The Department of Energy's Project Reporting and Assessment System (PARS)

PARS Empower EAC Reasonableness, Module 6
PARS User Advanced Training

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Welcome to the sixth of eight session of the Department of Energy's Project Reporting and Assessment System advanced user training. This session is approximately 50 minutes in length. In this course the focus will be on the user, which include the contractor managing the project, the federal project director, the DOE program oversight, and DOE headquarters independent project analysis, using the tools in Empower to better look at projects performance data. The analysis and reporting capabilities of PARS provide decisions makers at all levels to best manage these projects over their lifecycle. In this course we will look at how to do EAC Analysis in the Empower tool, *this is* easy to do in Empower and will run very similarly to how the Project Analyst Standard Operating Procedure (EPASOP with some additional charts and reports. Now that we have identified the major variances, trending information, we can ask the question, How do we make sense of the EAC in light of revealed data?
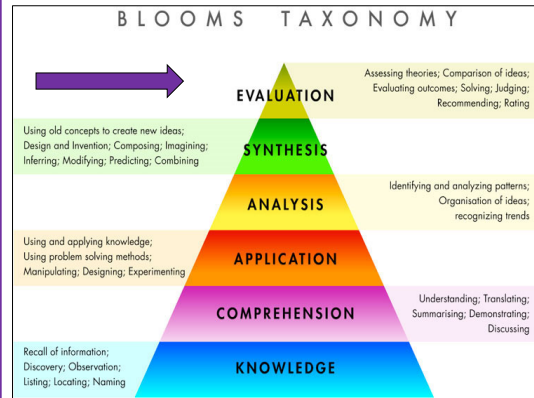
Training Objectives

- **Assess which Empower and PARS tools and capabilities to use in analyzing projects.**
- **Apply DOE EVMS and Project Analysis Standard Operation Procedure to projects**
- **Evaluate Projects using appropriate dashboards, views, charts, and reports information**
- Assess data provided to DOE through the use of EVMS metric tests and data quality reports
- Building advanced pre-filters in Empower

AT COMPLETION - EARN **8 CEU/PDUs**
- Federal Employees – Will be added to CHRIS
- Contractor Employees – Certificate will be emailed MZW3

BLOOMS TAXONOMY

EVALUATION — Assessing theories; Comparison of ideas; Evaluating outcomes; Solving; Judging; Recommending; Rating

SYNTHESIS — Using old concepts to create new ideas; Design and Invention; Composing; Imagining; Inferring; Modifying; Predicting; Combining

ANALYSIS — Identifying and analyzing patterns; Organisation of ideas; recognizing trends

APPLICATION — Using and applying knowledge; Using problem solving methods; Manipulating; Designing; Experimenting

COMPREHENSION — Understanding; Translating; Summarising; Demonstrating; Discussing

KNOWLEDGE — Recall of information; Discovery; Observation; Listing; Locating; Naming

This sixth session will focus on training objectives in Bold, focusing on the EACs in Empower. We will use the advanced capabilities within Empower to provided EAC reasonableness analysis capabilities, to evaluate the project now and in the future.

We will cover some of the basic concepts outlined in the EPA SOP, but will also add additional capabilities. There are a lot of additional charts and reports not to mentioned methodology the Empower brings to the table. The purpose of this sixth module is to use the Empower data to determine if the EAC is reasonable and how you can use the independent EAC (IEAC) as a comparison to the contractor's reported EAC. Let's get started

MZW3   How to provide credit? - Sig

Matthew Z West, 8/25/2020

Forecast Analysis Discussion

- Estimate AT Complete - by definition is ACWPcum + estimate TO complete + Undistributed Budget (UB)
- Accuracy of EAC is vital – provides insight into the funding estimate needed to cover cost to accomplish the PMB
- Although ACWP is in the EAC formula, in reality, it is the remaining work that is driving the EAC calculation.
- Said another way: EAC is the effort/work that remains to be completed + the actuals spend to date.
- In this session we will look at contractor provided CAM and PM EAC and Independent EAC calculations to check for reasonableness, valid and current
- Look at supporting charts and reports to get a clearer picture of the EAC

By definition, the Estimate AT Complete is ACWPcum to date plus the SUM of each of the Estimate to Complete (future time phased forecast values).   This is the CAM EAC. This is based on the Contractors CAM each providing their ETC. There is also the PM ETC which is entered each month in terms of Best Case, Most Likely, and Worst Case and uses the CAM EAC as a component.

An accurate EAC is vital since it provides working estimate of the projected funding required to cover cost to perform the work in the PMB.

Although ACWP is in the EAC formula, in reality, it is the remaining work that is driving the EAC calculation. An accurate BCWP is needed to proper gauge the remaining work or BCWR to complete the effort.
Said another way: EAC value is the effort/work that remains to be completed + the actuals spend to date.

In this session we will look at contractor provided EACs and Independent EAC calculations to check for reasonableness, validity and currency.   There is not a holy grail on a single chart or report that will provide a complete Forecast or EAC reasonableness, you will need a various 'dashboard' performance data to get a

clearer picture. Keep in mind that additional discussion with PM/CAM to gain insight that may not be reflected in the provided data such as: insight into risks, resources and is the task more difficult that originally planned, just to name a few?

D-006 DOE Forecast Dashboard Overview

- DOE Forecast View
  - SPICum and CPI values from Current back to the last 6 periods
  - DQI EAC High/Low and TCPI
  - At Complete value and delta changes from prior periods
  - At Complete value with Independent EAC calculations
- DOE Forecast Chart
  - Trending At Complete values for past periods
  - Trending IEAC value to compare with supplied EAC
- Six Period Summary Report
  - EAC and BAC with TCPI calculations
  - Numerous IEAC calculations

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We have provided various Dashboard of the PARS Empower environment that you can select and use to conduct analysis. One of them is the D-006 DOE Forecast Dashboard. This dashboard can be used as your initial launching point to conduct EAC Reasonableness and conduct IEAC analysis.

Let's start with an overview of the Forecast Dashboard. D-006 DOE Forecast Dashboard include a S-006 DOE Forecast View. The view has:

SPICum and CPI values from Current back to the last 6 periods - Useful in when observing performance over time, which we covered Trend analysis already.

DQI EAC High/Low and TCPI – quickly see if the EAC is optimistic or pessimistic. Empower will trigger a failure if TCPI to EAC is greater than .10

At Complete value and delta changes from prior periods – EAC provided by contractor and delta from prior period

At Complete value with Independent EAC calculations – we will spend some time here later, but this IEAC are calculated independently and provides comparison to provided EAC
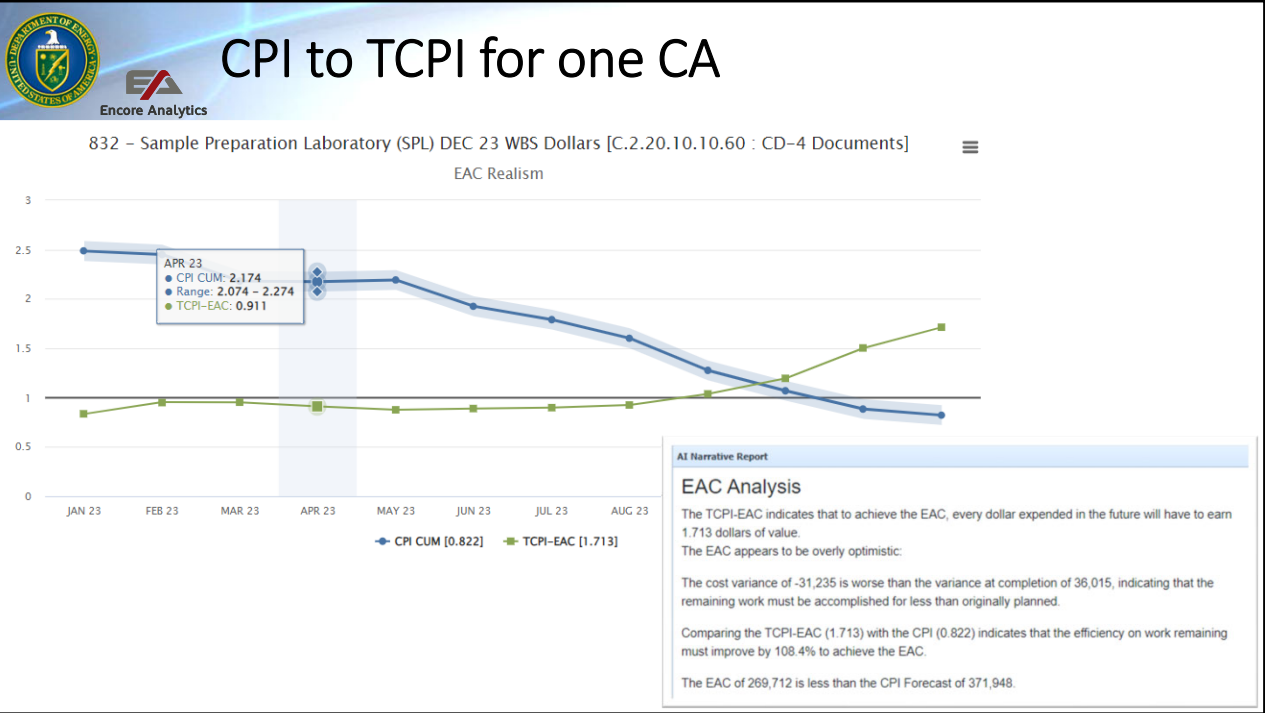
DOE Forecast Chart

Trending At Complete values for past periods - The contractor provided data is the columns

Trending IEAC value to compare with supplied EAC – they are shown in lines across multiple periods
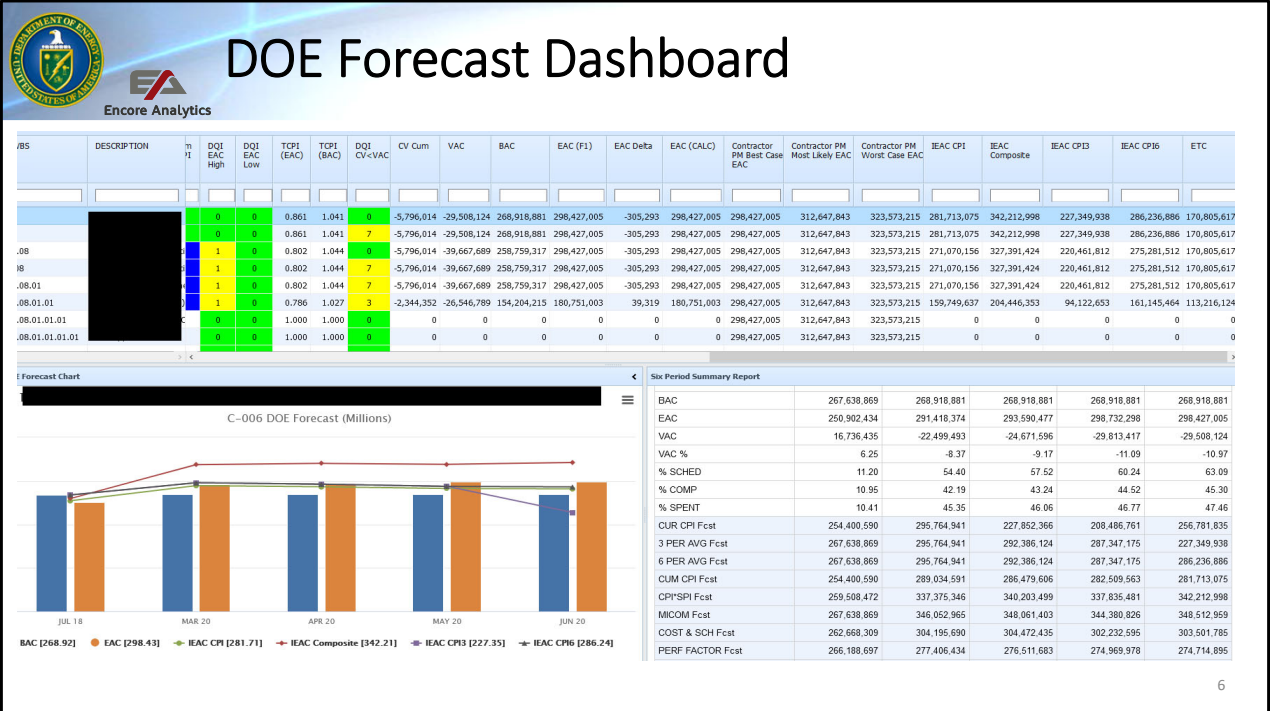
Six Period Summary Report – lots of information that we will cover in greater depth in coming slides, for now:

EAC and BAC with TCPI calculations in a tabular form

Numerous IEAC calculations over time, based on the provided data for that give period.

Is this realistic?
At this point, what should you do?

DOE Forecast Dashboard

Encore Analytics

/BS	DESCRIPTION	m PI	DQI EAC High	DQI EAC Low	TCPI (EAC)	TCPI (BAC)	DQI CV<VAC	CV Cum	VAC	BAC	EAC (F1)	EAC Delta	EAC (CALC)	Contractor PM Best Case EAC	Contractor PM Most Likely EAC	Contractor PM Worst Case EAC	IEAC CPI	IEAC Composite	IEAC CPI3	IEAC CPI6	ETC
			0	0	0.861	1.041	0	-5,796,014	-29,508,124	268,918,881	298,427,005	-305,293	298,427,005	298,427,005	312,647,843	323,573,215	281,713,075	342,212,998	227,349,938	286,236,886	170,805,617
			0	0	0.861	1.041	7	-5,796,014	-29,508,124	268,918,881	298,427,005	-305,293	298,427,005	298,427,005	312,647,843	323,573,215	281,713,075	342,212,998	227,349,938	286,236,886	170,805,617
.08			1	0	0.802	1.044	0	-5,796,014	-39,667,689	258,759,317	298,427,005	-305,293	298,427,005	298,427,005	312,647,843	323,573,215	271,070,156	327,391,424	220,461,812	275,281,512	170,805,617
8			1	0	0.802	1.044	7	-5,796,014	-39,667,689	258,759,317	298,427,005	-305,293	298,427,005	298,427,005	312,647,843	323,573,215	271,070,156	327,391,424	220,461,812	275,281,512	170,805,617
.08.01			1	0	0.802	1.044	7	-5,796,014	-39,667,689	258,759,317	298,427,005	-305,293	298,427,005	298,427,005	312,647,843	323,573,215	271,070,156	327,391,424	220,461,812	275,281,512	170,805,617
.08.01.01			1	0	0.786	1.027	3	-2,344,352	-26,546,789	154,204,215	180,751,003	39,319	180,751,003	298,427,005	312,647,843	323,573,215	159,749,637	204,446,353	94,122,653	161,145,464	113,216,124
.08.01.01.01			0	0	1.000	1.000	0	0	0	0	0	0	0	298,427,005	312,647,843	323,573,215	0	0	0	0	0
.08.01.01.01.01			0	0	1.000	1.000	0	0	0	0	0	0	0	298,427,005	312,647,843	323,573,215	0	0	0	0	0

C-006 DOE Forecast (Millions)

JUL 18 MAR 20 APR 20 MAY 20 JUN 20

BAC [268.92]   EAC [298.43]   IEAC CPI [281.71]   IEAC Composite [342.21]   IEAC CPI3 [227.35]   IEAC CPI6 [286.24]

Six Period Summary Report

BAC	267,638,869	268,918,881	268,918,881	268,918,881	268,918,881
EAC	250,902,434	291,418,374	293,590,477	298,732,298	298,427,005
VAC	16,736,435	-22,499,493	-24,671,596	-29,813,417	-29,508,124
VAC %	6.25	-8.37	-9.17	-11.09	-10.97
% SCHED	11.20	54.40	57.52	60.24	63.09
% COMP	10.95	42.19	43.24	44.52	45.30
% SPENT	10.41	45.35	46.06	46.77	47.46
CUR CPI Fcst	254,400,590	295,764,941	227,852,366	208,486,761	256,781,835
3 PER AVG Fcst	267,638,869	295,764,941	292,386,124	287,347,175	227,349,938
6 PER AVG Fcst	267,638,869	295,764,941	292,386,124	287,347,175	286,236,886
CUM CPI Fcst	254,400,590	289,034,591	286,479,606	282,509,563	281,713,075
CPI*SPI Fcst	259,508,472	337,375,346	340,203,499	337,835,481	342,212,998
MICOM Fcst	267,638,869	346,052,965	348,061,403	344,380,826	348,512,959
COST & SCH Fcst	262,668,309	304,195,690	304,472,435	302,232,595	303,501,785
PERF FACTOR Fcst	266,188,697	277,406,434	276,511,683	274,969,978	274,714,895

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The DOE Forecast Dashboard will display the selected project from the Dataset and open with the All Elements (all levels) on.

Start with selecting Dashboard > Global > and Select D-006 DOE Forecast and the following Dashboard will display. As you learned in previous training sessions, you can adjust the vertical and horizontal curtains based on your liking and select a different Chart and Report. But the default dashboard is showing

Top Level EAC Analysis

- Empower has EAC calculations at all levels of the WBS to include the top level
- When comparing the TCPI to CPI, the most realistic approach is to select the PMB element that only has distributed budgets - No MR
- Remember, the TCPI represents the efficiency necessary to complete the work (PMB)
- However, some of the top level data tends to mask and hide underscoring issue in the lower levels.
  - Since the data is available, filter for CA and look EAC High Low fields
  - Use the techniques were about to use to determine EAC reasonableness
  - Remember you are looking for confidence level not exact projected values

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Now that we understand the various Views, Fields, Charts and Reports in the Forecast Dashboard, lets focus on identifying the what that data tells us: EAC Reasonableness.

But first let's talk about top level analysis for just a second.

Empower has EAC calculations at all levels of the WBS to include the top level

When comparing the TCPI to CPI, the most realistic approach is to select the PMB element that only has distributed budgets - No UB and MR

Remember, the TCPI represents the efficiency necessary to complete the work (PMB)

However, some of the top level data tends to mask and hide underscoring issue in the lower levels.
  Since the data is available, filter for CA and look EAC High Low fields
  Use the techniques were about to use to determine EAC reasonableness
  Remember you are looking for confidence level not exact projected values

EAC Reasonableness Analysis

- Now that we have discuss the Forecast Dashboard let focus on EAC reasonableness analysis
- We will look at:
  - ETC vs BCWR comparison charts
  - CPI to TCPI comparison charts
  - IEAC to EAC comparison Charts and Reports
  - CV> VAC data
- May also review Funding reports for assisting in revealing potential funding shortfalls
- Lastly, Format 5 EAC discussion for insight as to how the Contractor derived their EAC's.

Now that we have discuss the Forecast Dashboard let focus on EAC reasonableness analysis
We will look at:
 ETC vs BCWR comparison charts
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 IEAC to EAC comparison Charts and Reports
 CV> VAC data

May also review Funding reports for assisting in revealing potential funding shortfalls

Lastly, Format 5 EAC discussion for insight as to how the Contractor derived their EAC's.

Encore Analytics

- Analysts are given lots of data and can be very overwhelming
- Use the Interactive Filters in Empower to "manage by exception"
- Focus your efforts on significant elements, use BCWR and % Complete to screen out elements that are:
  - Very close to finishing: BCWR = $100K and % Complete = 97%
  - Are too early to analyze, but watch: BCWR = $900K and % Complete = 2%
  - That are too minor: BCWR = $15K and % Complete = 55%
  - Ideal range may vary: BCWR = $1,200K and % Complete = 40%
- Another screening process is the CPI Cum to TCPI (EAC) Trend
  - Red is unachievable, look for the trending arrow
  - Yellow is 'maybe' achievable

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Given that you will need to analyze lots of contracts and some of these contracts may have large volume.   This task can be overwhelming and challenge specially if you have time constraints and need to provide a quick turnaround analysis. Welcome to the 'management by exception' concept, this concept will screen or filter to only key drivers and elements that are the "squeaky wheel". Here are several key tricks that I used to assist in narrowing down to meat of the problem areas.

Focus your efforts on significant elements, use BCWR and % Complete to screen out elements that are:

Very close to finishing: BCWR = $100K and % Complete = 97%
Are too early to analyze, but watch: BCWR = $900K and % Complete = 2%
That are too minor: BCWR = $15K and % Complete = 55%
Ideal range may vary: BCWR = $1,200K and % Complete = 40%

Another screening process is the CPI Cum to TCPI (EAC) Trend

Red is unachievable, look for the trending arrow as well, is it improving or getting worse
Yellow is 'maybe' achievable

Encore Analytics

CPI Cum To TCPI (EAC) Trend	DQI EAC High	DQI EAC Low	TCPI (EAC)	TCPI (BAC)	DQI CV<VAC	CV Cum	VAC	BAC	EAC (F1)	EAC Delta	EAC (CALC)	Contractor PM Best Case EAC	Contractor PM Most Likely EAC	Contractor PM Worst Case EAC	IEAC CPI	IEAC Composite	IEAC CPI3	IEAC CPI6	ETC
↑	1	0	0.786	1.027	3	-2,344,35	-26,546,789	154,204,215	180,751,00	39,319	180,751,0	298,427,005	312,647,843	323,573,215	159,749,63	204,446,353	94,122,653	161,145,46	113,2
↓	0	0	0.927	1.096	2	-2,111,08	-4,017,743	39,003,028	43,020,771	1	43,020,7	298,427,005	312,647,843	323,573,215	44,570,795	65,153,276	50,061,947	45,317,020	26,12
—	1	0	0.524	1.301	0	-1,612,88	-7,937,228	22,935,219	30,872,447	-369,01	30,872,44	298,427,005	312,647,843	323,573,215	25,251,849	25,251,849	24,258,790	25,939,788	13,29

1. Which of the following definition (s) describe Forecast (EAC)?
   A. It can change based on performance to date
   B. Effort that remains plus actuals to date
   C. It is not guaranteed, looking for confidence level
   D. One time setup, it takes a lot of time to constant update
   E. Answer A, B and C are correct
   F. Answer B and C are correct

2. What can you tell me about EAC analysis in Empower
   A. There are two lines; PMB and Total Contract
   B. EAC and IEAC can be reviewed at any level
   C. Total Contract line include MR value in the Forecast calculations
   D. Answer A and C are correct
   E. All Answer are correct

3. What can you tell me about Top level analysis?
   A. When selecting the PMB, it will not include MR
   B. Technical issue with software notify PARS technical support
   C. Missing data either BCWP or ACWP
   D. None are correct

4. DOE Forecast View has the following information.
   A. Contractor provided EAC and three point estimates
   B. Independent EAC to the most common used in industry
   C. TCPI values and Trending
   D. A single field that contain the holy grail value for EAC
   E. Answers A, B and C are all correct
   F. Answers A, C and D are correct

Encore Analytics

- Cost Performance Index – The most common indicator used to analyze cost performance data. It represents the average efficiency at which work has be performed to data
- The capability of future performance significantly changing decreases as the element/contract progresses.
- CPI Cur - CPI for the current period
- CPI Cum – CPI Cumulative since inception to current period
- CPI Cum3 - CPI Cumulative three (3) periods
- CPI Cum6 – CPI Cumulative six (6) periods

CPI Cur	CPI Cum Trend	CPI Cum	CPI Cum3	CPI Cum6
2.567	↑	0.965	3.348	0.951
0.219	↓	0.875	0.730	0.852
1.000	—	0.996	1.152	0.996
1.000	—	1.084	0.000	1.013

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CPI (or Cumulative CPI): The most common indicator used to analyze cost performance data. It represents the average efficiency at which work has been performed to date. CPI stabilizes largely because it is a cumulative index. As the project progresses, monthly BCWP and ACWP have decreasing influence on the cumulative CPI. The capability of future performance to significantly alter the cumulative record of past performance decreases as the contract progresses. •

Current CPI: Another indicator used to analyze cost performance data. It represents the average efficiency that work has been performed for the current (most recent) reporting period. Unlike cumulative CPI, there is no dampening effect on the Current CPI trend as a project progresses. This is because there is no mounting backlog of historical data to overpower the most recent cost performance.

CPI Cum3 - Similar to the CPI Cumulative, except it is an average over the past three (3) periods
CPI Cum6 – Similar to the CPI Cumulative, except it is an average over the past six (6) periods

Forecast View Fields Defined

- CPI Cum to TCPI Trend – TCPI diverges from CPI trending indicator
  - Color show 'achievablity'
  - Arrow show trending information
- DQI EAC High – Triggers if CPI – TCPI > 0.10, EAC Pessimistic or High
- DQI EAC Low - Triggers if CPI – TCPI < -0.10, EAC Optimistic or Low
- TCPI to EAC and BAC – the average future cost efficiency that must be maintained to achieve EAC or EAC
- DQI CV<VAC – DQI showing that Cvcum has a 'larger negative' than the VAC. Possible overrun

CPI Cum To TCPI (EAC) Trend	DQI EAC High	DQI EAC Low	TCPI (EAC)	TCPI (BAC)	DQI CV<VAC	CV Cum
↓	0	0	0.927	1.096	2	-2,111,085
—	0	1	0.875	1.024	0	-72,154
—	0	0	0.976	1.031	1	-18,310
—	0	0	0.963	0.991	1	64,291

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CPI Cum to TCPI Trend – TCPI diverges from CPI trending indicator

DQI EAC High – Triggers if CPI – TCPI > 0.10, EAC Pessimistic or High

DQI EAC Low - Triggers if CPI – TCPI < -0.10, EAC Optimistic or Low

These two need to be reviewed, could be valid reasons why it trips based on EVMSD and project process steps.

TCPI to EAC and BAC – the average future cost efficiency that must be maintained to achieve EAC or EAC

DQI CV<VAC - DQI (True or False) 1 = True showing that Cvcum has a 'larger negative' than the VAC. Possible overrun CV Cum –

Cost Variance Cumulative – we have address this calculation in previous session

Forecast At Complete Fields Defined

- VAC- Variance at Complete = BAC – EAC (F1)
- BAC- Budget at Complete
- EAC (F1) – Reported Format 1 EAC value
- EAC Delta – EAC change from prior period
- EAC (CALC) - ACWP + Sum (Time Phase ETC Values)
- Best Case, Mostly Likely and Worst Case EAC

VAC	BAC	EAC (F1)	EAC Delta	EAC (CALC)	Contractor PM Best Case EAC	Contractor PM Most Likely EAC	Contractor PM Worst Case EAC
-4,017,743	39,003,028	43,020,771	1	43,020,771	298,427,005	312,647,843	323,573,215
-519,637	3,323,160	3,842,797	0	3,842,797	298,427,005	312,647,843	323,573,215
-33,035	5,118,749	5,151,784	0	5,151,784	298,427,005	312,647,843	323,573,215
-199,856	17,352,197	17,552,054	24,400	17,552,054	298,427,005	312,647,843	323,573,215

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These group of column data deals with EAC number based on calculated from the PMT to F1 three point estimated based on best case, most likely and worst case EACS

VAC- Variance at Complete = BAC – EAC (F1)
BAC- Budget at Complete – this value at the top lines also include MR. You will need to look at the PMB to find the BAC without MR.

EAC (F1) – Reported Format 1 EAC value

EAC Delta – EAC change from prior period

EAC (CALC) - ACWP + Sum (Time Phase ETC Values) used as secondary validation to the provided EAC (F1). If there is a delta value, further investigation is needed.

Best Case, Mostly Likely and Worst Case EAC

Independent EAC Fields Defined

- IEAC CPI – Future cost performance will be the same as past performance
- IEAC Composite – Future performance will be influenced by past schedule and cost performance
- IEAC CPI3- Future cost performance will be influenced by past 3 periods
- IEAC CPI6 - Future cost performance will be influenced by past 6 periods
- ETC and BCWR – Estimate to complete and Budget Cost Work Remaining

IEAC CPI	IEAC Composite	IEAC CPI3	IEAC CPI6	ETC	BCWR
281,713,075	342,212,998	227,349,938	286,236,886	170,805,617	147,093,507
281,713,075	342,212,998	227,349,938	286,236,886	170,805,617	147,093,507
271,070,156	327,391,424	220,461,812	275,281,512	170,805,617	136,933,943
271,070,156	327,391,424	220,461,812	275,281,512	170,805,617	136,933,943

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These IEAC are industry standard calculations of cost estimate based on the reported data and variety of performance factors to establish reasonableness for at complete cost.

An IEAC is an independently calculated forecast of the final cost of the element. I can be at the top level or anywhere in the "WBS leg.   The are numerous IEAC calculations of cost estimates based reported data and a variety of performance factors. The aim is to provide reasonableness range for at complete cost. The are several used in the DOE Dashboard, Estimate at completion based on CPI, Estimate at completion based on Composite, Estimate at completion based on CPI 3 and 6 period data.

Typically, IEAC based on CPI formulas provides the most optimistic result, EAC based on SPI CPI (Composite) provides the most pessimistic and EAC based on 3 period CPI cum provides the most likely.   These calculations are most accurate when % Complete is between 15 – 95% complete. When using the SPI CPI, it is best used between 15 – 50% complete since SPI becomes less accurate with greater % Complete.

IEAC CPI = BAC / CPIcum = ACWPcum + [BCWR / CPIcum]= Estimate at Completion

(CPI) - Future cost performance will be the same as past performance

IEAC COMPOSITE = ACWPcum + [BCWR / (CPIcum * SPIcum)] = Estimate at Completion (composite) - Future performance will be influenced by past schedule and cost performance

IEACCPI3cum = ACWP + (BCWR/CPI3) = ACWP + [(BAC − BCWPcum) / ((BCWP4 − BCWP1) / (ACWP4 − ACWP1))] = Estimate at Completion (CPI 3 Period Cum) - Future cost performance will be influenced by past 3 periods

IEACCPI6cum = ACWP + (BCWR/CPI6) = ACWP + [(BAC − BCWPcum) / ((BCWP7 − BCWP1) / (ACWP7 − ACWP1))] = Estimate at Completion (CPI 6 Period Cum) - Future cost performance will be influenced by past 6 periods

DOE Forecast Chart

- Shows performance data the last periods
- BAC (Blue) and EAC (Orange) are columns
- IEAC are displayed as lines
- Hover over each month end to display the values
- Where the Line (IEAC) intersect the Column
  - Above column – Over run
  - In the column – under run
  - Even with column - ideal

C-006 DOE Forecast (Millions)

JUN 20
- BAC: 268.92
- EAC: 298.43
- IEAC CPI: 281.71
- IEAC Composite: 342.21
- IEAC CPI3: 227.35
- IEAC CPI6: 286.24

BAC [268.92]   EAC [298.43]   IEAC CPI [281.71]   IEAC Composite [342.21]   IEAC CPI3 [227.35]   IEAC CPI6 [286.24]
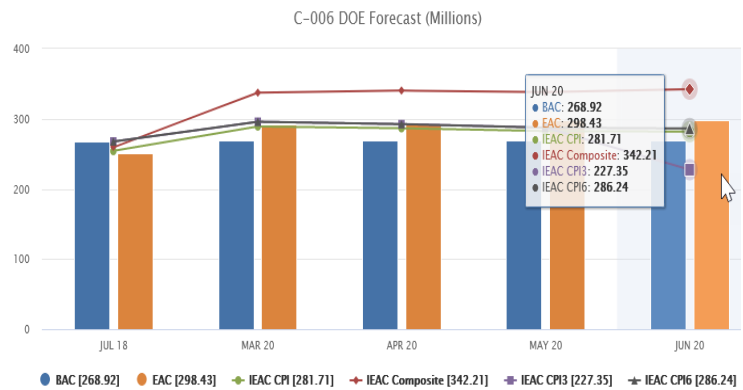
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Shows performance data the last periods, we will go over in greater detail shortly, but just want to familiarize you with the contents of the charts, as way of introduction.

BAC (Blue) and EAC (Orange) are columns

IEAC are displayed as lines

Hover over each month end to display the values

Line intersection with Column
        Above column – Over run
        In the column – under run
        Even with column - ideal

Six Period Summary – Trend Analysis

- Up to Six Period of past data represented by period (column)
- Each calculation (SPI, CPI) is shown for each period
- Many IEAC calculations are shown in the light blue section
- You will notice the 3 major DOE IEAC are included in this report
- There are others, but do your research to see if your organization will use them

Six Period Summary Report

CPI	1.052	0.930	0.939	0.952	0.955
TCPI-BAC	0.994	1.058	1.052	1.042	1.041
TCPI-EAC	1.069	0.917	0.899	0.863	0.861
BAC	267,638,869	268,918,881	268,918,881	268,918,881	268,918,881
EAC	250,902,434	291,418,374	293,590,477	298,732,298	298,427,005
VAC	16,736,435	-22,499,493	-24,671,596	-29,813,417	-29,508,124
VAC %	6.25	-8.37	-9.17	-11.09	-10.97
% SCHED	11.20	54.40	57.52	60.24	63.09
% COMP	10.95	42.19	43.24	44.52	45.30
% SPENT	10.41	45.35	46.06	46.77	47.46
CUR CPI Fcst	254,400,590	295,764,941	227,852,366	208,486,761	256,781,835
3 PER AVG Fcst	267,638,869	295,764,941	292,386,124	287,347,175	227,349,938
6 PER AVG Fcst	267,638,869	295,764,941	292,386,124	287,347,175	286,236,886
CUM CPI Fcst	254,400,590	289,034,591	286,479,606	282,509,563	281,713,075
CPI*SPI Fcst	259,508,472	337,375,346	340,203,499	337,835,481	342,212,998
MICOM Fcst	267,638,869	346,052,965	348,061,403	344,380,826	348,512,959
COST & SCH Fcst	262,668,309	304,195,690	304,472,435	302,232,595	303,501,785
PERF FACTOR Fcst	266,188,697	277,406,434	276,511,683	274,969,978	274,714,895

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The Six Period Summary Reports represents up to six periods (if available) in a tabular report. Each period is represented in a calendar description at the top of the header. The first column represent what value is being represented in the rows.

Highlighted are the rows or fields for EAC Analysis: The upper section in clear (or white) is the At Complete values and TCPI calculations section of the report. Below that section in the 'darken' section are the Independent EAC calculations, we show 8 but there are more such as User Input Forecast.

This reports shows past period calculations based on provided data. You can see changes in the AT Complete and IEAC for the last period, providing 'trending' EAC values to compare against.

Should not be on level 1 which assumes all MR is co

Checks on Learning – Forecast Fields

Legend: ● BAC [22.9] ● EAC [24.78] IEAC CPI [24.78] IEAC Composite [26.53] IEAC CPI3 [24.46] IEAC CPI6 [24.66]
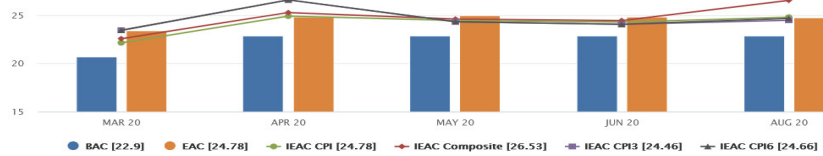
1. EAC DQI show?
   A. DQI EAC High – EAC is too pessimistic
   B. DQI EAC High – EAC is too optimistic
   C. DQI EAC Low – EAC is too optimistic
   D. DQI EAC Low – EAC is too pessimistic
   E. Answer A and C are correct
   F. Answer B and D are correct

2. What you tell me about EAC (F1) and CalcEAC?
   A. Redundant, they are always the same number
   B. EAC F1 is provide by Format 1
   C. CalcEAC has MR value
   D. CalcEAC is check field with ACWP + Sum Timephase ETC value
   E. Answer B and C are correct
   F. Answer B and D are correct

3. What can you tell me about the chart above?
   A. IEAC 3-6 show an underrun
   B. CPI cum is on track with provide EAC
   C. IEAC show overrun in the current period
   D. Answers B and C are correct
   E. All are correct

4. The DOE Forecast Dashboard has following IEAC which are standards in the industry to measure against Contractor EAC.
   A. IEAC Composite
   B. Most likely EAC
   C. IEAC CPI cum
   D. IEAC CPI6
   E. Answers A, C and D are all correct
   F. All answers are correct

BCWR to ETC analysis is looking at the work you have left (BCWR) and comparing it to the estimate that it will take to accomplish the work (ETC)

Another way to viewed TCPI (eac): BCWR/ETC

Which value is higher is really important:
>   In looking at the formula, ETC line on top (higher value) then of BCWR, will calculate a more favorable TCPI to achieved
>   A BCWR value is higher than ETC is a difficult TCPI to achieve

Monthly comparison of BCWR & ETC values, a proven indices :
>   If lines are trending <u>divergence</u>, and BCWR is higher value, then there may be not enough EAC or more funding is necessary to complete the effort
>   If lines are trending <u>converge</u>, EAC may has reasonableness attributes
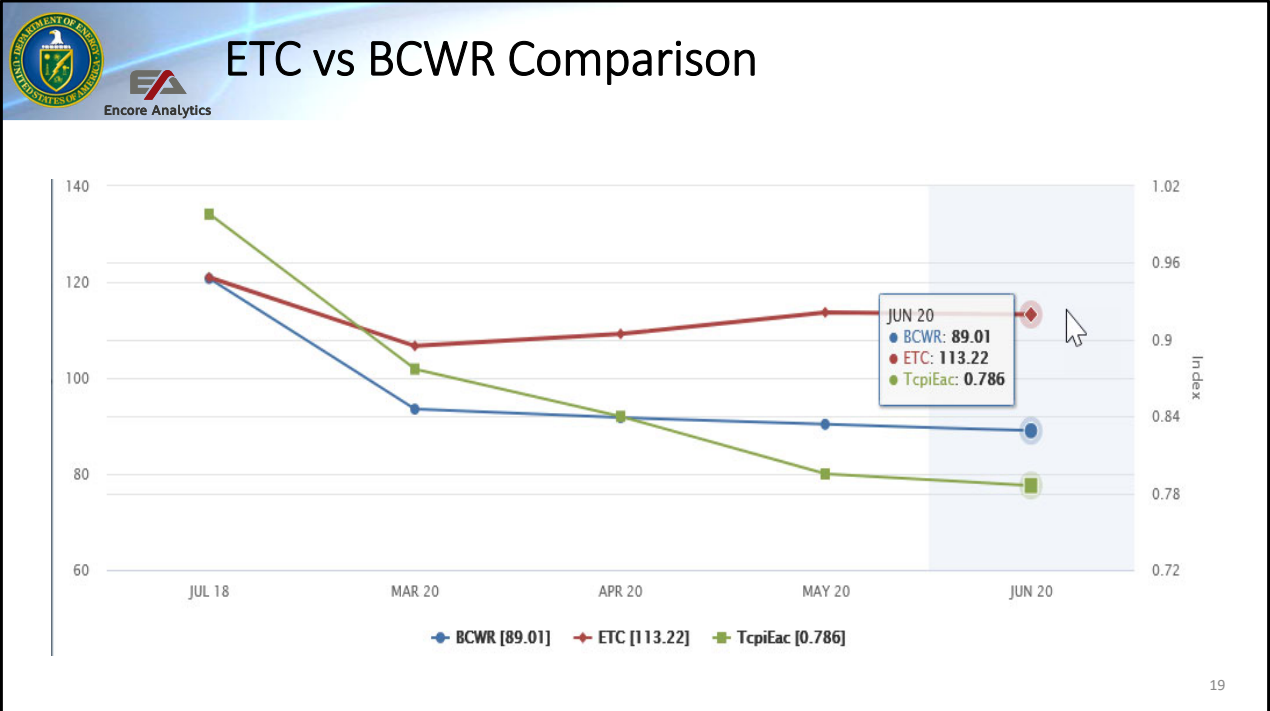
This is the ETC vs BCWR chart that also include the TCPI eac for additional analysis.

Just like most of the charts, it shows trending information very easily. In this case, the monthly comparison of BCWR & ETC values, show that:
- There is divergence happening between the BCWR and ETC. Luckily in this situation ETC is higher or "on top" of BCWR.
- Since the ETC is 'above' or higher value than the BCWR, the TCPI will much easier to be achieved.
- Why remember the formula TCPI = BCWR/ETC

CPI to TCPI Comparison

- To Complete Performance Index – TCPI, the cost efficiency index of future performance required to achieve the EAC or BAC
- Compare the CPIcum to TCPI to gauge EAC Reasonableness
- Difference of +/- .10 is an early warning indicator that EAC is not reasonable (High or Low)
- We are checking for EAC Reasonableness, not whether the CPI is under or over performing
- What is relevant is the <u>TCPI delta to the CPI</u>, not the whether the CPI is 1.0 or not
- Look for divergence from CPI – the likelyhood of achieving that cost target decreases because the gap of efficiency has widened

Before we embark into the CPI and TCPI analysis, keep in mind we are looking for EAC reasonableness. We are looking for confidence factor that the EAC provided highly likely or that it requires more investigation since there is low confidence.

To Complete Performance Index – TCPI, the cost efficiency index of future performance required to achieve the EAC or BAC

Difference of +/- .10 is an early warning indicator that EAC is not reasonable (High or Low)

We are checking for EAC Reasonableness, not whether the CPI is under or over performing

What is relevant is the <u>TCPI delta to the CPI</u>, not the whether the CPI is 1.0 or not

Look for divergence from CPI – the likehood of achieving that cost target decreases because the gap of efficiency has widened

CPI to TCPI Comparison

- TCPIeac > CPIcum indicates:
  - Efficiency required to meet EAC is greater than performance to date
  - EAC might suggest to be optimistic or some planned event will result in higher CPI
- TCPIeac < CPIcum indicates:
  - Efficiency required to meet EAC is less than performance to date
 - EAC might suggest to be pessimistic or some planned event will result in lower CPI
- TCPIeac within +/- .10 indicates realistic (shaded area)
- Look for upward trending of TCPI indicating declining performance requiring better projected performance to meet EAC
- Look for credible future performance based on past data – it may be unreasonable to have confidence that efficiency will improve significantly

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TCPI > CPIcum indicates:

    Efficiency required to meet EAC is greater than performance to date
    EAC might suggest to be optimistic or some planned event will result in higher CPI

TCPI < CPIcum indicates:

    Efficiency required to meet EAC is less than performance to date
    EAC might suggest to be pessimistic or some planned event will result in lower CPI

TCPI within +/- .10 indicates realistic (shaded area), or higher level confidence

Look for upward trending of TCPI indicating declining performance requiring better projected performance to meet EAC

Look for credible future performance based on past data – it may be unreasonable to have confidence that efficiency will improve significantly

CPI to TCPI(eac) Comparison
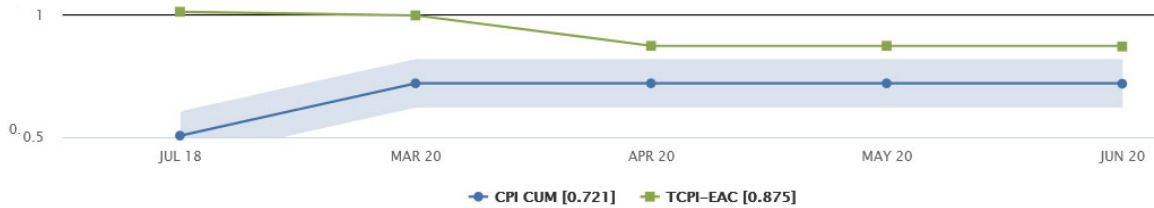
ITEM	JUL 18	MAR 20	APR 20	MAY 20	JUN 20
CPI	0.506	0.721	0.721	0.721	0.721
TCPI-BAC	1.019	1.024	1.024	1.024	1.024
TCPI-EAC	1.015	1.000	0.875	0.875	0.875
BAC	4,591,284	3,323,160	3,323,160	3,323,160	3,323,160
EAC	4,608,536	3,395,314	3,842,797	3,842,797	3,842,797

This chart is a bit different that other, it will not return a pass or fail result. Instead, it either increases or decreases the confidence in the projected accuracy of the EAC based on how close, within the TCPIeac line is in the shaded area and how close it is to CPI line

The top chart element will reflect an 'optimistic' EAC based on the formula EAC – TCPIeac < -0.10 The estimate implies an expected increase in cost efficiency by over -0.154 for the remainder of the effort. This is an example of an element that will need further investigation into the reasonableness of the forecast.   Another words, little confidence in the EAC as it likely too low.

The bottom reports shows the same data, but in tabular format using the Six Period Summary Report. This report will display the same timeline but with the EAC displayed for the last six periods.

CPI to TCPI(eac) Comparison
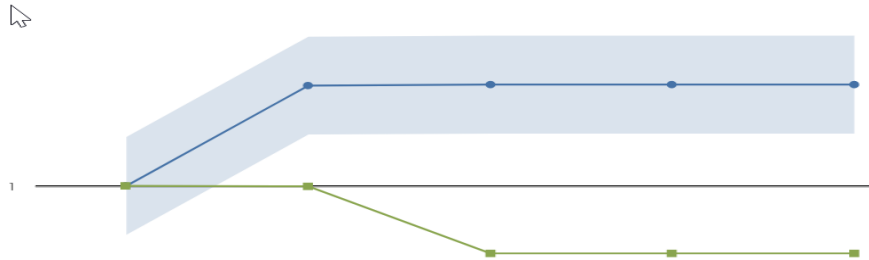
ITEM	JUL 18	MAR 20	APR 20	MAY 20	JUN 20
CPI	1.000	1.205	1.207	1.207	1.207
TCPI-BAC	1.000	0.999	0.999	0.999	0.999
TCPI-EAC	1.000	0.999	0.862	0.862	0.862
BAC	4,094,578	4,214,489	4,214,489	4,214,489	4,214,489
EAC	4,094,578	4,214,489	4,885,714	4,885,714	4,885,714

This chart is a bit different that other, it will not return a pass or fail result. Instead, it either increases or decreases the confidence in the projected accuracy of the EAC based on how close, within the TCPIeac line is in the shaded area and how close it is to CPI line

The chart is showing a 'Pessimistic' EAC. The estimate implies an expected drop in cost efficiency by greater than 0.10 or more for the remainder of the effort. Low confidence in the EAC reasonableness of the estimate, indicates that the EAC is too high.

One last point, if the TCPI were in the 'shaded area' meaning it is within the ABS |0.10| , the EAC would be considered in range. Another words, the downstream cost efficiency is in line with efficiency that has been demonstrated to date. Keep in mind, while this does not guarantee the accuracy of the project EAC, it does increase confidence.

IEAC to EAC Comparison

- DOE uses three IEAC formulas:
  - IEAC based on CPIcum
  - IEAC based on a composite
  - IEAC based on 3 and 6 period CPI
- Typically the IEAC based on
  - CPIcum provide the most optimistic
  - Composite provides the most pessimistic
  - CPI 3 period and sometime 6 period provide the most likely
- They are most accurate between 15 – 95% complete
- Compare the provided EAC to the IEAC for validity, reasonableness and currently updated

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IEAC can be used as a 'sanity check' of the element's EAC. It is calculated based on historical efficiencies and without any influence from subjective variables.

Keep in mind that lots of organization look review IEAC at the top level, Empower has calculated all the way to lowest level, some like to analyze at the CA level.

DOE uses three IEAC formulas, they are common and highly utilized within the EVM community.

> IEAC based on CPIcum – if this is the 'best case', if the EAC below this value, it should spark some question and tremble a bit of the confidence of the EAC reasonableness

> IEAC based on a composite - this is typically the worst case scenario and if the EAC is higher than this value, the likelihood of overrun has increased. Further investigation into the EAC will be needed.

> IEAC based on 3 and 6 period CPI - Has recent cost efficiency in the last 3 -6 months been significantly better or worse than cumulative performance? Are

these more realistic or 'most likely' scenario going forward and more in line with the EAC?

Keep in mind that this IEAC are most accurate between 15 – 95% complete.

Which EAC to use where content from a white paper written by Dave Kester and Zac West.

Research conducted by David Christensen at the Air Force Institute of Technology (AFIT):
- composite method is more useful earlier in the project (prior to 40% complete), but can still be useful through the 80% completion mark.
- The CPI cum method is best used starting at the 40% completion mark to the end of the project, with the likelihood that the composite and CPI cum methods diverge towards the later stages in a project's lifecycle.
- The CPI 3-month average and 6-month average formulae are better in the middle stages of a project's lifecycle as work scope begins to accelerate.
- These and other IEAC formulae are a key feature in the Project Assessment and Reporting System (PARS) Empower Analytics tool.
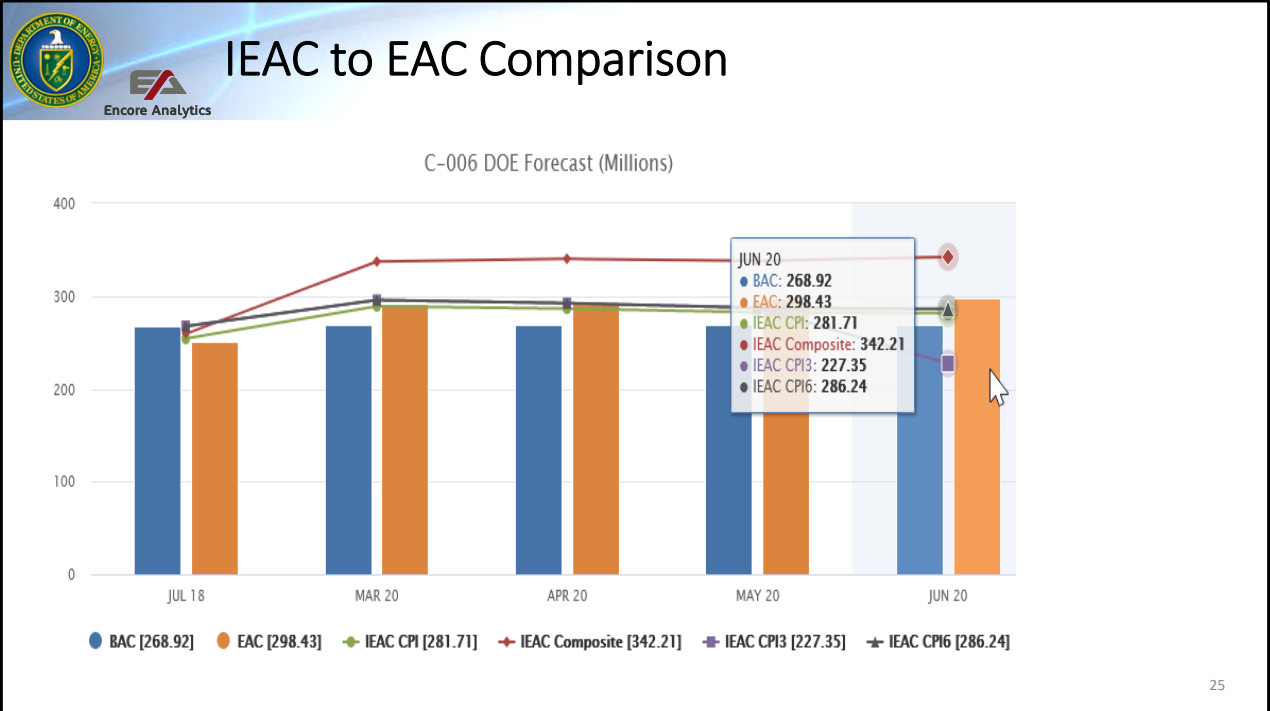
Compare the provided EAC to the IEAC for validity, reasonableness and if it was currently updated.

IEAC based on CPIcum – if this is the 'best case', if the EAC below this value, it should spark some question and tremble a bit of the confidence of the EAC reasonableness

IEAC based on a composite - this is typically the worst case scenario and if the EAC is higher than this value, the likelihood of overrun has increased. Further investigation into the EAC will be needed.

IEAC based on 3 and 6 period CPI - Has recent cost efficiency in the last 3 -6 months been significantly better or worse than cumulative performance? Are these more realistic or 'most likely' scenario going forward and more in line with the EAC? Notice the downward swing on the IEAC CPI3, is this just this period or should this be expected in the future?

IEAC to EAC Comparison

Six Period Summary Report

CPI	1.052	0.930	0.939	0.952	0.955
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% COMP	10.95	42.19	43.24	44.52	45.30
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PERF FACTOR Fcst	266,188,697	277,406,434	276,511,683	274,969,978	274,714,895

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The Six Period Summary Report provides another perspective to the same data we observed in the slide. In this case it has some additional data such:
- Is the % complete within the 15 – 95% range?
- I can see a correlation between better performance of the CPI in the recent 4 months that lowering of IEAC calculations, that should be expected. However, I do not see that reflected in the EAC provided by the contractor. I should with the improvement of CPI, should I expect a lower EAC in the future?

With all that in mind, I would think the EAC is reasonable, right? But like Columbo used to say, "just one more question", why is the IEAC Composite getting higher? Well not shown in the screen but SPI is moving from .77 to .71 during the same period that CPI been improving. Doing some additional cross checking from prior lessons, I noticed the BEI has been steady below .95 and SV has been increasing. Probably need to investigate the BCWS Volatility report for a stable baseline. Then look at the schedule for what activities are not being completed.   My confidence level for EAC reasonableness is now less until further investigation is done.

CV to VAC Comparison

- VAC is the forecast of what the variance, specifically the cost variance will be upon the completion
- When the CV < VAC, it indicates the CVcum is more 'negative' or larger overrun than the project VAC
- It is a projection which assumes that whatever conditions caused the CV today, will result in a variance position in the future
- This condition indicates that the EAC has not been updated to reflect an overrun
- Another concern is negative CV and positive VAC
- Flag elements with CV different color than VAC, especially those with a red CV and green VAC

DQI CV<VAC	CV Cum	VAC
1		
1	-27,670	-572
1	-65,684	-40,262
1	-1,115,163	-902,772
1	-1,208,670	-0

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VAC is the forecast of what the variance, specifically the cost variance will be upon the completion

When the CV < VAC, it indicates the CVcum is more 'negative' or larger overrun than the project VAC

It is a projection which assumes that whatever conditions caused the CV today, will result in a variance position in the future

Typically this comparison formula is used for a negative resultant

This indicates that the EAC has not been updated to reflect an overrun

Another concern is negative CV and positive VAC
What is going to happen between now to complete that VAC will be positive?

Flag elements with CV different color than VAC, especially those with a red CV and green VAC

Forecast questions to consider

- Some useful questions to ask:
  - Has anything they learned changed their opinion/assumptions on how hard it will be to finish the effort?
  - What factors might be causing future cost efficiency to differ from what has been demonstrated to date? Resources? capacity, technology, plan?
  - If CPI < 1 and TCPI >1, are future ETC being shrunk to artificially project meeting target EAC?
  - If the CPI to TCPI values diverging or converging over time?
  - What factors might be causing the calculated IEAC to be significantly different than EAC? Probable Risk or Opportunities?

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Some useful questions to ask:

Has anything they learned changed their opinion/assumptions on how hard it will be to finish the effort?

What factors might be causing future cost efficiency to differ from what has been demonstrated to date? Resources? capacity, technology, plan?

If CPI < 1 and TCPI >1, are future ETC being shrunk to artificially project meeting target EAC?

If the CPI to TCPI values diverging or converging over time?

Checks on Learning – Forecast Analysis

1. What you tell me about the EAC Realism Chart to the right?
   - A. The past 5 periods the EAC was optimistic
   - B. The past 5 periods were projecting a higher CPI, which happened
   - C. There is confidence in the current provided EAC since it is the 'shaded' area
   - D. Downward trending TCPI shows improvement in CPI
   - E. Answer A and C are correct
   - F. Answer A, C and D are correct
   - G. All answers are correct

2. Looking at the View to the right, the following is true for 5.05.40.03?)
   - A. TCPI recently diverged from CPI
   - B. TCPI efficiency is achievable but getting worse
   - C. EAC DQI shows Optimistic EAC
   - D. EAC has not been updated to reflect an overrun
   - E. Answer A, C and D are correct
   - F. All are correct

3. What are several techniques to screen the large volume of data so you can focus on key EAC driving elements ?)
   - A. Filter for Red conditions on the CPI cum to TCPI Trend field
   - B. Look for large BCWR and % complete between 15 -95%
   - C. All data is important, you do not want to miss anything
   - D. Filter for DQI EAC High or Low
   - E. Answer A, B and D are correct
   - F. All are correct

CPI CUM [1.063]   TCPI–EAC [1.03]

WBS	CPI Cum To TCPI (EAC) Trend	DQI EAC High	DQI EAC Low	TCPI (EAC)	TCPI (BAC)	DQI CV<VAC
5.05.40.01	↓	0	0	0.925	2.791	3
5.05.40.02	↑	0	0	1.011	0.960	6
5.05.40.03	↓	1	0	0.966	0.723	1
5.05.40.04	↓	1	0	0.772	0.604	0

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