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Project Definition Rating Index Guide for Traditional Nuclear and Non-Nuclear Construction Projects DOE G 413.3-12

Project Management Programs

November 2022

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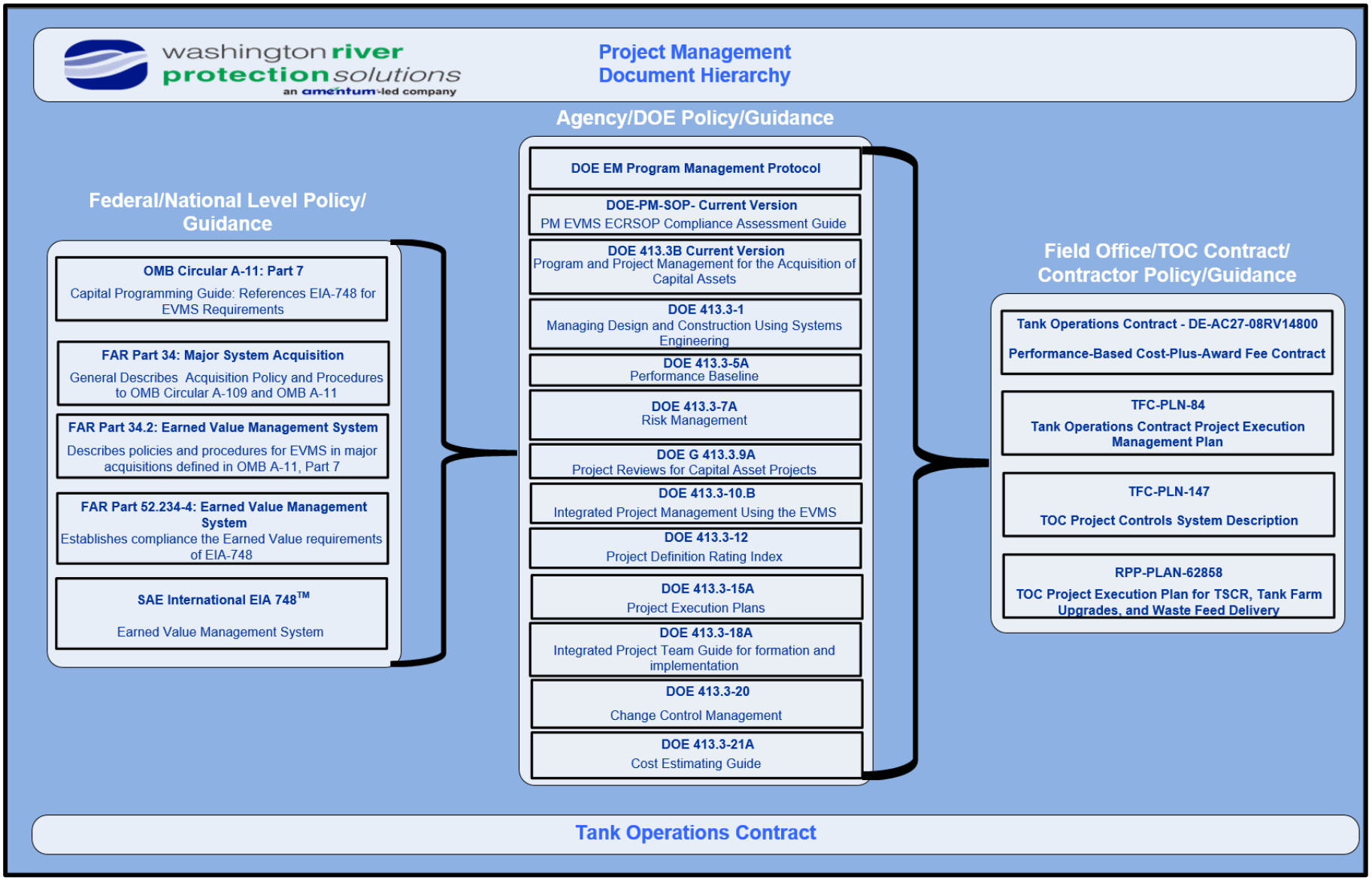

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Forward

This Department of Energy (DOE) Guide may be used by all DOE elements. **This Guide assists individuals and teams involved in conducting assessments of project definition (i.e. how well has front end planning been conducted to define the project scope) using a numerical project management tool developed by the Construction Industry Institute (CII) that has been tailored for DOE use.** The tool is called the Project Definition Rating Index (PDRI). The **PDRI is a simple but powerful tool** that facilitates the measurement of the degree of scope definition for completeness for traditional construction projects (nuclear and non-nuclear). **DOE programs may use alternate methodologies or tailored PDRIs more suitable to their types of projects for conducting their assessments/measurements of completeness of project definition.**

DOE Guides are part of the DOE Directives Program and are issued to provide supplemental information and additional guidance regarding the Department's expectations of its requirements as contained in rules, Orders, Notices, and regulatory standards. Guides may also provide acceptable methods for implementing these requirements but are not prescriptive by nature. **Guides are not substitutes for requirements, nor do they replace technical standards that are used to describe established practices and procedures for implementing requirements.**

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Purpose

The Project Definition Rating Index **(PDRI)** for traditional construction projects (nuclear and non-nuclear) **is a project management tool** designed to increase the likelihood of project success by **improving project scope definition**, specifically **by identifying deficiencies in scope definition early during the front-end planning process.** As one of the corrective measures to improve front-end planning within the DOE Project Management Process, DOE proposed the development and implementation of tailored PDRI models by their programs similar to the Construction Industry Institute (CII) PDRI. (References: DOE, Root Cause Analysis, Contract and Project Management, Corrective Action Plan, July 2008; and CII, PDRI for Buildings Projects, Implementation Resource 155-2, Second Edition, 2006).

This DOE Guide provides a tailored model of the CII PDRI for traditional construction projects for use by the DOE programs, as it may apply and is appropriate, when reviewing the levels of adequacy of project scope definition during the project development stages. This document is intended to be a "living document" and will be modified periodically as the understanding of PDRI models and tools evolves within the DOE programs. **DOE programs may use this Guide to develop their own PDRI Manuals/Procedures tailored to their own peculiar capital construction projects and technologies/processes.**

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The PDRI should be used during front-end planning that encompasses the project activities from pre-conceptual design through final design. Research has shown the importance of front-end planning on capital projects and its influence on project success. **Findings in a CII study have proven that higher levels of front-end planning effort can result in significant cost and schedule savings**. Specifically, the research study categorized 53 capital facility projects into three different intensities of front-end planning effort and compared total potential cost and schedule performance differences as follows: [**Reference: Gibson, G.E.** and Hamilton, M. R. (1994), "Analysis of pre-project planning effort and success variables for capital projects." Report prepared for the CII, University of Texas at Austin, Texas]

- A 20% cost savings with a high level of front end planning effort.
- A 39% schedule savings with a high level of front end planning effort.

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Because of the significant savings associated with improved project predictability, **the study concluded that a complete scope definition prior to project execution is imperative to project success.** The PDRI tool in this Guide **based on a score of 1-1000** assists project reviewers in measuring the level of project definition at a given project phase. **The higher the score in this scale, the higher the level of project definition is.** Other CII studies for industrial projects have shown that scores above 800 (equivalent scale) versus those scoring below 800 at the time of project baselining had:

- **Average cost savings** for design and construction of **19%** versus estimated cost.
- **Schedule reduction** for design and construction of **13%** versus estimated schedule.
- **Fewer project changes.**
- **Increased predictability** of operational performance.

[Reference: **Gibson, G.E.** and Dumont, P.R. (1996), "Project Definition Rating Index," Res.

Rep. 113-11 prepared for the CII, University of Texas at Austin, Texas]

This Guide will introduce the PDRI concept for DOE traditional construction projects (nuclear and non-nuclear) as it can be used to measure the degree of scope definition through the different progressive phases in the front-end planning process and to assist in identifying areas of risk consideration where the scoring is low.

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Background

In fiscal year (FY) 1999, the **Congressional Committee of Conference on Energy and Water Resources directed DOE to have an independent expert review of DOE's structure and process for managing its projects.**

In response to this request, **DOE asked the National Research Council (NRC) to review and assess the procurement and management of DOE's major construction projects** - as well as its environmental restoration and waste management projects.

In July 1999, **NRC published a report entitled Improving Project Management in the Department of Energy.**

In general, **NRC report was very critical of DOE's project management efforts with one of the principal concerns being the lack of up-front planning.**

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Based on direction from the Office of Environmental Management's (EM's) leadership, **a working group was formed of experienced project management professionals representing a cross-section of federal and contractor project management expertise from around the DOE complex.**

The group developed an EM Project Definition Rating Index (EM PDRI) similar to the CII PDRI for the specific purpose of improving project planning in EM. The initial EM PDRI Manual was released in March-2000, with tailored versions for traditional conventional construction projects, environmental restoration projects, and facility disposition projects.

This initial manual was revised subsequently to accommodate the changes from DOE O 413.3, Program and Project Management for the Acquisition of Capital Assets, and other improvements in the definitions of the rating sub-elements. Similar to the CII, EM has found this up-front planning tool to be very effective in assessing "readiness to proceed" to the next project phase.

EM also is finding that the project sub-elements in the PDRI model provide a good road map for planning future activities.

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Subsequently, the National Nuclear Security Administration (**NNSA**) **developed its own tailored version of the CII PDRI very similar to the EM PDRI for traditional construction** projects (January 2009).

The **principal purpose of the NNSA PDRI is to assist Integrated Project Teams (IPTs) by identifying key engineering and design elements** that are critical to a well defined scope at various phases of the project.

In addition, **the NNSA PDRI is expected to assist the IPTs in identifying staffing requirements at each project phase**; reporting progress on project definition at Quarterly Progress Reviews (QPRs); assessing readiness for Internal and External Project Reviews; and supporting the Acquisition Executive in approving Critical Decisions.

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In an April 2008 report on the **root cause analysis** of contract and project management deficiencies within DOE it was concluded that **DOE often does not complete front end planning to an appropriate level before establishing project performance baselines.**

This had led to scope, cost and schedule increases from the originally approved project baselines (Reference: DOE, Root Cause Analysis, Contract and Project Management, April 2008).

A Corrective Action Plan to this report was approved in July 2008 which addressed this shortcoming by planning for the development and implementation of tailored PDRI models for the DOE programs similar to the CII PDRI model.

The Corrective Action Plan proposes a metric that by the end of FY 2011, **80% of projects** (Total Project Cost greater than $100M) **will use PDRI methodologies no later than Critical Decision-2 (CD-2).**

(Reference: DOE, Root Cause Analysis, Contract and Project Management, Corrective Action Plan, July 2008)

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What is the PDRI?

The PDRI model used in this Guide is a simple and easy-to-use tool for measuring the degree of scope development for traditional construction projects (nuclear and non-nuclear) within DOE.

Tailored versions can be developed by the DOE programs using the basic CII PDRI model for other more specialized projects such as nuclear reactor facilities, decontamination and decommissioning (D&D) projects, environmental restoration projects, facility disposition projects, and other types of projects using other technologies/processes, as it can be applied and found appropriate.

It is recognized that Science Programs already have a methodology and processes to assess adequacy of project front end planning. In place of PDRI, the Office of Science may use its own specific methodology to assess the maturity of projects.

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The PDRI used in this Guide offers a comprehensive list of **73 scope definition sub-elements** within **five key major elements for project planning**. These major key elements are (1) **Cost**, (2) **Schedule**, (3) **Scope/Technical**, (4) **Management Planning and Control**, and (5) **Safety**.

Each sub-element within the major key element it belongs to **is weighted on its relative importance to the other sub-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 is low, to quickly predict factors impacting project risk.

Since the **PDRI score relates to risk**, those **areas** (sub-elements within the major elements, such as safety) **that need further work** can easily be identified. **CII empirical studies have shown** that **a**n overall **score of 800** (80% based on a scoring scale of 1-1000), or more, prior to determining the project baseline **can greatly increase the probability of a successful project.**

It is recommended in this Guide that a scoring of 900 or better be used for the suitability of a project proceeding to Critical Decision-2, approval of project baseline.

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When to Use the PDRI

This PDRI Guide is **intended to be used during front-end planning**, which encompasses all activities from pre-conceptual, conceptual, preliminary leading to final design in a project.

With goals of significantly 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 Critical Decision-1** (CD-1), approval of alternative selection and cost range.

By CD-2, approval of project baseline, the project scope definition should be essentially complete. Also at CD-2, the cost and schedule are established in the performance baseline which requires independent validation per DOE O 413.3.

The importance of a well defined project scope at CD-2 is highlighted by the DOE O 413.3 expectation that the approved performance baseline for technical scope, cost and schedule will not be exceeded.

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There is much project work (with significant associated costs) to be done following CD-2 and before completion of final design drawings, technical specifications, and construction bid packages.

For major projects, there can be several hundred drawings needed before design is complete and the project is ready for the start of construction following approval of CD-3.

However, a well developed performance baseline, which includes adequate cost and schedule contingency allowances based on risk, should remain the bounding limit for the project and not be affected by the final design activities.

Just as important, **the final design activities should not cause the technical scope, safety or security design envelopes for the project established at CD-1 and finalized at CD-2 to be exceeded.**

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Benefits of Using the PDRI

Effective front-end planning 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 of any individual project, small, or large. Sub-elements that are not applicable** to a specific project **should be marked N/A and have their weighting factor reduced to zero.** The weighting of the **remaining sub-elements** within that major key element (e.g. Cost, Schedule, Scope/Technical, etc.) **should be readjusted by spreading the weighting factor of the deleted sub-element proportionally over the remaining weighting factors of the remaining sub-elements so as to maintain the same potential maximum score of 1000.** The PDRI is simple to use and can serve as a best-practices tool that 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 sub-elements that comprise the scope definition for the project under evaluation, as it may apply and considerate appropriate (programs may expand or tailor their version of the sub-elements for scope definition).

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- 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 front-end project planning effort and to **focus efforts in high-risks areas that need definition**.
- A tool that aids in communication and **promotes alignment between the owners and design contractors** by highlighting poorly defined areas in a scope definition package.
- 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 facility 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. Designers and constructors working with **DOE can use it as a method of identifying poorly defined project scope definition elements/sub-elements.** The PDRI provides a means for all project participants to communicate and reconcile differences using an objective tool as a common basis for project scope evaluation.

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PDRI Description of Scoring System

Individuals involved in the evaluation of the development status for front-end planning for a traditional construction project using the PDRI method in this Guide should **use the Project Score Sheets shown in Appendix D**, Project Score Sheet (Weighted); and **Appendix E**, Project Target Scores by Project Phase (Critical Decision Stage).

The first weighted score sheet in Appendix D allows the front-end planning/evaluating team to quantify the level of scope definition at any stage of the project (in the sheet it shows the Critical Decision Stages 0-3) on a scale of 1-1000 points. In the second score sheet in **Appendix E it provides the suggested target scores** for each element and sub-elements of the scope definition criteria that are expected at a given phase of the project (Critical Decision Stage).

A complete list of the PDRI's five elements and 73 sub-elements of the scope definition rating criteria is shown in Table 3-1. Appendix F, PDRI – Construction Project Definitions and Target Score Criteria, provides the definitions for each sub-element of the scope criteria to obtain the maximum rating or maturity value.

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The summary descriptions and instructions for using the PDRI method in this Guide are given in the subsections as described below.

- **PDRI Key Elements** (rating elements and sub-elements)
- **Sub-Element Definitions**
- **PDRI Maturity Values**
- **Scoring the Project**
- **Inapplicable Sub-Elements**

Note: It is recognized that Science Programs already have a methodology and processes to assess adequacy of project front end planning. In place of PDRI, Science Programs may use its own specific methodology to assess the maturity of projects.

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Rating Area Elements	Sub-Elements for Construction Projects
A. Cost	7
B. Schedule	7
C. Scope/Technical	34
D. Management Planning and Control	21
E. Safety	4
Totals	**73**

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Sub-Elements Definitions

Key Elements group together all Sub-Elements that apply to an aspect of a project in a logical sequence. **Associated with each Sub-Element is a definition that provides the criterion for achieving the maximum score or maturity rating of "5" for the Sub-Element** (see Appendix F for the definitions). The definitions are generally qualitative and are expected to improve as more experience is gained in the use of the PDRI by the DOE programs for use in their tailored PDRI manuals, as applicable and appropriate.

As with many rating systems, it is difficult to provide comprehensive and detailed definitions that are fully meaningful to a wide range of activities, as is the case with DOE projects. **In general, the definitions provided in the PDRI Guide establish a basis for determining that a Key Element/Sub-Element is fully matured and, and just as importantly, demonstrates a high degree of quality planning.** It is important to note that **maturity values discussed in the next section are meant only to measure the degree of completeness and/or the extent that an Element or Sub-element meets the DOE O 413.3 requirements** and/or other more specific criteria for that Element/Sub-element (such as meeting the safety expectations in DOE STD 1189, Integration of Safety into the Design Process). **Maturity values are not to be construed as a subjective measure of merit or perceived technical quality that is not directly related to the definition criteria for that Element/Sub-element.**

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PDRI Maturity Values

The PDRI Maturity Value provides a numerical rating system (from 0 to 5) based upon the maturity of each particular Sub-Element, as provided by the Sub-Element definition. **A "0" value effectively means that the criteria embodied in the Sub-Element definition is not met at all**; a value of **"5" means full compliance with the Sub-Element definition criteria, which describes the ideal end state.**

In general, Maturity Values should be developed by applying the qualitative and quantitative criteria in Table 3-3 to the Sub-Element definitions. (Note: Ultimately, as explained in Section 3.4, the Maturity Value rating is multiplied by a specified weighting factor to obtain a PDRI score). For some DOE projects, a Sub-Element criterion may not be applicable.

In that case, an "N/A" should be entered as the maturity value on the PDRI score sheet. The other Sub-Elements criteria weights should be adjusted proportionally to preserve the maximum score for the Key Element to which they belong (this assures the same weight balances among the five main Key Elements and the 1000 maximum score level).

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The Maturity Value rating should be recorded on the PDRI score sheet. The expected or "targeted" Maturity Value rating shown on the Appendix E should not be changed by the assessor, but will vary depending on the phase of the project and can be used as a guide for what to expect at each project phase.

For example, **a Maturity Value rating of "1" for the Sub-Element "Cost Estimate" during the Pre-Conceptual Design phase (CD-0) is the expected rating** (i.e., the element matches expectations for that stage of the project).

On the other hand, **a Maturity Value rating of "1" at the end of the Preliminary Design phase (CD-2) indicates a potentially serious project deficiency** since the expected maturity rating for that Sub-Element at that project stage is "5".

Similarly, a Maturity Value rating of "5" is expected to be applied at CD-0 (and for all subsequent CDs) for all Sub-Elements that should be fully defined during the pre-conceptual phase of the project, such as the Sub-Element "Mission Need Statement" in the "Management Planning and Control" Key Element.

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For those projects where the subcontractor is responsible for providing critical project documents (e.g., Health and Safety Plan, Quality Assurance Plan, etc.) after the bid award, (such as with Design-Build (D-B) projects), **a maturity Value rating of "5" is acceptable, provided that the requirements are fully and completely communicated in the contracting documents** (e.g., special conditions, drawings, specifications, etc.).

While the "MATURITY VALUE RATING CRITERIA" Table criteria are used in assessing the Maturity Value of various Sub-Elements, the Project Manager/staff or the independent Review Team scoring a particular Sub-Element are free to use some discretion based upon supporting documentation. For example, **where the preparation of a project-specific Quality Assurance Plan may not have been started, but a documented and approved site-wide Quality Assurance Program is in place and fully implemented, the reviewer may assign a Maturity Value of "1" or "2"** to the Quality Assurance Project Plan Sub-Element even though that document doesn't yet exist due to the overall maturity of the site quality management system.

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The Maturity Values ratings for each of the Sub-Elements are used to determine the PDRI score for each Sub-Element, and the overall score of the project as described

Maturity Value Rating	Qualitative Criteria	Quantitative Criteria (% Complete)
N/A	Not Applicable	-
0	Work Not Started	0
1	Work Initiated	1-20
2	Concept Defined	21-50
3	Substantive Working Detail	51-80
4	Final Draft	81-95
5	Complete/Fully Meets Definition Criteria	96-100

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Scoring the Project

Each Maturity Value rating ("0" to "5") for each Sub-Element is multiplied by its respective weighting factor and shows in the scoring spreadsheet the importance of that Sub-Element relative to the others within the grouping and to the project overall. There are two levels of priority: **"H" designates a high priority Sub-Element** and a **"P" designates a pro-rated Sub-Element (lower weight).** The weight of these priority factors may vary by project type; such as, traditional construction vs. clean up projects, or other specialized non-traditional construction type of project, and should be codified in that specific DOE program published PDRI Manual/Procedures, as it may apply and appropriate. However, **for traditional construction projects the weighting factors shown in this Guide may be used for consistency sake.** Otherwise, the shifting of weighing schemes would hinder comparable measurement of progress within projects, between projects, or between self assessments and independent review team PDRI results. **For example, the sub-element "Pollution Prevention/Waste Minimization" is given an "H" weighting factor for clean-up projects in the EM PDRI Manual, as it is a significant part of that work. However, it is given a "P" weighting factor for a construction project in this Guide in the "Scope/Technical" Element, because it is only an incidental aspect of that work for traditional construction.** When multiplied by the rating, the weighting factors produce a score for each Sub-Element.

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Scoring System Bases

The underlying bases of the PDRI Guide weighted scoring system are:

- The **overall maximum score is 1000 points at the completion of the final project phase (CD-3).** This score reflects an ideal, fully matured project planning at a stage just prior to project implementation with a maximum Maturity Value rating (i.e., "5") assigned to each Sub-Element.
- **The maximum score for each Key Element (e.g., Cost, Schedule, etc.) was established principally by considering both the number of Sub-Elements in each Key Element group and the relative importance of the Key Elements for defining a successful project.** For example, for a project at the final phase (CD-3), the distribution of the 1000 points among each of the Key Elements, and the number of Sub-Elements is as shown in Figure 3-1 (this data was correlated from CII empirical data and DOE-EM/NNSA experience with traditional construction).
- **The overall approximate "targeted" score depends on the project phase as indicated below for traditional construction projects** The basis for each of the approximate "targeted" scores shown below can be found in Appendix E. **Targeted scores should only be used as a subjective indicator of the quality of front-end planning and not as a "pass" or "no pass" indicator.** Low scores should mandate an explanation for further evaluation.

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- **Some Sub-Elements are more important than others, and such Sub-Elements are designated as high priority ("H").** The combination of all "H" Sub-Elements for a given Key Element receives approximately 50 percent of the points for that Key Element maximum scoring. **For example, Sub-Elements designated "H" for the "Cost" Key Element for Final Design (CD-3) would have a total value of 75 of the total 150 points for that Key Element.** All of the **"P" Sub-Elements would also total 75 as shown in Appendix E for the "Cost" Key Element**. However the **"P" Sub-elements will have a lower weight value because they outnumber the number of "H" Sub-elements.**
- To account for the fact that some Sub-elements may not be applicable (i.e., N/A) for various projects, and to maintain consistent "targeted" scores for each Key Element (e.g., 300 points for Pre-Conceptual or 900 points at the end of Preliminary Design), Sub-Elements not designated by an "H" are designated by a "P" (are pro-rated). **The use of "H" and "P" weighting allows for keeping the "targeted" score the same for all phases, while accounting for the fact that some Sub-Elements are more important than others, and allows proportional adjustments in the weights when a Sub-Element is identified as N/A.** (see "Target Scores" for an explanation)

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Note: This works well as long as the number of "P" Sub-Elements outnumbers the number of "H" Sub-elements for any given Key Element. If there is an equal number or greater number of "H" Sub-Elements than "P" Sub-Elements (normally when some "P" Sub-Elements were considered N/A or were not rated) for any given Key Element, the scoring sheet should be adjusted to give more weight to the "H" Sub-Elements so as to maintain the maximum target score for the Key Element. **A good rule of thumb is to give the "H" Sub Elements 1.5 times the weighted value of the "P" Sub-Elements where the combination of the weighted values times the maximum rating criteria ("5") should equal the Key Element maximum scoring.**

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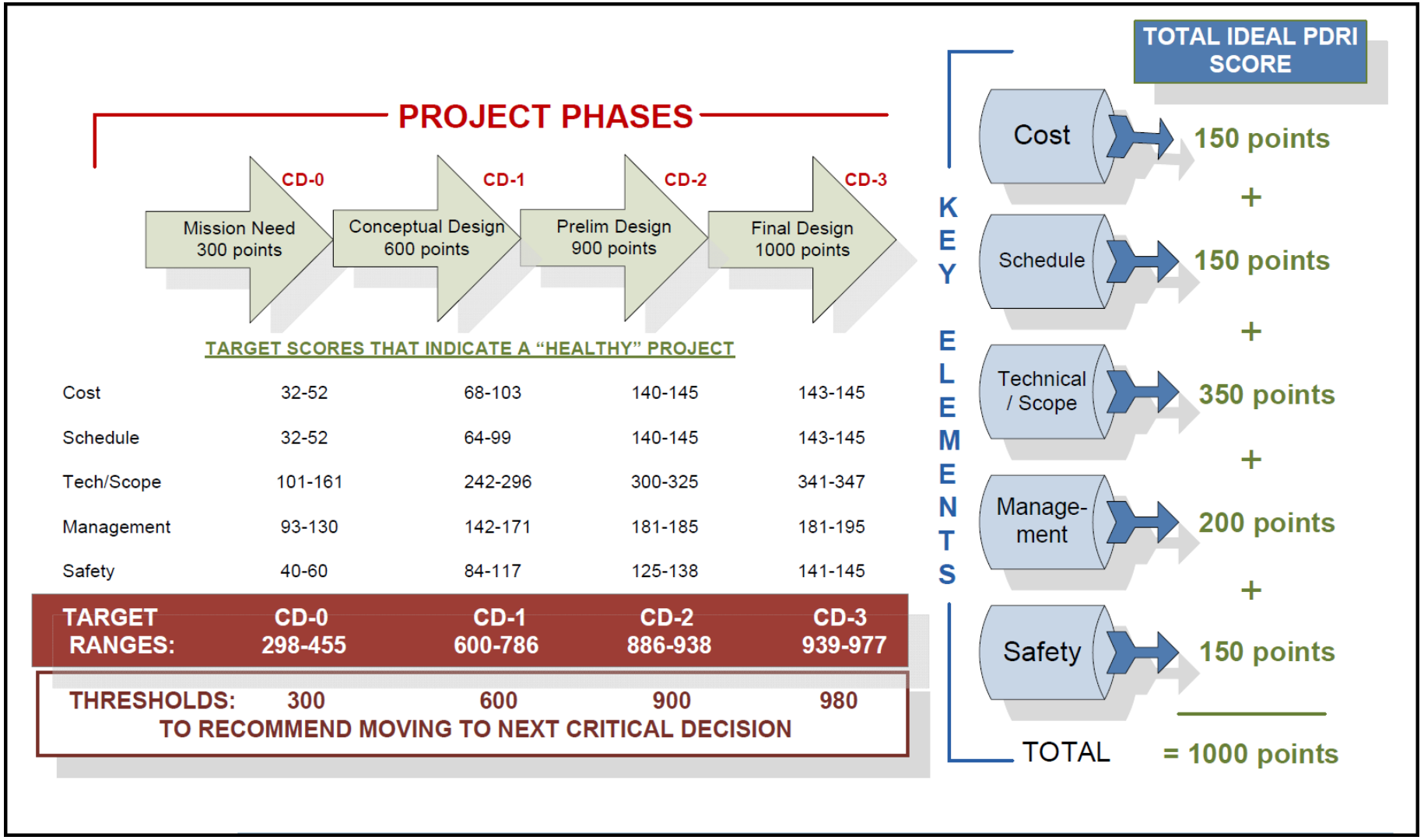
MAXIMUM AND TARGET SCORES FOR KEY ELEMENTS ON DOE CONSTRUCTION



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At completion of the Preliminary Design Phase, prior to CD-2 (above), the total **target score is set at 900 points out of 1000** (90 percent level).

In terms of actual work in a traditional construction project, the completion of **the Preliminary Design Phase is approximately 35 percent or more of the total design effort.**

However, **the PDRI target score is set at the 90 percent maturity level to ensure that the planning and preliminary design effort will provide a more accurate performance baseline** which will include a rigorous assessment of project risks and associated cost and schedule contingency.

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Target Scores

Target scores are those scores for a Sub-Element that is expected at a given phase of each project. Based on the above, projects are scored and then compared to targeted values. Taken in their entirety, **target scores provide a good indication of how well a project is actually defined versus how well it should be defined at any given stage.** Target scores increase from early to later phases of a project, and should not be changed by the assessor. **Sub-Elements that are expected to mature more slowly will have correspondingly lower target scores at the early stages of the project than others with more rapid maturity levels.** Target Scores are presented in Appendix E for comparison with actual evaluation scores reported in the score sheet in Appendix D.

Project Score

For each Sub-Element the actual score is determined by multiplying its Weighting Factor by the appropriate Maturity Value rating. After each Sub-Element score is calculated, the score for each Key Element (Cost, Schedule, Scope/Technical, Management Planning and Control, and Safety) and the Total Project Score are totaled.

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Design-Build (D-B) Projects

It should be noted that the score sheets and the definitions in **Appendices D, E and F do not adequately account for the particular differences** that would be **encountered in a Design-Build (D-B) acquisition strategy.**

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 definitions in Appendix F assume that most of these documents will be generated before the bidding process and, therefore, scores for D-B projects may be lower than the maturity of the project warrants.

These differences should be fully explained in the review report that accompanies the PDRI review. This is also true for components procured through a "performance specification." The actual design will be completed after the procurement is made.

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Inapplicable Sub-Elements

Certain Sub-Elements are not expected to be completed (or even started) at early stages of a project. For these Sub-Elements, the rating showing expected Maturity Values should be given an "N/A." **When totaling the scores, N/A should be considered to be zero (0), but does not negatively affect the scores.**

Prior to using this PDRI system for a specific project, all Sub-Elements should be reviewed for applicability through all phases of the project. If a particular Sub-Element is not applicable (N/A) for the specific project through all phases, it should be so noted and the weights of the other Sub-Elements should be re-calculated proportionally to keep the total possible score equal to 1000 (see Section 3.4.1, steps 4 and 5, for the readjustments). **Ratings cells should not be left blank.** A blank cell means the assessor did not feel qualified to rate a particular Sub-Element. **The assessor(s) should be able to rate every Sub-Element, or additional assessors should be included in the review.**

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Philosophy of Use - Who Should Perform the PDRI?

The PDRI rating should be performed by assessors. Assessors may consist of the **Project Management Team** for a given project, **or independent review groups** that are well-versed in project management concepts, and have a good understanding of the particular project. **The Project Management Team usually may be asked to self-assess the project.** DOE O 413.3 requires an independent assessment at different project phases for different sized projects. (Reference: DOE O 413.3, Program and Project Management for the Acquisition of Capital Assets)

Ideally, the project team and/or an independent review team should conduct a PDRI evaluation at various points in the project. Experience has shown that **the scoring process works best in a team environment with a neutral facilitator familiar with the project.** The facilitator provides objective feedback to the team and controls the pace of team meetings. If this arrangement is not possible, an alternate approach is to have key individuals 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.

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Users experience (CII, private entities and other Federal Agencies) **has shown that the PDRI is best used as a tool to help project managers** (project coordinators, project planners) **organize and monitor progress of the front end planning effort.** In many cases, a planner may use the PDRI prior to the existence of a team in order to understand major risk areas. **Using the PDRI early in the project life cycle will usually lead to high PDRI scores later.** This is considered good practice since the early completed score sheets provide a road map of areas that are weak in terms of definition and need more focused attention.

The PDRI provides an excellent tool to use in early team meetings in that it provides a means for the team to align itself on the project and organize its work. Experienced PDRI users feel 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 handing off the project to other entities or helping maintain continuity as new project participants are added to the project.**

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If the organization has front-end planning procedures and execution standards and deliverables in place, many PDRI elements may be partially defined when the project begins front end planning. **An organization may want to standardize many of the PDRI element/sub-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 that some elements are not as well-defined as initially assumed. It is important to assess the elements/sub-elements both in content and quality in an honest unbiased manner (do not use the score sheet as a simple check-list of documentation in place). **The level of maturity of existing relevant project documentation should be assessed as part of the sub-element rating.** Any changes that occur in assumptions or planning parameters need to be resolved with earlier planning decisions. The target score may not be important as the team's progress over time in resolving issues that harbor risk.

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When using the PDRI on small projects, the assessor/project team may determine a new target score at which it feels comfortable when recommending authorization for a project for detailed design and construction (the maturity levels and weights for some sub-elements may vary by the type/size of the project and acquisition strategy). **Each program/organization should develop an appropriate threshold range of scores for the particular phase of front-end planning 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 score of 900 before going to procurement/construction if the functional and performance requirements fall within the commercially available ranges of performance or boiler plate designs).

Caution: Using the PDRI for this purpose should be done carefully or else elements/sub-elements that are more important for small projects may be given less emphasis than needed. The operative phrase for using the PDRI in these situations is common sense. An experienced facilitator can help in this regard.

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Another point that needs to be made is that experience (**lessons learned**) from users **has shown that successful implementation of the PDRI process requires training.** Several facilitators should be trained, and the number will vary by organization and the projects that will require its use to assist decision making (such as authorization for Critical Decisions). **The objective is to insure 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 peer's projects**.

In addition to a cadre of trained facilitators, **all key members participating in a PDRI review process should understand the PDRI model 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.**

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Analyzing PDRI Scores - What to Look for?

The PDRI is of little value unless the user takes action 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 front-end planning using the PDRI score as a macro-evaluation tool.** Individual elements and sub-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 it is a subjective rating.
- **Compare project-to-project scores over time in order to look at 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 your acceptable PDRI score for those projects and identify critical success factors from that analysis.
- **Determine a comfort level (PDRI score) at which you are willing to recommend authorization** for the project for final design.

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- **Look at weak areas for your project at the element level or sub-element level over time.** By adding these sub-elements' PDRI scores, one can see how much risk they bring to the project relative to 1000 points. This provides an effective method of risk analysis since each sub-element and element is weighted relative to each other in terms of potential risk exposure. **Use the PDRI score to redirect effort by the project team.**
- **The individual sub-element scores can be used to highlight the "critical few" sub-elements for team focus** – either through segregating by sub-element score or definition level. **Remember that the weights given in the score sheet were developed for a generic traditional construction project.** Your project may have unique requirements that should be met, therefore examine the level of definition in some amount of detail because the score may not be reflective of the project's 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 front-end planning effort should focus on the critical few sub-elements that, if poorly defined, could have the greatest potential to negatively impact project performance.**

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Potential PDRI Score Applications

The Program/Field Office/Project (Center) 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 may serve as a gauge for the Center in deciding whether or not to move forward with 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 or Centers.

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 the CII PDRI for Building Projects Research Team (1999) are suggested critical performance factors in the execution and operation of a capital facility. In general, higher PDRI scores represent scope definition packages that are well-defined and correspond to higher project success. **Lower PDRI scores**, on the other hand, may signify that certain elements in the scope definition package lack adequate definition and, if the project moves forward with development of construction documents, **could result in poorer project performance and lower success.**

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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.** (Reference on how to develop these curves: PDRI, Industrial Projects, Implementation Resource 113-2, CII, Austin, TX, July 1996)

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Lessons Learned Using the PDRI

Specific lessons learned using the PDRI process includes: (Source: CII PDRI for Building Projects Research Team)

- The **PDRI should be used at a minimum of two times during project planning.**
- A **facilitator provides 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 is often 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, in order to **honestly identify deficiencies**.
- **Use the PDRI initially on pre-selected pilot projects** in order **to gain proficiency with using the tool.**

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- **Train individuals** in the use and background of the tool in order **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 sub-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.

Note: It is recognized that **Science Programs already have a methodology** and processes to assess adequacy of front-end planning. In place of PDRI, Science Programs may use its own specific methodology to assess maturity of projects.

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Appendix F - Project Definition Rating Index - Construction Project Definitions and Target Score Criteria

The following definitions describe the criteria required to achieve a maximum rating or maturity value of 5. It should be assumed that maturity values of 0-5 represent a subjective assessment of the quality of definition and/or the degree to which the end-state or maximum criteria have been met, or the product has been completed in accordance with the definition of maturity values.

Below are a few of examples of the PDRI Criteria from Appendix F:

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Appendix F - Rating Element		Criteria for Maximum Rating
A. COST		
A1	Cost Estimate	A cost estimate has been developed and formally approved by FPD and is the basis for the cost baselines. The cost estimate is a reasonable approximation of Total Project Costs (TPCs), and covers all phases of the project. The estimate is prepared in accordance with DOE requirements. The estimate bases are fully documented and traceable. Supporting backup information has been collected and organized and is available in a central file or location. Major estimate assumptions, especially those affecting major cost drivers, are fully documented and explained. Estimate exclusions or qualifications are clearly documented. Estimated costs are time-phased and escalated using current DOE or other justifiable escalation rates. For cost estimate point values AACEI Cost Recommended Practice 17R-97 is a useful reference. A Class I (PDRI score of 5) estimate is developed from quantity take offs from completed design plans and specifications. Whereas the Class 5 estimate (PDRI score 1) is of a rough order of magnitude estimate useful for determining the range of costs for various alternatives at CD-0.

Project Phase (DOE O 413.3A)	Level of Project Definition	Estimate Class (*AACE Recommended Practice No. 17R-97*)	PDRI Maturity Value
CD-0 /Approve Mission Need	0% to 15%	Class 4/5	1
CD-1 /Approve Alternative Selection & Cost Range	10% to 40%	Class 3	2
CD-2 /Approve Performance Baseline	30% to 70%	Class 2	3-4
CD-3 /Approve Start of Construction	50% to 100%	Class 1	5

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A2	Cost Risk/Contingency Analysis	The cost estimate includes contingency allowances developed in accordance with DOE guidance. In addition to any deterministic contingency analyses that may have been developed, a probabilistic risk analysis has been performed. The assumptions, rationale and methodology used to perform the probabilistic analysis are explained. The cost risk analysis builds on and is tied to the Project Risk Management Plan. Risk mitigation costs, if appropriate, have been included in the baseline cost estimate, or addressed by the risk analysis model. Costs related to schedule contingency also are included. The use of management reserve by contractors in procurement actions has been evaluated. The confidence level of the baseline cost estimate is clearly stated and explained. All of the preceding requirements are documented in the project record.

	Appendix F - Rating Element	**Criteria for Maximum Rating**
A3	Funding Requirements/Profile	Funding requirements have been defined and the project timeline is in compliance with the DOE budget timeline/process. Required budget documentation, including Project Data Sheets (where required), reflects current project cost and schedule estimates/forecasts. The funding profile is based on quantified resource requirements derived from the cost estimate, time-phased through integration with the project baseline schedule. Resource constraints (personnel, budget authorizations, etc.) have been considered when developing the project schedule, and an iterative process used to correlate the cost estimate, schedule and funding profile. The funding profile is based on full consideration of available or expected budget or funding levels for the project. The impact of any projected funding shortfalls has been assessed and management strategies developed to accommodate those shortfalls have been considered and incorporated in the project plans. All of the preceding requirements are documented in the project record.

A4	Independent Cost/Schedule Review	In addition to any internal cost and schedule estimate reviews, the cost estimate and schedule have been subjected to an independent review by an organization not directly involved with the project (Independent Cost Estimate, when required). The independent review has been documented, including the techniques used and type of review performed. The results, findings and recommendations of the independent review have been reconciled with the cost and schedule estimates and changes have been incorporated.

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A5	Life Cycle Cost	The project Life Cycle Costs (LCC) includes relevant assumptions, bases of estimate, qualifications, and exclusions. LCC includes the estimated cost for government commitments that result from execution of this project, including downstream projects/facilities and eventual disposition of the facilities constructed for this project. The LCC estimate should meet the requirements of Office of Management and Budget directives and DOE Orders and guidance. LCC of competing projects or alternative strategies are estimated and documented on a comparable basis. For nuclear projects, or other projects with significant safety hazards, accidents mitigation costs associated with structures, systems, and components (SSCs) have been included. For high hazard facilities, safety mitigation costs are often a key discriminator in competing projects or alternatives.
A6	Forecast of Cost at Completion	The cost baseline is approved and the measurement of actual performance is begun, forecasts of costs at completion (actual costs to-date plus "to-go" costs) are developed and issued at regular intervals. Cost forecasts are developed in accordance with project procedures. Key assumptions supporting the baseline estimate are documented and periodically re-evaluated and the impacts of changing assumptions are reflected in the estimates of "to-go" costs. Forecasts are related to the Change Control system and incorporate both approved and pending changes, as appropriate. The forecast of cost at completion is a reasonable projection based on the status of the project and experience to-date.
A7	Cost Estimate for Next Phase of Work	A detailed cost estimate is prepared and approved for the work scope to be accomplished during the next phase of the project (i.e., the efforts needed to successfully complete the prerequisites for the next Critical Decision). Cost estimates are defensible with an appropriate level of supporting detail and documentation. Assumptions are clearly documented and stated.