Engineering/Construction Plan Approach
E4	Emergency Preparedness	P2	Engineering/Construction Plan Approach
N/A	Not well mapped in DOE PDRI	F4	Permit requirements
N/A	Not well mapped in DOE PDRI	J1	Water Treatment Requirements
N/A	Not well mapped in DOE PDRI	J3	Transportation Requirements
N/A	Not well mapped in DOE PDRI	M1	CADD/Model Requirements
N/A	Not well mapped in DOE PDRI	M2	Deliverables Defined
N/A	Not well mapped in DOE PDRI	N3	Risk Analysis

Figure 9. CII to DOE Maturity Elements

CII Industrial Maturity Elements		DOE Developed PDRI Maturity Elements	
A1	Reliability Philosophy	C1	Systems Engineering/System Design Descriptions
A2	Maintenance Philosophy	C1	Systems Engineering/System Design Descriptions
A3	Operating Philosophy	C1	Systems Engineering/System Design Descriptions
B1	Products	C3	Functional and Operational Requirements
B1	Products	D1	Mission Need Statement
B2	Market Strategy	C3	Functional and Operational Requirements
B3	Product Strategy	C3	Functional and Operational Requirements
B4	Affordability/Feasibility	D14	Value Engineering
B5	Capacities	C3	Functional and Operational Requirements
B6	Future Expansion Considerations	C3	Functional and Operational Requirements
B7	Expected Project Life Cycle	C3	Functional and Operational Requirements
B8	Social Issues	C9	Site Location

CII Industrial Maturity Elements		DOE Developed PDRI Maturity Elements	
C1	Technology	C6	Technology Needs Identified
C1	Technology	C7	Technology Needs Demonstrated
C2	Processes	C7	Technology Needs Demonstrated
D1	Project Objectives Statement	C3	Functional and Operational Requirements
D2	Project Design Criteria	C4	Design Basis (How)
D2	Project Design Criteria	C5	Design Criteria/Design Margins (How to)
D3	Site Characteristics Available vs Required	C2	Alternative Analysis
D4	Dismantling and Demolition Requirements	C17	Site Characterization (Including Surveys & Soil Tests)
D4	Dismantling and Demolition Requirements	C18	Waste Characterization and Disposition
D4	Dismantling and Demolition Requirements	C19	Pollution Prevention & Waste Minimization
D4	Dismantling and Demolition Requirements	C20	Waste Storage, Packaging and Transportation
D5	Lead/Discipline Scope of Work	C25	Interface Planning and Control
D6	Project Schedule	B1	Project Schedule
D6	Project Schedule	B2	Major Milestones
D6	Project Schedule	B3	Resource Loading
D6	Project Schedule	B4	Critical Path Management
D6	Project Schedule	B5	Schedule Risk/Contingency Analysis
D6	Project Schedule	B6	Forecast of Schedule at Completion
D6	Project Schedule	B7	Schedule for Next Phase Work Scope
E1	Process Simplification	D12	Project Risk Management Plan/Assessment
E2	Design & Material Alternatives Considered/Rejected	C2	Alternative Analysis
E2	Design & Material Alternatives Considered/Rejected	C8	Trade-Off Optimization Studies
E3	Design for Constructability Analysis	C31	Constructability and Construction Planning
F1	Site Location	C9	Site Location
F2	Survey & Soil Tests	C17	Site Characterization (Including Surveys & Soil Tests)
F3	Environmental Assessment	C12	Natural Phenomena
F3	Environmental Assessment	C21	NEPA Documentation
F4	Permit requirements	N/A	Not well mapped in DOE PDRI
F5	Utility Sources with Supply Conditions	C9	Site Location
F6	Fire Protection & Safety Considerations	C27	Safeguards and Security
F6	Fire Protection & Safety Considerations	E2	Integrated Safeguards and Security Planning
G1	Process Flow Sheets	C11	Process Flow Diagrams (PFDs)
G10	Line List	C13	Layout Drawings and Equipment List
G11	Tie-in List	C13	Layout Drawings and Equipment List
G12	Piping Specialty Items List	C13	Layout Drawings and Equipment List
G13	Instrument Index	C13	Layout Drawings and Equipment List

CII Industrial Maturity Elements		DOE Developed PDRI Maturity Elements	
G2	Heat & Material Balances	C28	Heat and Material Balances
G3	Piping & Instrumentation Drawings	C14	Piping & Instrumentation Diagrams (P&ID)
G4	Process Safety Management	E1	Hazard Analysis/Safety Documentation
G5	Utility Flow Diagrams	C14	Piping & Instrumentation Diagrams (P&ID)
G6	Specifications	C15	Mechanical (Piping)
G7	Piping System Requirements	C15	Mechanical (Piping)
G8	Plot Plans	C10	Plot Plan
G9	Mechanical Equipment List	C13	Layout Drawings and Equipment List
H1	Equipment Status	C3	Functional and Operational Requirements
H2	Equipment Location Drawings	C13	Layout Drawings and Equipment List
H3	Equipment Utility Requirements	C11	Process Flow Diagrams (PFDs)
I1	Civil / Structural requirements	C27	Safeguards and Security
I2	Architectural requirements	C27	Safeguards and Security
I2	Architectural requirements	C32	Sustainable Design
J1	Water Treatment Requirements	N/A	Not well mapped in DOE PDRI
J2	Loading, Unloading, Storage	C30	Materials Loading/Unloading/Staging
J3	Transportation Requirements	C20	Waste Storage, Packaging and Transportation
J3	Transportation Requirements	N/A	Not well mapped in DOE PDRI
K1	Control Philosophy	C16	Instrument & Electrical
K2	Logic Diagrams	C16	Instrument & Electrical
K3	Electrical Area Classification	C16	Instrument & Electrical
K4	Substation Requirements / Power Sources Identified	C16	Instrument & Electrical
K5	Electrical Single Line Diagram	C16	Instrument & Electrical
K6	Instrument & Electrical Specifications	C16	Instrument & Electrical
L1	Identify Long Lead/Critical Equipment and Materials	C22	Long Lead/Critical Equipment & Material List
L2	Procurement Procedures and Plans	D15	Procurement Packages
L3	Procurement Responsibility Matrix	D15	Procurement Packages
M1	CADD/Model Requirements	N/A	Not well mapped in DOE PDRI
M2	Deliverables Defined	N/A	Not well mapped in DOE PDRI
M3	Distribution Matrix	D18	Inter-Site and On-Site Coordination
M3	Distribution Matrix	D19	Stakeholder Program
N/A	Part of ICR / ICE / EIR rather than PDRI	A1	Cost Estimate
N/A	Part of ICR / ICE / EIR rather than PDRI	A2	Cost Risk/Contingency Analysis
N/A	Part of ICR / ICE / EIR rather than PDRI	A3	Funding Requirements/Profile
N/A	Part of ICR / ICE / EIR rather than PDRI	A4	Independent Cost/Schedule Review
N/A	Part of ICR / ICE / EIR rather than PDRI	A5	Life Cycle Cost

CII Industrial Maturity Elements		DOE Developed PDRI Maturity Elements	
N/A	Part of ICR / ICE / EIR rather than PDRI	A6	Forecast Cost at Completion
N/A	Part of ICR / ICE / EIR rather than PDRI	A7	Cost Estimate for Next Phase Work Scope
N/A	Part of ICR / ICE / EIR rather than PDRI	D3	Key Project Assumptions
N/A	Part of ICR / ICE / EIR rather than PDRI	D10	Resources Required (People/Material) for Next Phase
N/A	Part of ICR / ICE / EIR rather than PDRI	D13	Quality Assurance Program
N1	Project Control Requirements	C25	Interface Planning and Control
N1	Project Control Requirements	D7	Baseline Change Control
N1	Project Control Requirements	D8	Project Control
N1	Project Control Requirements	D11	Configuration Management
N2	Project Accounting Requirements	D20	Funds Management
N3	Risk Analysis	N/A	Not well mapped in DOE PDRI
P1	Owner Approval Requirements	C24	Design Reviews
P1	Owner Approval Requirements	D6	Conceptual Design Report (CDR)
P1	Owner Approval Requirements	D21	Reviews/Assessments
P2	Engineering/Construction Plan Approach	C23	Design Completion
P2	Engineering/Construction Plan Approach	C26	Operating, Maintenance & Reliability (OMR) Concepts
P2	Engineering/Construction Plan Approach	C29	Reliability, Availability, Maintainability & Inspectability (RAMI) Analysis
P2	Engineering/Construction Plan Approach	D2	Acquisition Strategy Plan
P2	Engineering/Construction Plan Approach	D4	Project Execution Plan (PEP)
P2	Engineering/Construction Plan Approach	D5	Integrated Project Team/Project Organization
P2	Engineering/Construction Plan Approach	D9	Project Work Breakdown Structure (WBS)
P2	Engineering/Construction Plan Approach	D16	Project Acquisition Process
P2	Engineering/Construction Plan Approach	D17	Integrated Regulatory Oversight Program
P2	Engineering/Construction Plan Approach	E3	ES&H Management Planning (Including ISM)
P2	Engineering/Construction Plan Approach	E4	Emergency Preparedness
P3	Shut Down/Turn-Around Requirements	C29	Reliability, Availability, Maintainability & Inspectability (RAMI) Analysis
P4	Pre-Commissioning Turnover Sequence Requirements	C33	Transition and Startup Planning
P5	Startup Requirements	C33	Transition and Startup Planning
P5	Startup Requirements	C34	Operations Plans and Procedures
P6	Training Requirements	C34	Operations Plans and Procedures

APPENDIX D – DOE PROJECT DEFINITION RATING INDEX TRADITIONAL CONSTRUCTION PROJECTS[17]

Project Definition Rating Index Traditional Construction Projects (Nuclear, Non-Nuclear), Target Scores by Project Phase											
Rating Element		Weighting Designation	Weighting Factor	Expected Target Values At End of Project Phase							
				Pre-Conceptual (CD-0)		Conceptual Design (CD-1)		Preliminary Design Performance Baseline (CD-2)		Final Design (CD-3)	
				Maturity Value	Target Score	Maturity Value	Target Score	Maturity Value	Target Score	Maturity Value	Target Score
A. COST											
A1	Cost Estimate	H	7.5	1	7.5	2	15.0	5	37.5	5	37.5
A2	Cost Risk/Contingency Analysis	P	3.0	1	3.0	2	6.0	5	15.0	5	15.0
A3	Funding Requirements/Profile	H	7.5	1	7.5	2	15.0	4	30.0	5	37.5
A4	Independent Cost/Schedule Review	P	3.0	N/A	0.0	2	6.0	5	15.0	5	15.0
A5	Life Cycle Cost	P	3.0	1	3.0	2	6.0	4	12.0	5	15.0
A6	Forecast Cost at Completion	P	3.0	1	3.0	N/A	0.0	3	9.0	5	15.0
A7	Cost Estimate for Next Phase Work Scope	P	3.0	5	15.0	5	15.0	5	15.0	5	15.0
Subtotal Cost Element					**39.0**		**63.0**		**133.5**		**150.0**

[17] PDRI Element definitions are contained in the *Project Definition Rating Index Workbook* located in PM MAX.

Project Definition Rating Index Traditional Construction Projects (Nuclear, Non-Nuclear), Target Scores by Project Phase											
Rating Element		Weighting Designation	Weighting Factor	Expected Target Values At End of Project Phase							
				Pre-Conceptual (CD-0)		Conceptual Design (CD-1)		Preliminary Design Performance Baseline (CD-2)		Final Design (CD-3)	
				Maturity Value	Target Score	Maturity Value	Target Score	Maturity Value	Target Score	Maturity Value	Target Score
B. SCHEDULE											
B1	Project Schedule	H	7.5	1	7.5	2	15.0	5	37.5	5	37.5
B2	Major Milestones	P	3.0	1	3.0	2	6.0	5	15.5	5	15.0
B3	Resource Loading	P	3.0	1	3.0	1	3.0	4	12.0	5	15.0
B4	Critical Path Management	H	7.5	1	7.5	1	7.5	4	30.0	5	37.5
B5	Schedule Risk/Contingency Analysis	P	3.0	1	3.0	1	3.0	5	15.0	5	15.0
B6	Forecast of Schedule at Completion	P	3.0	1	3.0	1	3.0	5	15.0	5	15.0
B7	Schedule for Next Phase Work Scope	P	3.0	5	15.0	5	15.0	5	15.0	5	15.0
Subtotal Schedule Element					**42.0**		**52.5**		**140.0**		**150.0**
C. SCOPE/TECHNICAL											
C1	Systems Engineering/System Design Descriptions	H	3.2	3	9.6	4	12.8	5	16	5	16
C2	Alternative Analysis	H	3.2	5	16	5	16	5	16	5	16

Project Definition Rating Index Traditional Construction Projects (Nuclear, Non-Nuclear), Target Scores by Project Phase											
Rating Element		Weighting Designation	Weighting Factor	Expected Target Values At End of Project Phase							
				Pre-Conceptual (CD-0)		Conceptual Design (CD-1)		Preliminary Design Performance Baseline (CD-2)		Final Design (CD-3)	
				Maturity Value	Target Score	Maturity Value	Target Score	Maturity Value	Target Score	Maturity Value	Target Score
C3	Functional and Operational Requirements	H	3.2	2	6.4	4	12.8	5	16	5	16
C4	Design Basis (How)	H	3.2	2	6.4	4	12.8	5	16	5	16
C5	Design Criteria/Design Margins (How to)	P	1.51	1	1.51	4	6.04	5	7.55	5	7.55
C6	Technology Needs Identified	P	1.51	3	4.53	5	7.55	5	7.55	5	7.55
C7	Technology Needs Demonstrated	H	3.2	2	6.4	4	12.8	5	16	5	16
C8	Trade-Off Optimization Studies	P	1.51	1	1.51	3	4.53	5	7.55	5	7.55
C9	Site Location	P	1.51	3	4.53	4	6.01	5	7.55	5	7.55
C10	Plot Plan	P	1.51	2	3.02	4	6.04	5	7.55	5	7.55
C11	Process Flow Diagrams (PFDs)	P	1.51	N/A	0.0	3	4.53	4	6.04	5	7.55
C12	Natural Phenomena	P	1.51	2	3.02	3	4.53	5	7.55	5	7.55
C13	Layout Drawings and Equipment List	P	1.51	N/A	0.0	3	4.53	4	6.04	5	7.55
C14	Piping & Instrumentation	H	3.2	N/A	0.0	3	9.60	4	12.8	5	16

Project Definition Rating Index Traditional Construction Projects (Nuclear, Non-Nuclear), Target Scores by Project Phase											
Rating Element		Weighting Designation	Weighting Factor	Expected Target Values At End of Project Phase							
				Pre-Conceptual (CD-0)		Conceptual Design (CD-1)		Preliminary Design Performance Baseline (CD-2)		Final Design (CD-3)	
				Maturity Value	Target Score	Maturity Value	Target Score	Maturity Value	Target Score	Maturity Value	Target Score
	Diagrams (P&ID)										
C15	Mechanical (Piping)	P	1.51	N/A	0.0	1	1.51	2	3.02	5	7.55
C16	Instrument & Electrical	P	1.51	N/A	0.0	1	1.51	2	3.02	5	7.55
C17	Site Characterization (Including Surveys & Soil Tests)	P	1.51	1	1.51	3	4.53	5	7.55	5	7.55
C18	Waste Characterization and Disposition	H	3.2	1	3.2	3	9.60	5	16	5	16
C19	Pollution Prevention & Waste Minimization	P	1.51	2	3.02	3	4.53	4	6.04	5	7.55
C20	Waste Storage, Packaging and Transportation	H	3.2	2	6.4	3	9.60	5	16	5	16
C21	NEPA Documentation	H	3.2	2	6.4	4	12.8	5	16	5	16
C22	Long Lead/Critical Equipment & Material List	P	1.51	1	1.51	3	4.53	4	6.04	5	7.55
C23	Design Completion	P	1.51	N/A	0.0	1	1.51	2	3.02	5	7.55
C24	Design Reviews	P	1.51	N/A	0.0	5	7.55	5	7.55	5	7.55

Project Definition Rating Index Traditional Construction Projects (Nuclear, Non-Nuclear), Target Scores by Project Phase											
Rating Element		Weighting Designation	Weighting Factor	Expected Target Values At End of Project Phase							
				Pre-Conceptual (CD-0)		Conceptual Design (CD-1)		Preliminary Design Performance Baseline (CD-2)		Final Design (CD-3)	
				Maturity Value	Target Score	Maturity Value	Target Score	Maturity Value	Target Score	Maturity Value	Target Score
C25	Interface Planning and Control	P	1.51	1	1.51	3	4.53	4	6.04	5	7.55
C26	Operating, Maintenance & Reliability (OMR) Concepts	P	1.51	2	3.02	4	6.04	5	7.55	5	7.55
C27	Safeguards and Security	P	1.51	1	1.51	3	4.53	4	6.04	5	7.55
C28	Heat and Material Balances	P	1.51	N/A	0.0	3	4.53	5	7.55	5	7.55
C29	Reliability, Availability, Maintainability & Inspectability (RAMI) Analysis	P	1.51	N/A	0.0	3	4.53	4	6.04	5	7.55
C30	Materials Loading/Unloading/ Staging	P	1.51	1	1.51	2	3.02	4	6.04	5	7.55
C31	Constructability and Construction Planning	H	3.2	N/A	0.0	2	6.4	4	12.8	5	16
C32	Sustainable Design	P	1.51	1	1.51	3	4.53	5	7.55	5	7.55
C33	Transition and Startup Planning	H	3.2	N/A	0.0	3	9.60	4	12.8	5	16
C34	Operations Plans and Procedures	P	1.51	N/A	0.0	1	1.51	3	4.53	5	7.55

Project Definition Rating Index Traditional Construction Projects (Nuclear, Non-Nuclear), Target Scores by Project Phase

Rating Element		Weighting Designation	Weighting Factor	Expected Target Values At End of Project Phase							
				Pre-Conceptual (CD-0)		Conceptual Design (CD-1)		Preliminary Design Performance Baseline (CD-2)		Final Design (CD-3)	
				Maturity Value	Target Score	Maturity Value	Target Score	Maturity Value	Target Score	Maturity Value	Target Score
Subtotal Scope/Technical Element					**94.02**		**227.5**		**311.4**		**350**
D. MANAGEMENT PLANNING AND CONTROL											
D1	Mission Need Statement	H	2.23	5	11.15	5	11.15	5	11.15	5	11.15
D2	Acquisition Strategy Plan	H	2.23	3	6.69	5	11.15	5	11.15	5	11.15
D3	Key Project Assumptions	P	1.66	3	4.98	4	6.64	5	8.3	5	8.3
D4	Project Execution Plan (PEP)	H	2.23	1	2.23	3	6.69	5	11.15	5	11.15
D5	Integrated Project Team/Project Organization	P	1.66	2	3.32	3	4.98	5	8.3	5	8.3
D6	Conceptual Design Report (CDR)	H	2.23	N/A	0.0	5	11.15	5	11.15	5	11.15
D7	Baseline Change Control	H	2.23	1	2.23	4	8.92	5	11.15	5	11.15
D8	Project Control	P	1.66	N/A	0.00	3	4.98	5	8.3	5	8.3
D9	Project Work Breakdown Structure (WBS)	P	1.66	1	1.66	4	6.64	5	8.3	5	8.3
D10	Resources Required (People/Material) for	P	1.66	5	8.3	5	8.3	5	8.3	5	8.3

Project Definition Rating Index Traditional Construction Projects (Nuclear, Non-Nuclear), Target Scores by Project Phase											
Rating Element		Weighting Designation	Weighting Factor	Expected Target Values At End of Project Phase							
				Pre-Conceptual (CD-0)		Conceptual Design (CD-1)		Preliminary Design Performance Baseline (CD-2)		Final Design (CD-3)	
				Maturity Value	Target Score	Maturity Value	Target Score	Maturity Value	Target Score	Maturity Value	Target Score
	Next Phase										
D11	Configuration Management	H	2.23	1	2.23	3	6.69	5	11.15	5	11.15
D12	Project Risk Management Plan/Assessment	H	2.23	2	4.46	3	6.69	5	11.15	5	11.15
D13	Quality Assurance Program	H	2.23	1	2.23	4	8.92	5	11.15	5	11.15
D14	Value Engineering	P	1.66	1	1.66	3	4.98	5	8.3	5	8.3
D15	Procurement Packages	P	1.66	N/A	0.0	1	1.66	2	3.32	5	8.3
D16	Project Acquisition Process	P	1.66	5	8.3	5	8.3	5	8.3	5	8.3
D17	Integrated Regulatory Oversight Program	P	1.66	2	3.32	4	6.64	5	8.3	5	8.3
D18	Inter-Site and On-Site Coordination	P	1.66	2	3.32	3	4.98	5	8.3	5	8.3
D19	Stakeholder Program	H	2.23	2	4.46	4	8.92	5	11.15	5	11.15
D20	Funds Management	P	1.66	5	8.3	5	8.3	5	8.3	5	8.3
D21	Reviews/Assessments	P	1.66	5	8.3	5	8.3	5	8.3	5	8.3
Subtotal Management Planning and Control Element					**87.1**		**155**		**195**		**200**

Project Definition Rating Index Traditional Construction Projects (Nuclear, Non-Nuclear), Target Scores by Project Phase											
Rating Element		Weighting Designation	Weighting Factor	Expected Target Values At End of Project Phase							
				Pre-Conceptual (CD-0)		Conceptual Design (CD-1)		Preliminary Design Performance Baseline (CD-2)		Final Design (CD-3)	
				Maturity Value	Target Score	Maturity Value	Target Score	Maturity Value	Target Score	Maturity Value	Target Score
E. SAFETY											
E1	Hazard Analysis/Safety Documentation	H	9	2	18	4	36	5	45	5	45
E2	Integrated Safeguards and Security Planning	P	6	1	6	4	24	4	24	5	30
E3	ES&H Management Planning (Including ISM)	H	9	2	18	4	36	4	36	5	45
E4	Emergency Preparedness	P	6	1	6	2	12	4	24	5	30
Subtotal Safety Element					**48**		**108**		**129**		**150**
TOTAL					**310**		**606**		**909**		**1000**

MATURITY VALUES*	**N/A**	**0**	**1**	**2**	**3**	**4**	**5**
Definition	Not applicable	Work Not Started	Work Initiated	Concept Defined	Substantive Working Detail	Final Draft	Complete Fully Meets Criteria
Approximate % Complete Range	N/A	0	1% to 20%	21% to 50%	51% to 80%	81% to 95%	96% to 100%

*Application of maturity values may use the definitions section for the highest rating (complete fully meets criteria) and the approximate percent complete ranges shown above (to downscale the rating), as appropriate for the specific rating sub-elements. H = High Weighting P = Prorated Weighting

APPENDIX E – COMPARISION OF CII AND DOE SCORING METHODS

The following table provides a crosswalk between CII and DOE scoring methods illustrating recommended timing for PDRI use.

CII FEP Application Point	CD	Threshold Guidance To Move Forward (CII PDRI tools for Large Projects – where lower score is better)	Threshold Guidance To Move Forward (small project PDRI's – where lower score is better)	Threshold Guidance To Move Forward (DOE PDRI tool – where higher score is better)
1	CD-0	650-850	650-850	200-350
2	CD-1	350-450	450-550	550 - 650
2i	Between CD-1 & CD-2	150-350	250-450	650-850
3	pre-CD-2	150-200	250-300	850-950