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Case Study Enhancements Tracking

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Summary

This Case Study demonstrates the application of the **Enhancement Tracking** workflow to track and evaluate the benefits of executed enhancements using the **E&P Portal**.

The Study is based on the enhancement campaign implemented in an oil field located in Siberia, Russia. The campaign included such enhancements as fracturing, installing and upgrading the ESPs, choke opens and resulted in **4 mln bbl** of incremental oil recovery (**IOR**).

It is shown how to:

- Input the required data to the E&P Portal;
- Apply the Enhancement Tracking workflow to track and benchmark enhancements;
- Save and export the analysis results.
- All the input data is attached to the Case Study for the reference.



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Introduction

E&P Portal is a service to identify production enhancement opportunities and maximize production and recovery. The average production increase for the last 3 E&P companies applied the **E&P Portal** was 38%.

Enhancement Tracking is a workflow to assess the benefits achieved by executed Enhancements (Martins, MacDonald, Stewart, & Phillips, 1995). The workflow answers those questions:

- What is the campaign total incremental oil recovery (IOR) vs total cost?
- Which enhancement campaign has better \$/bbl performance?
- Which well has better **\$/bbl** performance?
- What is the **IOR** for each enhancement?

Enhancement is a well intervention to close the performance gap of the well. The typical enhancements are (From most **\$/bbl** effective to least):

- Choke open
- Pump Optimization
- ESP (converting the flowing well to ESP; upgrading the ESP etc)
- Acid Job
- Reperforation
- Frac
- Multistage Frac
- Sidetrack
- Drilling New Well



Figure 1 . Enhancement example: Converting the Flowing well to the ESP

Each Enhancement is tracked by calculating it's enhancement IOR.

Scorpion Plot is used for graphical representation of the Enhancements performance.

Enhancement Tracking is available at the E&P Portal as one of its engineering workflows. To get the access to the Enhancement Tracking tool please sign up at <u>ep.pengtools.com</u>. The accesses is free for the personal use.

Enhancement IOR and Scorpion Plot





Figure 2 . Calculating enhancement IOR

Decline Curves are used to model base (pre job) and enhanced (post job) well rates. The **Scorpion plot** (Figure 3) graphically illustrates total program split by individual events and ranked by success. The curve initiates from the origin at a low scope (low \$/bbl) and increasing until running to a vertical asymptote (money spent with no gain in production) and possibly even a negative portion (money spent and production lost as a result of the intervention). This effectively displays program performance (\$/bbl), total volume, total cost, and success rate (Nguyen, 2006).



Figure 3 . Scorpion Plot

More details on math and physics of the **Enhancement Tracking** are published on wiki at https://wiki.pengtools.com/index.php?title=Enhancement Tracking



Field and Reservoir Data

The "Huron" ¹ field has 14 wells drilled from pad "1", completed and producing form the reservoir "1" (Figure 1).



Figure 4 . Huron field production history in the E&P Portal

Well locations are shown on the bubble map showing cumulative production and injection:



Figure 5 . Huron field bubble map in the E&P Portal

¹ Note that the well, reservoir, field names as well as well production data, dates, costs were changed for the purpose of this study



The reservoir "1" data is given below:

STOIIP		63 MMstb
Connate water saturation	Sw	13 %
Rock compressibility	cr	4.08E-6 psia ⁻¹
Initial reservoir pressure	Pi	3700 psia
Initial reservoir temperature	Ti	100 F
Oil density		40 API
Bubble point pressure	Pb	3700 psia
Solution gas ratio	Rs	2007 scf/bbl
Gas specific gravity	SGgas	0.8
Water specific gravity	SGwater	1.1

Table 1 . Reservoir "1" data.



Enhancement Campaign Data

24 well enhancements were executed in the "Huron" field in 3 campaigns:

- 1. Choke Open campaign (4);
- 2. ESP campaign (13);
- 3. Frac campaign² (7).

Each well enhancement has the following data filed (Figure 6):

- Date
- Type of enhancement (campaign)
- Cost in USD
- Well Stop Date (actual and planned)
- Well Start Date (actual and planned)
- Enhancement design report
- Well Production Forecast

												PL	AN	ACT	UAL
	Country	Field	Pad	Well	Date Ja	Flag	Туре	Plo	tDescriptionReport	Cost	Production Forecast	Well Stop Date	Well Start Date	Well Stop Date	Well Start Date
				_						USD					
	*	*		*		*	*								
1	United States	Huron	1	9	2018-06-22	Actual	ESP	۲	ESP upgrade to GN10000	75000	Frac campaign(2013-01-01)	2018-06-12	2018-06-30	2018-06-12	2018-06-30
1	United States	Huron	1	5	2018-05-24	Actual	ESP	۲	upgrade to GN6200	65000	ESP campaign(2013-01-01)	2018-05-21	2018-05-28	2018-05-21	2018-05-28
1	United States	Huron	1	4	2018-05-16	Actual	ESP	0	ESP upgrade to GN6200	75000	ESP campaign(2013-01-01)	2018-05-12	2018-05-21	2018-05-12	2018-05-21
1	United States	Huron	1	14	2018-03-01	Actual	Frac	0	good 80 ton	480000	Frac campaign(2013-01-01)	2017-08-20	2018-03-07	2017-08-20	2018-03-07
1	United States	Huron	1	9	2018-02-03	Actual	Frac	0	nice 130 ton	550000	Frac campaign(2013-01-01)	2018-01-28	2018-02-14	2018-01-28	2018-02-14
1	United States	Huron	1	4	2017-11-11	Actual	ESP	0	DN4300	65000	ESP campaign(2013-01-01)	2017-11-09	2017-11-17	2017-11-09	2017-11-17
1	United States	Huron	1	3	2017-09-06	Actual	Frac	0	56 tons	300000	Frac campaign(2013-01-01)	2017-08-26	2017-09-17	2017-08-26	2017-11-10
	United States	Huron	1	4	2017-06-19	Actual	Choke Oper	•	Choke size changed from 22 mm to 65 mm	100	Choke campaign(2013-01-01)	2017-06-19	2017-06-19	2017-06-19	2017-06-19
1	United States	Huron	1	6	2017-06-18	Actual	ESP	0	ESP upgrade	60000	ESP campaign(2013-01-01)	2017-06-18	2017-06-21	2017-06-18	2017-06-21
1	United States	Huron	1	6	2017-01-13	Actual	ESP	0	3000 bbl/d	55000	ESP campaign(2013-01-01)	2017-01-11	2017-01-16	2017-01-11	2017-01-16
1	United States	Huron	1	5	2016-10-29	Actual	ESP	0	upgrade to 3000 bbl/d ESP	40000	ESP campaign(2013-01-01)	2016-10-23	2016-11-07	2016-10-23	2016-11-07
1	United States	Huron	1	11	2016-05-24	Actual	Frac	۲	50 ton + 20 m3	350000	Frac campaign(2013-01-01)	2016-05-24	2016-06-16	2016-05-24	2016-06-16
1	United States	Huron	1	5	2016-05-11	Actual	ESP	0	2500 bbl/d	35000	ESP campaign(2013-01-01)	2016-05-08	2016-05-10	2016-05-08	2016-05-14
1	United States	Huron	1	10	2016-04-24	Actual	Frac	۲	50 ton frac no	350000	Frac campaign(2013-01-01)	2016-04-24	2016-04-24	2016-04-24	2016-04-24
1	United States	Huron	1	3	2016-02-07	Actual	ESP	0	ESP	50000	ESP campaign(2013-01-01)	2016-02-02	2016-02-12	2016-02-02	2016-02-12
1	United States	Huron	1	11	2016-01-20	Actual	Frac	0	20 ton frac	250000	Frac campaign(2013-01-01)	2015-12-12	2016-02-02	2015-12-12	2016-02-02
1	United States	Huron	1	4	2016-01-12	Actual	Frac	0	15 ton	200000	Frac campaign(2013-01-01)	2016-01-10	2016-03-16	2016-01-10	2016-03-16
1	United States	Huron	1	8	2015-12-15	Actual	ESP	0	1000 bbl/d ESP	25000	ESP campaign(2013-01-01)	2015-12-11	2015-12-22	2015-12-11	2015-12-22
1	United States	Huron	1	14	2015-08-01	Actual	ESP	0	1000 bbl/d	30000	ESP campaign(2013-01-01)	2015-07-28	2015-08-10	2015-07-28	2015-08-10
	United States	Huron	1	5	2015-01-29	Actual	Choke Oper	0	choke full open	1	Choke campaign(2013-01-01	2015-01-29	2015-01-29	2015-01-29	2015-01-29
1	United States	Huron	1	6	2014-09-24	Actual	Choke Oper	1 💿	45 to 55 mm	1000	Choke campaign(2013-01-01	2014-09-24	2014-09-24	2014-09-24	2014-09-24
	United States	Huron	1	13	2014-06-16	Actual	ESP	۲	1000 bbl/d ESP	35000	ESP campaign(2013-01-01)	2014-06-15	2014-06-19	2014-06-15	2014-06-19
1	United States	Huron	1	5	2014-04-20	Actual	Choke Oper			5000	Choke campaign(2013-01-01	2014-04-20	2014-04-20	2014-04-20	2014-04-20
	United States	Huron	1	9	2013-10-11	Actual	ESP	۲	3000 bbl/d ESP	45000	ESP campaign(2013-01-01)	2013-10-10	2013-10-16	2013-10-10	2013-10-21
Total										3141101					

Figure 6. Wells Enhancement data in the E&P Portal

In the next section as an example well "9" enhancements are reviewed in detail.

² The ESP is installed after the frac job by default. The frac cost includes the cost of the frac itself and the cost of installed ESP.



Well 9 Enhancements

There are 3 enhancements done in Well "9":

- 1. Flowing well was converted to the ESP (before / after points 1 and 2);
- 2. Damaged well was fractured (before / after points 3 and 4);
- 3. Limited capacity ESP was upgraded (before / after points 4 and 5).

The enhancements are shown on the plot below:



Figure 7. *Well "9" history plot with enhancements in the E&P Portal*



The well "9" performance is shown on the PQplot below:

Figure 8 . Well "9" <u>PQplot</u> with before and after enhancement performance points

Below are details on each enhancement done.



Enhancement 1. Converting the flowing well to the ESP

Soon after well startup the well's flowing data was gathered and well performance was analyzed with <u>PQplot</u> (Figure 8 point 1). It was quickly realized that well is not working at potential (Q~2400 bbl/d) and where potential is (unstimulated well AOF~3800 bbl/d).

To close the performance gap ESP enhancement was designed. The maximum capacity ESP available at that moment was targeting ql=3000 bbl/d at Pwf ~ 1300 psi (Figure 9).



Figure 9. Well "9" ESP design with the <u>PumpDesign</u> tool

The pump design report is attached as:

Attachment 1"Huron 9 Pump Design Report.pdf".

The well was converted to a 5000 bbl/d ESP and started with enhanced performance shown as "point 2" on Figure 8.

The incremental oil recovery reached by this enhancement is **192,623 bbl** at cost of **\$45,000** which is **0.23 USD/bbl** (Figure 40).



Enhancement 2. Fracing the damaged well

After about 2 years of production well "9" was damaged during the workover and left behind for about 2 more years (Figure 8 point 3).

As soon as frac campaign was started the 290000 lbm (130 ton) frac enhancement was designed. Given the maximum permeability proppant 16/20 available at the moment the design target was JD=0.32 which is about 100 folds of productivity increase (Figure 10).



Figure 10 . Well "9" frac design with the <u>optiFrac</u> tool

The frac design report is attached as:

Mattachment 2"Huron 9 Frac Design Report.pdf".

The well "9" was fraced and started with new performance (Figure 8 point 4).

About 20 folds of productivity increase was achieved in this high permeability (~200md) sand (purple point on the frac design Figure 10 shows the achieved vs planned JD).

The incremental oil recovery reached by this enhancement is **399,903 bbl** at cost of **\$550,000** which is **1.38 USD/bbl** (Figure 46).



Enhancement 3. ESP upgrade

Soon after the fraced well flowing data was gathered well performance was reevaluated. It was realized that current ESP capacity is not enough to reach the well potential and ESP needs to be upgraded to the bigger one.

To close the performance gap ESP upgrade enhancement was designed The maximum capacity ESP available at that moment was targeting ql=5300 bbl/d at Pwf ~ 1450 psi (Figure 11).



Figure 11 . Well "9" ESP upgrade design with the <u>PumpDesign</u> tool

The pump design report is attached as:

Attachment 3"Huron 9 ESP upgrade Report.pdf".

The well was converted to a 10000 bbl/d ESP and started with new performance (Figure 8 point 5).

The incremental oil recovery reached by this enhancement is **87,814 bbl** at cost of **\$75,000** which is **0.85 USD/bbl** (Figure 52).



Data Input to the E&P Portal Signing up

First open <u>ep.pengtools.com</u> in your browser and signup or login to the **E&P Portal**.



Figure 12 . E&P Portal landing page

After signing up /logging in you'll see the main **E&P Portal** page:



Figure 13 . Main page of the E&P Portal



Check the units in the page footer to be "Field".



Figure 15. Current database in the main page footer

Now you are ready to start entering the data into the E&P Portal



Adding the "Huron" field

In the left menu open the "Fields" page of the "Subsurface" module:

				ep.	pengto	ols.com		🔁 About -	🚔 pengtools.com 👻
O Dashboard	Field	Well	Pad	Shop	Operator	License Area	Upload Wells		
Field Production +									
Surface Facilities +	Home /	Fields							
Sales Reports +									
» Field	Field	lS							
» Well	Create Fie	eld							
» Deviation Surveys									
» Perforations	Showing 1	1-11 of 11	items.						
» Well Logs Interpretations									
» BHP & Pres				Fie	əld		License	Area	Operato
» kh & JD									

Figure 16. Fields page of subsurface module of the E&P Portal

Click "Create Field", fill the form as follows and click "Create":

		eŗ	o.per	ngtoc	ols.com	
O Dashboard						
Well Production +	Field	Well	Pad	Shop	Operator	Licens
Field Production +						
Surface Facilities +	Home / I	Fields /	Create F	ield		
Sales Reports +						
Subsurface -	Croo	to D		4		
» Field	Grea	ler		J		
» Well	Field					
» Deviation Surveys	Huron					
» Perforations						
» Well Logs Interpretations	License A	rea				
» BHP & Pres	Select L	A				*
» kh & JD	Operator					
Dispatcher Office	operator					
Downhole +	Select o	perator				v
Equipment and Artificial Lift	Country					
Drilling +	Select o	ountry				*
Well Enhancement + List	Create	١				
Engineering Tools +	Create					

Figure 17. Creating the "Huron" field in the E&P Portal

Now you have successfully added the "Huron" field to the E&P Portal:



Adding the Huron pad "1"

In the left menu open the "Fields" page of the "Subsurface" module and click "Pad":

	e	ep.pengtoo	ols.com		🕄 About 🗸
O Dashboard Well Production +	Field Wel	Pad Shop	Operator	License Area	Upload Wells
Field Production + Surface Facilities +	Home / Fields				
Sales Reports + Subsurface - » Field	Fields				
» Well » Deviation Surveys	Create Field				

Figure 18.Pad page of subsurface module of the E&P Portal

Click "Create Pad", fill the form as follows and click "Create":

		eŗ	o.pei	ngtoc	ols.com		🔁 About -
© Dashboard Well Production+	Field	Well	Pad	Shop	Operator	License Area	Upload Wells
Field Production + Surface Facilities +	Home /	Pads / (Create Pa	ad			
Sales Reports + Subsurface + Dispatcher Office	Crea	te F	Pad				
Downhole + Equipment and Artificial Lift	Pad						
Drilling + Well Enhancement + List	Shop					J	
Engineering Tools + Reservoir + Management	Field						
Mature Water Flood + Analysis	Huron				×	Ŧ	
Production Forecast	Create						

Figure 19. Creating the pad "1" in the E&P Portal

Now you have successfully added the pad "1" field to the E&P Portal:



Uploading Huron wells

In the left menu open the "Well" page of the "Subsurface" module and click "Upload Wells":

		ep	.per	igtoo	ls.com		🕄 About -			
Dashboard Well Production +	Field	Well	Pad	Shop	Operator	License Area	Upload Wells			
Field Production + Surface Facilities +	Id Production + rface Facilities + Home / Wells									
Sales Reports + Subsurface - » Field	Sales Reports + Subsurface • Wells									
» Well » Deviation Surveys	Create We	ell 🚯	Wiki it							

Figure 20. Well page of Subsurface module of the E&P Portal

Fill the form as follows and click "Upload". The well list as attached as:

Attachment 4"Huron wells.csv".

		eŗ	p.pe	ngtoo	ols.com		🖯 Abo	out -	-
O Dashboard Well Production +	Field	Well	Pad	Shop	Operator	License Area	Upload Wells		
Field Production + Surface Facilities +	Upload								
Sales Reports + Subsurface +	File Choose File	Huron V	Vells.csv						
Dispatcher Office Downhole + Equipment and	Update Ty	pe							Ţ
Artificial Lift Drilling +	File Heade	NF .						×	Ľ
Well Enhancement + List	File with	header						×	•
Reservoir +	File Colum	nns Map							
Management	#01 col	Field					\$		
Mature Water Flood + Analysis	#02 col	Pad					¢		
Production Forecast +	#03 col	Well					\$		
Enhancements Tracking	#04 col						\$		
⇔ Calculator +	#05 col						\$		
¢ Admin +	#06 col						¢		
	#07 col						¢		
	#08 col						\$		

Figure 21. Creating the well "8" in the E&P Portal

Wait for the message showing the data upload status:

		ep	.per	igtoo	ls.com		🕒 About 🗸	🚔 pengtools.com 👻
O Dashboard	Field		Ded	Ohan	Oranta			
Well Production +	Field	vveii	Pad	Snop	Operator	License Area	Upload wells	
Field Production +								
Surface Facilities +	14 rows r	ead from	file					
Sales Reports +	Time elap	sed 1 (46	6.5 Mb) s	ec				~
Subsurface +			,					
Dispatcher Office								

Figure 22. Successful wells upload message

Now you have successfully added Huron wells to the E&P Portal:



E&P Portal. Case Study Enhancements Tracking

		ep	o.peng	tool	s.com			0 About	- 🖻 pe	ingtools	.com +	🌣 Settings	👤 MishaT 🗸	⊖ Support -	🏴 Language 👻		
Dashboard Well Production + Field Production +	F	ield Well	Pad	Shop	Operator	License	Area Uş	pload Wells									
Surface Facilities + Sales Reports +	Hor	ne / Wells															
Subsurface	W	ells															
* Well * Deviation Surveys	Crea	ite Well 🚺 🚯	Wiki it														
 Perforations Well Logs 	Sho	ving 1-14 of 14	4 items.												Expo	rt table data: i≣	<u>A</u> -
Interpretations » BHP & Pres		Well 12	Pad	Shop	Field	Operator	License Area	Country	Well Type	Status	Status Type	Deviation Type	Operation Type	Username	Created At	Updated At	
» kh & JD					Hungen 🔻		*	· · · ·		*							
Dispatcher Office	1	1	1		Huron			United States	Change	Change	Change		Change	Mikhail Tuzovskiy	2018-07-26 10:16:28+00	2018-07-26 10:16:28+0	10 💉 🏛
Downhole +	1	10	1		Huron			United States	Change	Change	Change		Change	Mikhail Tuzovskiy	2018-07-26 10:16:28+00	2018-07-26 10:16:28+0	10 💉 🏦
Artificial Lift	1	11	1		Huron			United States	Change	Change	Change		Change	Mikhail Tuzovskiy	2018-07-26 10:16:28+00	2018-07-26 10:16:28+0	0 💉 🏦
Drilling +	1	12	1		Huron			United States	Change	Change	Change		Change	Mikhail Tuzovskiy	2018-07-26 10:16:28+00	2018-07-26 10:16:28+0	0 💉 🏦
Well Enhancement + List	1	13	1		Huron			United States	Change	Change	Change		Change	Mikhail Tuzovskiy	2018-07-26 10:16:28+00	2018-07-26 10:16:28+0	JO 💉 🏦
Engineering Tools +	1	14	1		Huron			United States	Change	Change	Change		Change	Mikhail Tuzovskiy	2018-07-26 10:16:28+00	2018-07-26 10:16:28+0	JO 💉 🏦
Reservoir +	1	2	1		Huron			United States	Change	Change	Change		Change	Mikhail Tuzovskiy	2018-07-26 10:16:28+00	2018-07-26 10:16:28+0	JO 💉 🏛
Mature Water Flood +	1	3	1		Huron			United States	Change	Change	Change		Change	Mikhail Tuzovskiy	2018-07-26 10:16:28+00	2018-07-26 10:16:28+0	JO 💉 🏦
Anatysis	1	4	1		Huron			United States	Change	Change	Change		Change	Mikhail Tuzovskiy	2018-07-26 10:16:28+00	2018-07-26 10:16:28+0	JO 💉 🏦
Production Forecast+	1	5	1		Huron			United States	Change	Change	Change		Change	Mikhail Tuzovskiy	2018-07-26 10:16:28+00	2018-07-26 10:16:28+0	JO 💉 🏦
Tracking	1	6	1		Huron			United States	Change	Change	Change		Change	Mikhail Tuzovskiy	2018-07-26 10:16:28+00	2018-07-26 10:16:28+0	JO 💉 🏦
Calculator +	1	7	1		Huron			United States	Change	Change	Change		Change	Mikhail Tuzovskiy	2018-07-26 10:16:28+00	2018-07-26 10:16:28+0	JO 💉 🏦
¢ Admin +	1	8	1		Huron			United States	Change	Change	Change		Change	Mikhail Tuzovskiv	2018-07-26 10:16:28+00	2018-07-26 10:16:28+0	JO 💉 🍿
	1	9	1		Huron			United States	Change	Change	Change		Change	Mikhail Tuzovskiy	2018-07-26 10:16:28+00	2018-07-26 10:16:28+0	10 💉 🏛

Figure 23. Huron wells in the E&P Portal



Upload the Huron wells daily production data

In the left menu open the "Daily Data" page of the "Well Production" module and click "Upload":



Fill the form as follows and click "Upload". ells daily production data is attached as:

Attachment 5"Huron wells daily measures.csv".

		ep.pengtools.com	8 Abor	սե~ 🚔 բ	bengtools.com + 🌣 Settings 🛔 MishaT + 🎧 Support + 🏼 🛤 Language +
O Dashboard Well Production +	Plot	Table Compare Wells Upload			
Field Production + Surface Facilities + Sales Reports + Subsurface + Dispatcher Office Downhole + Equipment and Artificial Lift Drilling +	Upload File Choose File Update Ty Do not o File Heade	Huron WellsMeasures.cev pe verwrite r		×	Wiki Info Brief Daily Measures are uploaded to the E&P Portal here @. Workflow
Well Enhancement + List	File with	header		×	1. Prepare a csv file with the data
Engineering Tools +	File Colum	ins Map			 csv file example in METRIC units UploadDailyMeasuresMETRIC.csv csv file example in FIELD units UploadDailyMeasuresFIELD.csv
Management	#01 col	Field	\$		2. Select the file in the dialog
Mature Water Flood + Analysis	#02 col	Well	\$		 Chose the Upload type (Merge / Do not overwrite) Select the File header (File with header / File without header)
Production Forecast	#03 col	Date	\$		5. Select the columns you want to upload 6. Check the units
☆ Calculator + ☆ Admin +	#04 col	Uptime	¢ 1	h	7. Click upload
	#05 col	Liquid Production Volume	¢ 1	bbl	In case you have issues contact us at support@pengtools.com
	#06 col	Oil Production Volume	¢ 1	Idd	Demoised a channel
	#07 col	Water production Volume	¢ 1	Idd	Required columns
	#08 col	Gas Production Volume	¢ 1	MMscf	Field Well
	#09 col	Water Injection Volume	¢ 1	Idd	Date Mell Listime
	#10 col	PIP	¢ ,	psia	• The Optime
	#11 col	P Tub	¢ ;	psia	Quick select last templates
	#12 col	P Ann	¢ ;	psia	Once you've uploaded the data, the system saves your columns selection.
	#13 col	P Line	¢ ;	psia	to repeat the upload you can select your previously used template.
	#14 col	D Choke Tub	¢ /	/64in	
	#15 col	Watercut	¢ 9	%	
	#16 col		\$		Quick select last templates
	417				

Figure 25. Huron wells daily data upload to the E&P Portal

Wait for the message showing the data upload status:

		ep	.pengtool	s.com	🕄 About -	🚔 pengtools.com
O Dashboard						
Well Production +	Plot	Table	Compare Wells	Upload		
Field Production +						
Surface Facilities +	18306 m	WE WORD R	and from file			
Sales Reports +	Time elar	psed 126 (46.5 Mb) sec			~
Subsurface +						
Dispatebor Office						

Figure 26. Huron wells daily data upload status message



Now you have successfully uploaded Huron wells daily data to the E&P Portal.

Let's visually inspect the data uploaded for one of the wells. In the top menu click the "Plot". Fill the filter as follows and click "Search":



Figure 27. Huron well "9" daily data visualization in the E&P Portal



Upload the Huron wells enhancement production forecast data

In the left menu open the "Well" page of the "Production Forecast" module and click "Well Upload":

		ep. <mark>pen</mark> g	tools.	com		3 Abou	t 🗸 🚔 pengtod	ols.com - 🌣
Dashboard Well Production +	Well Plots	Well Table	Well Daily	Forecast	Well Month	ly Forecast	Well Yearly Forecast	Well Upload
Field Production + Surface Facilities +	Reservoir Ye	early Forecast	Reservoir	Upload	Forecast Typ	pe		
Sales Reports + Subsurface + Diepstoher Office	Country		Huron 🗙	×	Pad		Well	Choke ca
Downhole + Equipment and	iii ×			Search	Reset			
Drilling + Well Enhancement +	10k							Production
List Engineering Tools +								
Management Mature Water Flood +								
Production Forecast - » Well								
» Reservoir	s							

Figure 28. Production Forecast upload page of the E&P portal

Fill the form as follows and click "Upload". The wells production forecast data is attached as:

Attachment 6 "Huron wells production forecast data.csv".

		ep.p	eng	tools.com		🕄 АЪо	ut -	🟛 per	ıgtools	s.com -	¢ s
Dashboard Well Production +	Well P	lots Well Ta	ıble	Well Daily Forecas	st Well Mon	thly Forecast	Well Ye	arly Fo	recast	Well Up	load
Field Production + Surface Facilities +	Reser	voir Yearly Fore	cast	Reservoir Upload	d Forecast T	ӯре					
Sales Reports + Subsurface + Dispatcher Office	Upload File									Quick se	lect las
Downhole + Equipment and Artificial Lift	Choose File	Huron wells p	cas	t data.csv						AttributAttribut	es Set # es Set #
Drilling + Well Enhancement + List	Do not ov	verwrite					×	•			
Engineering Tools + Reservoir + Management	File with	header					×	•			
Mature Water Flood + Analysis	#01 col	ns Map									
Production Forecast+ Enhancements	#02 col	Well				(•				
Tracking	#03 col	Date				\$	bbl				
¢ Admin +	#04 col	Version Date	_			4					
	#06 col	Version				\$	÷				
	#07 col #08 col	Forecast Type	9			4	÷				

Figure 29. Huron wells enhancement campaign production forecast upload to the E&P Portal

Wait for the message showing the data upload status:

E&P Portal. Case Study Enhancements Tracking



	ep.pengtools.co	m 🕄 About 🗸	🚔 pengtools.com 👻 🌣
O Dashboard	Well Dista - Well Table - Well Daily Far	agast Wall Monthly Earsest Wall Ve	arky Easternant - Well Lipland
Well Production +	Well Plots Well Table Well Daily For	cast well wonthly Porecast well re	any Porecast Well Opload
Field Production +	Deservoir Veerly Forecast Deservoir Un	load Envocant Turce	
Surface Facilities +	Reservoir rearry Forecast Reservoir Op	oad Forecast Type	
Sales Reports +			
Subsurface +	11829 rows were read from file		
Dispatcher Office	Time elapsed 19 (46.75 Mb) sec		<u></u>
Downhole +			
Equipment and Artificial Lift			
Drilling +			

Figure 30. Huron wells enhancement campaign production forecast upload status message

Now you have successfully uploaded Huron wells enhancement production forecast data to the E&P Portal

		ep.	pen	gtoo	ols.co	m	3 About -	÷,	engtools.	com 👻	¢ Sett	tings	1 M	lishaT	• ก	Support	- ■ Lan	iguage +		
O Dashboard	v	Vell Plots We	II Table	Well	Daily Fo	recast Well Monthl	y Forecast Well Y	early For	ecast We	ell Upload	Rese	rvoir P	Plots	Reserv	oir Table	Reservo	ir Daily Forec	ast Reservoir Mo	nthly Forecast	
Field Production + Surface Facilities +	F	leservoir Yearly F	orecast	Res	ervoir Up	bload Forecast Typ	е													
Sales Reports + Subsurface + Dispatcher Office	Hor	ne / Well Produ	ction For	recast																
Downhole + Equipment and Artificial Lift	W	ell Pro	duc	tio	n F	orecast														
Drilling + Well Enhancement + List	Crea	ate Production Fo	orecast V tems.	/ersion														Franciska	bla data: 😑	
Engineering Tools + Reservoir +		Country	Field	Pad	Well	Version Date 12	Version	Туре	Start Date	End Date	Days F	Flag 🎝	GP	PGIP	OP	POIP	Username	Created At	Updated /	At
Management													MMscf	MMsc	bbl	bbl				
Mature Water Flood +		*		*										0						
Analysis	1	United States	Huron	1	14	2013-01-01	ESP campaign	Decline	2015-08-04	2017-07-14	711		9.18	0	10,791	18,355		2018-07-26 10:53:14	2018-07-26 10	:53:14 🖍 🔟
Production Forecast+	4	United States	Huron	1	14	2013-01-01	Frac campaign	Decline	2018-03-13	2019-09-14	551		24.3	0	249,255	120,849		2018-07-26 10:53:14	2018-07-26 10	:53:14 🖍 🏢
Enhancements	1	United States	Huron	1	13	2013-01-01	ESP campaign	Decline	2014-06-19	2015-07-24	401		6.01	0	67,172	267,090		2018-07-26 10:53:10	2018-07-26 10	:53:10 🖍 🏢
Tracking	1	United States	Huron	1	11	2013-01-01	Frac campaign	Decline	2016-02-02	2016-11-15	257			0		40,450		2018-07-26 10:53:18	2018-07-26 10	:53:18 🖍 🛄
tor Calculator +	5	United States	Huron	1	10	2013-01-01	Frac campaign	Decline	2016-04-24	2016-08-01	100		100.7	0	k1 700	081		2018-07-26 10:53:21	2018-07-26 10	:53:21 💉 🏢
Q Admin +	1	United States	Huron	1	9	2013-01-01	ESP campaign	Decline	2013-10-16	2016-07-11	1,000		36.7	0	1,799	0.700.070		2018-07-26 10:53:04	2018-07-26 10	:53:04 🖍 🏢
	1	United States	Huron	-	9	2013-01-01	Frac campaign	Decline	2018-02-14	2020-11-09	0.74		70.0	0	00.040	2,720,270		2018-07-26 10:53:04	2018-07-26 10	:53:04 💉 🏢
	5	United States	Huron		0	2013-01-01	Chake compaign	Decline	2015-12-22	2010-09-20	2/4		0.0	0	70,090	20,400		2018-07-26 10:53:16	2018-07-26 10	.53:10 / 🔟
	5	United States	Huron	1	0	2013-01-01	Choke campaign	Decline	2014-09-24	2015-01-22	121		20.4	0	1 560 557	2 207 400		2018-07-26 10:53:12	2018-07-26 10	:53:12 🖍 🛄
	5	United States	Huron		6	2013-01-01	Cheke compaign	Decline	2017-01-16	2020-01-31	714		2,002	0	no 067	3,207,400		2018-07-26 10:53:12	2018-07-26 10	:00:12 / 🛄
	5	United States	Huron	1	5	2013-01-01	ESP compaign	Decline	2014-04-20	2010-04-00	1 601		2.140	0	1 217 854	2 565 016		2018-07-26 10:53:03	2018-07-26 10	.53:05 / 🛄
	5	United States	Huron		0	2013-01-01	ESP campaign	Decline	2016-05-10	2020-12-29	405		2,140	0	1,317,654	3,505,910	_	2018-07-26 10:53:07	2018-07-26 10	:53:07 / 🗾
	-	United States	Huren	-	4	2013-01-01	Cheke compaign	Decline	2010-03-16	2017-05-14	425		1.91	0	2 144	87.449		2010-07-26 10:53:16	2018-07-26 10	:00:10 🖍 📗
	-	United States	Huron	1	4	2013-01-01	ESP compaign	Decline	2017-00-19	2017-11-10	140		1.592	0	202 952	1 959 007		2010-07-26 10:53:17	2018-07-26 10	.55.17 / 📗
	-	United States	Huren		4	2013-01-01	ESP campaign	Decline	2017-11-17	2021-00-09	011		7.0	0	201.5	80.242		2010-07-20 10:03:17	2010-07-20 10	.00.17 / 📗
	~	PERCENTER STREET				ZU1-3-01-01	EOF CHIMDRIGH	Lancine	ZU10-UZ-12	CULUDAI Mal M					001,007	E03.646		ZU10-UZ-ZD 10/03/18	<pre></pre>	.00.10 🥖
	1	I Inited States	Huron	1	3	2013-01-01	Erac campaign	Dacline	2017-00.17	2022-01 24	1 501		1.970	0	088 777	8 911		2018-07-26 10-52-20	2018-07-26 10	-53-20 2 1

Figure 31. Huron wells enhancement campaign production forecast in the E&P Portal



Upload the Huron wells enhancement campaign data

In the left menu open the "Upload" page of the "Enhancement Tracking" module and click "Upload":



Figure 32. Enhancement Tracking upload page of the E&P portal

Fill the form as follows and click "Upload". The wells enhancement data is attached as:

Attachment 7 "Huron wells enhancement data.csv":

			ep. <mark>pen</mark>	gtools.com		🕄 АЪо	ut -	£	pengtoo
O Dashboard		Plot	Enhancements	Enhancement Flag	Enhancement Type	Uploa	ł		
Well Production									
Surface Facilities	s +	Upload							
Sales Reports	+	File	1						i Q
Subsurface	+	Choose File	Huron wells eer	nt data.csv					
Dispatcher Office	•	Undate Tv	00						
Downhole Equipment and Artificial Lift	•	Do not or	verwrite				×	•	
Drilling	•	File Heade	r						
Well Enhanceme List	int +	File with	header				×	•	
Engineering Tool	ls +	File Colum	ns Map						
Reservoir Management	•	#01 col	Field			\$			
Mature Water Fic Analysis	+ bod	#02 col	Date			¢			
Production Fore	cast+	#03 col	Well			\$			
Enhancements Tracking		#04 col	Flag			¢			
Calculator	+	#05 col	Туре			\$			
¢ Admin	+	#06 col	Description			¢			
		#07 col	Cost			¢	USD		
		#08 col	Plan Well Stop Da	te		\$			
		#09 col	Plan Well Start Da	te		¢			
		#10 col	Actual Well Stop	Date		÷			
		#11 col	Actual Well Start	Date		¢			
		#12 col	Production Foreca	ast Version		\$			
		#13 col	Production Foreca	ast Version Date		¢			
		#14 col	-			¢			

Figure 33. Huron wells enhancement campaign data upload to the E&P Portal

Wait for the message showing the data upload status:



		ep. <mark>pen</mark>	gtools.com		🕄 About 🗸	🚔 pengtools.com 👻
Dashboard Well Production +	Plot	Enhancements	Enhancement Flag	Enhancement Type	Upload	
Field Production +						
Surface Facilities +	24 10000	wara road from filo				
Sales Reports +	Time elar	osed 0 (46.5 Mb) se	с			×
Subsurface +		,				
Dispatcher Office						
Downhole + Equipment and						

Figure 34. *Huron wells enhancement campaign data upload status message*

Now you have successfully uploaded Huron wells enhancement campaign data to the E&P Portal

												PL	AN	AC1	UAL
	Country	Fiel	d Pad	Well	Date 12	Flag	Туре	Plo	tDescriptionRepor	t Cost	Production Forecast	Well Stop Date	Well Start Date	Well Stop Date	Well Start Date
					_					USD					
	*		• - •	· - •							*				
1	United States	Hurc	n 1	9	2018-06-22	Actual	ESP	۲	ESP upgrade to GN10000	75000	Frac campaign(2013-01-01)	2018-06-12	2018-06-30	2018-06-12	2018-06-30
1	United States	Hurc	n 1	5	2018-05-24	Actual	ESP	۲	upgrade to GN6200	65000	ESP campaign(2013-01-01)	2018-05-21	2018-05-28	2018-05-21	2018-05-28
1	United States	Hurc	n 1	4	2018-05-16	Actual	ESP	0	ESP upgrade to GN6200	75000	ESP campaign(2013-01-01)	2018-05-12	2018-05-21	2018-05-12	2018-05-21
1	United States	Hurc	n 1	14	2018-03-01	Actual	Frac	0	good 80 ton	480000	Frac campaign(2013-01-01)	2017-08-20	2018-03-07	2017-08-20	2018-03-07
1	United States	Hurc	n 1	9	2018-02-03	Actual	Frac	0	nice 130 ton	550000	Frac campaign(2013-01-01)	2018-01-28	2018-02-14	2018-01-28	2018-02-14
1	United States	Hurc	n 1	4	2017-11-11	Actual	ESP	۲	DN4300	65000	ESP campaign(2013-01-01)	2017-11-09	2017-11-17	2017-11-09	2017-11-17
1	United States	Hurc	n 1	3	2017-09-06	Actual	Frac	0	56 tons	300000	Frac campaign(2013-01-01)	2017-08-26	2017-09-17	2017-08-26	2017-11-10
1	United States	Hurc	n 1	4	2017-06-19	Actual	Choke Ope	n 💿	Choke size changed from 22 mm to 65 mm	100	Choke campaign(2013-01-01)	2017-06-19	2017-06-19	2017-06-19	2017-06-19
1	United States	Huro	n 1	6	2017-06-18	Actual	ESP	0	ESP upgrade to DN5850	60000	ESP campaign(2013-01-01)	2017-06-18	2017-06-21	2017-06-18	2017-06-21
1	United States	Hurc	n 1	6	2017-01-13	Actual	ESP	0	3000 bbl/d	55000	ESP campaign(2013-01-01)	2017-01-11	2017-01-16	2017-01-11	2017-01-16
1	United States	Hurc	n 1	5	2016-10-29	Actual	ESP	0	upgrade to 3000 bbl/d ESP	40000	ESP campaign(2013-01-01)	2016-10-23	2016-11-07	2016-10-23	2016-11-07
1	United States	Hurc	n 1	11	2016-05-24	Actual	Frac	۲	50 ton + 20 m3 acid	350000	Frac campaign(2013-01-01)	2016-05-24	2016-06-16	2016-05-24	2016-06-16
1	United States	Hurc	n 1	5	2016-05-11	Actual	ESP	۲	2500 bbl/d ESP	35000	ESP campaign(2013-01-01)	2016-05-08	2016-05-10	2016-05-08	2016-05-14
1	United States	Hurc	n 1	10	2016-04-24	Actual	Frac	۲	50 ton frac no oil	350000	Frac campaign(2013-01-01)	2016-04-24	2016-04-24	2016-04-24	2016-04-24
1	United States	Hurc	n 1	3	2016-02-07	Actual	ESP	۲	ESP	50000	ESP campaign(2013-01-01)	2016-02-02	2016-02-12	2016-02-02	2016-02-12
1	United States	Hurc	n 1	11	2016-01-20	Actual	Frac	۲	20 ton frac	250000	Frac campaign(2013-01-01)	2015-12-12	2016-02-02	2015-12-12	2016-02-02
1	United States	Hurc	n 1	4	2016-01-12	Actual	Frac	۲	15 ton	200000	Frac campaign(2013-01-01)	2016-01-10	2016-03-16	2016-01-10	2016-03-16
	United States	Hurc	n 1	8	2015-12-15	Actual	ESP	۲	1000 bbl/d ESP	25000	ESP campaign(2013-01-01)	2015-12-11	2015-12-22	2015-12-11	2015-12-22
	United States	Hurc	n 1	14	2015-08-01	Actual	ESP	۲	1000 bbl/d ESP	30000	ESP campaign(2013-01-01)	2015-07-28	2015-08-10	2015-07-28	2015-08-10
	United States	Huro	n 1	5	2015-01-29	Actual	Choke Ope	n 💿	choke full open	1	Choke campaign(2013-01-01	2015-01-29	2015-01-29	2015-01-29	2015-01-29
1	United States	Hurc	n 1	6	2014-09-24	Actual	Choke Ope	n 💿	45 to 55 mm	1000	Choke campaign(2013-01-01	2014-09-24	2014-09-24	2014-09-24	2014-09-24
	United States	Hurc	n 1	13	2014-06-16	Actual	ESP	۲	1000 bbl/d ESP	35000	ESP campaign(2013-01-01)	2014-06-15	2014-06-19	2014-06-15	2014-06-19
1	United States	Hurc	n 1	5	2014-04-20	Actual	Choke Ope	n 💿		5000	Choke campaign(2013-01-01	2014-04-20	2014-04-20	2014-04-20	2014-04-20
	United States	Hurc	n 1	9	2013-10-11	Actual	ESP	۲	3000 bbl/d ESP	45000	ESP campaign(2013-01-01)	2013-10-10	2013-10-16	2013-10-10	2013-10-21
Total										3141101					

Figure 35. Huron wells enhancement campaign data in the E&P Portal



Applying the Enhancement Tracking

The well enhancement tracking workflow is:

- 1. Open the well enhancement page
- 2. Create the decline model before the enhancement Base Type Curve
- 3. Create the decline model after the enhancement Enhanced Type Curve
- 4. Inspect the actual IOR vs plan
- 5. Save the model data
- 6. Move to the next well enhancement

First well "9" enhancements will be processed as an example.

Then the total enhancement campaign will be analyzed.



Well 9 Enhancement

Enhancement 1. Converting the flowing well to the ESP

STEP 1: In the left menu open the "Enhancement Tracking" page, scroll down to the table and click "Show Plot" to open the ESP enhancement:

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Sho	wing 1-24 of 2	4 items.													
												PI	LAN	AC	TUAL
	Country	Field	Pad	Well	Date 12	Flag	Туре	Plo	tDescriptionRepor	t Cost	Production Forecast	Well Stop Date	Well Start Date	Well Stop Date	Well Star Date
		_	_							USD		1			
		▼	🔻			▼					*				
1	United States	Huron	1	9	2018-06-22	Actual	ESP	۲	ESP upgrade to GN10000	75000	Frac campaign(2013-01-01)	2018-06-12	22018-06-30	2018-06-1	22018-06-3
1	United States	Huron	1	5	2018-05-24	Actual	ESP	۲	upgrade to GN6200	65000	ESP campaign(2013-01-01)	2018-05-2	12018-05-28	2018-05-2	12018-05-2
1	United States	Huron	1	4	2018-05-16	Actual	ESP	۲	ESP upgrade to GN6200	75000	ESP campaign(2013-01-01)	2018-05-12	22018-05-21	2018-05-1	22018-05-2
1	United States	Huron	1	14	2018-03-01	Actual	Frac	۲	good 80 ton	480000	Frac campaign(2013-01-01)	2017-08-20	02018-03-07	2017-08-2	02018-03-0
1	United States	Huron	1	9	2018-02-03	Actual	Frac		nice 130 ton	550000	Frac campaign(2013-01-01)	2018-01-2	82018-02-14	2018-01-2	82018-02-1
1	United States	Huron	1	4	2017-11-11	Actual	ESP	۲	DN4300	65000	ESP campaign(2013-01-01)	2017-11-0	92017-11-17	2017-11-0	92017-11-1
1	United States	Huron	1	3	2017-09-06	Actual	Frac	۲	56 tons	300000	Frac campaign(2013-01-01)	2017-08-20	62017-09-17	2017-08-2	62017-11-1
	United States	Huron	1	4	2017-06-19	Actual	Choke Oper	n 💿	Choke size changed from 22 mm to 65 mm	100	Choke campaign(2013-01-01	2017-06-19	92017-06-19	2017-06-1	92017-06-1
1	United States	Huron	1	6	2017-06-18	Actual	ESP	۲	ESP upgrade	60000	ESP campaign(2013-01-01)	2017-06-1	82017-06-21	2017-06-1	82017-06-2
1	United States	Huron	1	6	2017-01-13	Actual	ESP	۲	3000 bbl/d	55000	ESP campaign(2013-01-01)	2017-01-1	12017-01-16	2017-01-1	12017-01-1
	United States	Huron	1	5	2016-10-29	Actual	ESP	۲	upgrade to 3000 bbl/d ESP	40000	ESP campaign(2013-01-01)	2016-10-2	32016-11-07	2016-10-2	32016-11-0
1	United States	Huron	1	11	2016-05-24	Actual	Frac	۲	50 ton + 20 m3	350000	Frac campaign(2013-01-01)	2016-05-24	42016-06-16	2016-05-2	42016-06-1
1	United States	Huron	1	5	2016-05-11	Actual	ESP	۲	2500 bbl/d	35000	ESP campaign(2013-01-01)	2016-05-0	82016-05-10	2016-05-0	82016-05-1
1	United States	Huron	1	10	2016-04-24	Actual	Frac		50 ton frac no	350000	Frac campaign(2013-01-01)	2016-04-24	42016-04-24	2016-04-2	42016-04-2
1	United States	Huron	1	3	2016-02-07	Actual	ESP	0	ESP	50000	ESP campaign(2013-01-01)	2016-02-02	22016-02-12	2016-02-0	22016-02-1
1	United States	Huron	1	11	2016-01-13	Actual	Frac	۲	20 ton frac	250000	Frac campaign(2013-01-01)	2015-12-12	22016-02-02	2015-12-1	22016-02-0
1	United States	Huron	1	4	2016-01-12	Actual	Frac	۲	15 ton	200000	Frac campaign(2013-01-01)	2016-01-10	02016-03-16	2016-01-1	02016-03-1
1	United States	Huron	1	8	2015-12-15	Actual	ESP	۲	1000 bbl/d	25000	ESP campaign(2013-01-01)	2015-12-1	12015-12-22	2015-12-1	12015-12-2
1	United States	Huron	1	14	2015-08-01	Actual	ESP	۲	1000 bbl/d	30000	ESP campaign(2013-01-01)	2015-07-20	82015-08-10	2015-07-2	82015-08-1
1	United States	Huron	1	5	2015-01-29	Actual	Choke Oper	n 💿	choke full open	1	Choke campaign(2013-01-01	2015-01-2	92015-01-29	2015-01-2	92015-01-2
1	United States	Huron	1	6	2014-09-24	Actual	Choke Oper	n 💿	45 to 55 mm	1000	Choke campaign(2013-01-01	2014-09-24	42014-09-24	2014-09-2	42014-09-2
1	United States	Huron	1	13	2014-06-16	Actual	ESP	۲	1000 bbl/d	35000	ESP campaign(2013-01-01)	2014-06-1	52014-06-19	2014-06-1	52014-06-1
1	United States	Huron	1	5	2014-04-20	Actual	Choke Oper	1 💿	Lor	5000	Choke campaign(2013-01-01	2014-04-20	02014-04-20	2014-04-2	02014-04-2
1	United States	Huron	1	9	2013-10-11	Actual	ESP	0	3000 bbl/d	45000	ESP campaign(2013-01-01)	2013-10-10	02013-10-16	2013-10-1	02013-10-2
Total				-				-	LOF	3141101					

Figure 36. Opening the well "9" ESP enhancement in the E&P Portal



Figure 37 Well "9" ESP enhancement page in the E&P Portal



<u>STEP 2&3:</u> Fill the decline model parameters for Base and Enhanced type curves as follows and click Enter.

		DC BASE				D		Đ	
q _{oi}	Di	b	Q _{ab}	Start Day	q oi	Di	b	Start Day	End Day
bbl			bbl		bbl				
2700	1.5	0.6	10	0	2800	1.5	0.6	120	557

Figure 38 Well "9" ESP enhancement Base and Enhanced type curves parameters



Figure 39 Well "9" ESP enhancement page with Base and Enhanced decline models

<u>STEP 4:</u> Inspect the IOR results. The incremental oil recovery reached by this enhancement is **192,623 bbl** at cost of **\$45,000** which is **0.23 USD/bbl**. The achieved IOR is about 30% less than planned.

	IC)R	
IOR Plan	IOR	Diff	Cost/IOR
bbl	bbl	%	USD/bbl
288237	192623	-33.2	0.23

Figure 40 Well "9" ESP enhancement IOR results in the E&P Portal

STEP 5: Click "Save Changes" to save the model:

С	ountry 🔻	Field V	₆ 9 v 201	3-10-11 ESI	P Huron/9 A	ctual x	×	Submit	Reset											
			PL	AN	ACT	UAL			DC BASE				D	C ENHANCI	ED			Ю	R	
Tab	le Date	Cost	Well Stop Date	Well Start Date	Well Stop Date	Well Start Date	q _{oi}	Di	b	Q _{ab}	Start Day	q _{oi}	Di	b	Start Day	End Day	IOR Plan	IOR	Diff	Cost/IOR
		USD					bbl			bbl		bbl					bbl	bbl	%	USD/bbl
2013-10-1 45000 2013-10-1C 2013-10-1C 2013-10-2C 200-20-200-200-20-200-200-20-200-200-20									557	288237	192623	-33.2	0.23							
Description: 3000 bb/d ESP China Gaved H Gave Chin										ve Changes										

Figure 41 Well "9" Saving the ESP enhancement model in the E&P Portal

Now well "9" ESP Enhancement analysis is complete.



Enhancement 2. Fracing the damaged well

<u>STEP 1:</u> In the left menu open the "Enhancement Tracking" page, scroll down to the table and click "Show Plot" to open the Frac enhancement:

	eŗ	o.pe	ngto	ools	.com				3 About -	pengto	ols.com - 🌣	Setti	ings 👤	MishaT 🗸	հ Տսբ	oport -
	Country	Field	Pad	Well	Date ↓ ^z	Flag	Туре	Plo	tDescriptionRep	oort Cost	Production For	ecast	PL Well Stop Date	AN Well Start Date	AC Well Stop Date	TUAL Well Start Date
										USD						
	🔻	🔻	🔻	🔻		▼	🔻		COD un annula			Ŧ				
1	United States	Huron	1	9	2018-06-22	Actual	ESP	۲	to GN10000	75000	Frac campaign(2013	<u>-01-01)</u>	2018-06-12	2018-06-30	2018-06-12	22018-06-30
1	United States	Huron	1	5	2018-05-24	Actual	ESP	۲	upgrade to GN6200	65000	ESP campaign(2013	<u>-01-01)</u>	2018-05-21	2018-05-28	2018-05-21	12018-05-28
1	United States	Huron	1	4	2018-05-16	Actual	ESP	۲	ESP upgrade to GN6200	75000	ESP campaign(2013	<u>-01-01)</u>	2018-05-12	2018-05-21	2018-05-12	22018-05-21
1	United States	Huron	1	14	2018-03-01	Actual	Frac	۲	good 80 ton job	480000	Frac campaign(2013	<u>-01-01)</u>	2017-08-20	2018-03-07	2017-08-20	02018-03-07
1	United States	Huron	1	9	2018-02-03	Actual	Frac	0	nice 130 ton	550000	Frac campaign(2013	<u>-01-01)</u>	2018-01-28	2018-02-14	2018-01-28	82018-02-14
	United States	Huron	1	4	2017-11-11	Actual	ESP	0	DN4300	65000	ESP campaign(2013	<u>-01-01)</u>	2017-11-09	2017-11-17	2017-11-09	92017-11-17
1	United States	Huron	1	3	2017-09-06	Actual	Frac	۲	56 tons	300000	Frac campaign(2013	<u>-01-01)</u>	2017-08-26	2017-09-17	2017-08-26	62017-11-10
	United States	Huron	1	4	2017-06-19	Actual	Choke Open	•	Choke size changed from 22 mm to 65 mm	100	Choke campaign(201	3-01-01	2017-06-19	2017-06-19	2017-06-19	92017-06-19
1	United States	Huron	1	6	2017-06-18	Actual	ESP	۲	ESP upgrade	60000	ESP campaign(2013	-01-01)	2017-06-18	2017-06-21	2017-06-18	82017-06-21
1	United States	Huron	1	6	2017-01-13	Actual	ESP	۲	3000 bbl/d	55000	ESP campaign(2013	- <u>01-01)</u>	2017-01-11	2017-01-16	2017-01-1	12017-01-16
	United States	Huron	1	5	2016-10-29	Actual	ESP	۲	upgrade to 3000 bbl/d ESP	40000	ESP campaign(2013	<u>-01-01)</u>	2016-10-23	2016-11-07	2016-10-23	32016-11-07
1	United States	Huron	1	11	2016-05-24	Actual	Frac	۲	50 ton + 20 m3 acid	350000	Frac campaign(2013	<u>-01-01)</u>	2016-05-24	2016-06-16	2016-05-24	42016-06-16
1	United States	Huron	1	5	2016-05-11	Actual	ESP	۲	2500 bbl/d ESP	35000	ESP campaign(2013	<u>-01-01)</u>	2016-05-08	2016-05-10	2016-05-08	82016-05-14
1	United States	Huron	1	10	2016-04-24	Actual	Frac	۲	50 ton frac no	350000	Frac campaign(2013	<u>-01-01)</u>	2016-04-24	2016-04-24	2016-04-24	42016-04-24
1	United States	Huron	1	3	2016-02-07	Actual	ESP	۲	ESP	50000	ESP campaign(2013	<u>-01-01)</u>	2016-02-02	2016-02-12	2016-02-02	22016-02-12
1	United States	Huron	1	11	2016-01-13	Actual	Frac	۲	20 ton frac	250000	Frac campaign(2013	<u>-01-01)</u>	2015-12-12	2016-02-02	2015-12-12	22016-02-02
1	United States	Huron	1	4	2016-01-12	Actual	Frac	۲	15 ton	200000	Frac campaign(2013	<u>-01-01)</u>	2016-01-10	2016-03-16	2016-01-10	02016-03-16
1	United States	Huron	1	8	2015-12-15	Actual	ESP	۲	1000 bbl/d ESP	25000	ESP campaign(2013	<u>-01-01)</u>	2015-12-11	2015-12-22	2015-12-1	12015-12-22
1	United States	Huron	1	14	2015-08-01	Actual	ESP	۲	1000 bbl/d ESP	30000	ESP campaign(2013	-01-01)	2015-07-28	2015-08-10	2015-07-28	82015-08-10
1	United States	Huron	1	5	2015-01-29	Actual	Choke Open	0	choke full open	1	Choke campaign(201	3-01-01	2015-01-29	2015-01-29	2015-01-29	92015-01-29
1	United States	Huron	1	6	2014-09-24	Actual	Choke Open	۲	45 to 55 mm	1000	Choke campaign(201	3-01-01	2014-09-24	2014-09-24	2014-09-24	42014-09-24
1	United States	Huron	1	13	2014-06-16	Actual	ESP	۲	1000 bbl/d ESP	35000	ESP campaign(2013	-01-01)	2014-06-15	2014-06-19	2014-06-15	52014-06-19
	United States	Huron	1	5	2014-04-20	Actual	Choke Open	۲		5000	Choke campaign(201	3-01-01	2014-04-20	2014-04-20	2014-04-20	02014-04-20
1	United States	Huron	1	9	2013-10-11	Actual	ESP	۲	3000 bbl/d	45000	ESP campaign(2013	-01-01)	2013-10-10	2013-10-16	2013-10-10	02013-10-21
Total										314110	1					

Figure 42. Opening the well "9" Frac enhancement in the E&P Portal



Figure 43 Well "9" Frac enhancement page in the E&P Portal



<u>STEP 2&3</u>: Fill the decline model parameters for Base and Enhanced type curves as follows and click Enter.

			DC BASE				D	C ENHANCE	Ð	
	q oi	Di	b	b Q _{ab}		q oi	Di	b	Start Day	End Day
	bbl			bbl		bbl				
Ĵ	400	1.5	0.6	10	1300	4000	2	2	1565	1657

Figure 44 Well "9" Frac enhancement Base and Enhanced type curves parameters



Figure 45 Well "9" Frac enhancement page with Base and Enhanced decline models

<u>STEP 4:</u> Inspect the IOR results. The incremental oil recovery reached by this enhancement is **399,903 bbl** at cost of **\$550,000** which is **1.38 USD/bbl**. The achieved IOR is about 50% less than planned.

	IC	R	
IOR Plan	IOR	Diff	Cost/IOR
bbl	bbl	%	USD/bbl
869681	399903	-54	1.38

Figure 46 Well "9" Frac enhancement IOR results in the E&P Portal

STEP 5: Click "Save Changes" to save the model:

С	ountry	•	Field -	9 - 201	8-02-03 Fra	c Huron/9 A	ctual x	×	Submit	Reset											
				PL	AN	ACT	UAL			DC BASE				D	C ENHANC	D			10	R	
Tab	ble Date Cost Well Stop Date Date Well Stop Date Date Date Date						Well Start Date	q _{oi}	Di	b	Q _{ab}	Start Day	q _{oi}	Di	b	Start Day	End Day	IOR Plan	IOR	Diff	Cost/IOR
			USD					bbl			bbl		bbl					bbl	bbl	%	USD/bbl
C	2018	3-02-0	550000	2018-01-28	2018-02-14	2018-01-28	2018-02-14	400	1.5	0.6	10	1300	4000	2	2	1565	1657	869681	399903	-54	1.38
																				-	
Des	criptic	on: nic	e 130 ton jo	b														C R		🖻 Sav	e Changes

Figure 47 Well "9" Saving the Frac enhancement model in the E&P Portal

Now well "9" Frac Enhancement analysis is complete.



Enhancement 3. ESP upgrade

<u>STEP 1:</u> In the left menu open the "Enhancement Tracking" page, scroll down to the table and click "Show Plot" to open the ESP upgrade enhancement:

	Country	Field	Pad	Well	Date 12	Flag	Туре	Plo	tDescriptionRepor	Cost	Production Forecast	PL Well Stop	AN Well Start	ACT Well Stop	Well Star
										USD		Date	Date	Date	Date
	· · · · · · ·	*	🔻			*					*				
1	United States	Huron	1	9	2018-06-22	Actual	ESP	0	ESP upgrade to GN10000	75000	Frac campaign(2013-01-01)	2018-06-12	2018-06-30	2018-06-12	2018-06-3
1	United States	Huron	1	5	2018-05-24	Actual	ESP	0	upgrade to GN6200	65000	ESP campaign(2013-01-01)	2018-05-21	2018-05-28	2018-05-21	2018-05-2
1	United States	Huron	1	4	2018-05-16	Actual	ESP	0	ESP upgrade to GN6200	75000	ESP campaign(2013-01-01)	2018-05-12	2018-05-21	2018-05-12	2018-05-2
1	United States	Huron	1	14	2018-03-01	Actual	Frac	۲	good 80 ton	480000	Frac campaign(2013-01-01)	2017-08-20	2018-03-07	2017-08-20	2018-03-0
1	United States	Huron	1	9	2018-02-03	Actual	Frac	0	nice 130 ton	550000	Frac campaign(2013-01-01)	2018-01-28	2018-02-14	2018-01-28	2018-02-1
1	United States	Huron	1	4	2017-11-11	Actual	ESP	۲	DN4300	65000	ESP campaign(2013-01-01)	2017-11-09	2017-11-17	2017-11-09	2017-11-1
1	United States	Huron	1	3	2017-09-06	Actual	Frac	0	56 tons	300000	Frac campaign(2013-01-01)	2017-08-26	2017-09-17	2017-08-26	2017-11-1
1	United States	Huron	1	4	2017-06-19	Actual	Choke Open	0	Choke size changed from 22 mm to 65 mm	100	Choke campaign(2013-01-01)	2017-06-19	2017-06-19	2017-06-19	2017-06-1
1	United States	Huron	1	6	2017-06-18	Actual	ESP	0	ESP upgrade to DN5850	60000	ESP campaign(2013-01-01)	2017-06-18	2017-06-21	2017-06-18	2017-06-2
1	United States	Huron	1	6	2017-01-13	Actual	ESP	0	3000 bbl/d	55000	ESP campaign(2013-01-01)	2017-01-11	2017-01-16	2017-01-11	2017-01-1
/	United States	Huron	1	5	2016-10-29	Actual	ESP	0	upgrade to 3000 bbl/d ESP	40000	ESP campaign(2013-01-01)	2016-10-23	2016-11-07	2016-10-23	2016-11-0
1	United States	Huron	1	11	2016-05-24	Actual	Frac	۲	50 ton + 20 m3 acid	350000	Frac campaign(2013-01-01)	2016-05-24	2016-06-16	2016-05-24	2016-06-1
1	United States	Huron	1	5	2016-05-11	Actual	ESP	۲	2500 bbl/d ESP	35000	ESP campaign(2013-01-01)	2016-05-08	2016-05-10	2016-05-08	2016-05-1
1	United States	Huron	1	10	2016-04-24	Actual	Frac	0	50 ton frac no oil	350000	Frac campaign(2013-01-01)	2016-04-24	2016-04-24	2016-04-24	2016-04-2
1	United States	Huron	1	3	2016-02-07	Actual	ESP	0	ESP	50000	ESP campaign(2013-01-01)	2016-02-02	2016-02-12	2016-02-02	2016-02-1
1	United States	Huron	1	11	2016-01-13	Actual	Frac	۲	20 ton frac	250000	Frac campaign(2013-01-01)	2015-12-12	2016-02-02	2015-12-12	2016-02-0
1	United States	Huron	1	4	2016-01-12	Actual	Frac	۲	15 ton	200000	Frac campaign(2013-01-01)	2016-01-10	2016-03-16	2016- <mark>0</mark> 1-10	2016-03-1
1	United States	Huron	1	8	2015-12-15	Actual	ESP	۲	1000 bbl/d ESP	25000	ESP campaign(2013-01-01)	2015-12-11	2015-12-22	2015-12-11	2015-12-2
1	United States	Huron	1	14	2015-08-01	Actual	ESP	۲	1000 bbl/d ESP	30000	ESP campaign(2013-01-01)	2015-07-28	2015-08-10	2015-07-28	2015-08-1
1	United States	Huron	1	5	2015-01-29	Actual	Choke Open	0	choke full open	1	Choke campaign(2013-01-01)	2015-01-29	2015-01-29	2015-01-29	2015-01-2
1	United States	Huron	1	6	2014-09-24	Actual	Choke Open	0	45 to 55 mm	1000	Choke campaign(2013-01-01)	2014-09-24	2014-09-24	2014-09-24	2014-09-2
1	United States	Huron	1	13	2014-06-16	Actual	ESP	۲	1000 bbl/d ESP	35000	ESP campaign(2013-01-01)	2014-06-15	2014-06-19	2014-06-15	2014-06-1
/	United States	Huron	1	5	2014-04-20	Actual	Choke Open	•	6	5000	Choke campaign(2013-01-01)	2014-04-20	2014-04-20	2014-04-20	2014-04-2
	United States	Huron	1	9	2013-10-11	Actual	ESP	0	3000 bbl/d	45000	ESP campaign(2013-01-01)	2013-10-10	2013-10-16	2013-10-10	2013-10-2

Figure 48. Opening the well "9" ESP upgrade enhancement in the E&P Portal



Figure 49 Well "9" ESP upgrade enhancement page in the E&P Portal



<u>STEP 2&3</u>: Fill the decline model parameters for Base and Enhanced type curves as follows and click Enter.

		DC BASE				D	C ENHANCE	ED	
q _{oi}	Di	b	Q _{ab}	Start Day	q oi	Di	b	Start Day	End Day
bbl			bbl		bbl				
4000	2	2	10	1565	3600	2	2	1700	2500

Figure 50 Well "9" ESP upgrade enhancement Base and Enhanced type curves parameters



Figure 51 Well "9" ESP upgrade enhancement page with Base and Enhanced decline models

<u>STEP 4:</u> Inspect the IOR results. The incremental oil recovery reached by this enhancement is **87,814 bbl** at cost of **\$75,000** which is **0.85 USD/bbl**. The achieved IOR is about 80% less than planned.

	IC	R	
IOR Plan	IOR	Diff	Cost/IOR
bbl	bbl	%	USD/bbl
550194	87814	-84	0.85

Figure 52 Well "9" ESP upgrade enhancement IOR results in the E&P Portal

STEP 5: Click "Save Changes" to save the model:

Co	untry 🔻	Field -	. 9 - 201	8-06-22 ESI	P Huron/9 A	ctual x	×	✓ Submit	Reset											
			PL	AN	ACT	UAL			DC BASE				D	C ENHANC	ED			Ю	R	
Tabl	e Date	Cost	Well Stop	Well Start	Well Stop	Well Start	q _{oi}	Di	b	Qab	Start Day	q _{oi}	Di	b	Start Day	End Day	IOR Plan	IOR	Diff	Cost/IOR
	-		Date	Date	Date	Date		-												
		USD					bbl			bbl		bbl					bbl	bbl	%	USD/bbl
\bigcirc	2018-06-2	75000	2018-06-12	2018-06-30	2018-06-12	2018-06-30	4000	2	2	10	1565	3600	2	2	1700	2500	550194	87814	-84	0.85
				T					T		T			T	1					
Desc	cription: ES	SP upgrade f	to GN10000														C B	eload Saved	Ht Sav	

Figure 53 Well "9" Saving the ESP upgrade enhancement model in the E&P Portal

• Now well "9" ESP Upgrade Enhancement analysis is complete.



Well 9 enhancement summary

Displaying all well enhancements on one plot

In the left menu open the "Enhancement Tracking" page, scroll down to the table and click "Show Plot" to open the ESP upgrade enhancement:

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	Country	Field	Pad	Well	Date 1ª	Flag	Туре	P	otDescriptior	Report	Cost	Production	Forecast	Vell Stop Date	AN Well Start Date	ACT Well Stop Date	UAL Well Start Date
	-						_				USD						
	*	T	🔻	*		Y		*					Ψ.	I	l	I	
1	United States	Huron	1	9	2018-06-22	Actual	ESP	<	ESP upgrade to GN10000		75000	Frac campaign(a	2013-01-01)	2018-06-12	2018-06-30	2018-06-12	2018-06-30
1	United States	Huron	1	5	2018-05-24	Actual	ESP	<	upgrade to GN6200		65000	ESP campaign(2	2013-01-01)	2018-05-21	2018-05-28	2018-05-21	2018-05-28
1	United States	Huron	1	4	2018-05-16	Actual	ESP	(ESP upgrade to GN6200		75000	ESP campaign(2	2013-01-01)	2018-05-12	2018-05-2	2018-05-12	2018-05-21
	United States	Huron	1	14	2018-03-01	Actual	Frac	0	good 80 ton		480000	Frac campaign(2	2013-01-01)	2017-08-20	2018-03-07	2017-08-20	2018-03-07
	United States	Huron	1	9	2018-02-03	Actual	Frac	0	nice 130 ton		550000	Frac campaign(2	2013-01-01)	2018-01-28	2018-02-14	2018-01-28	2018-02-14

Figure 54. Opening the well "9" ESP upgrade enhancement in the E&P Portal

In the filter check "Select all" box and click "Submit"

Cou	intry 💌	Field -	×9 •	2018-06-22 ESP Huron/9 Actual x	🗸 Submit	Reset	
				O Select all		DC BASE	2
Table	Date	Cost	Well Dat	2013-10-11 ESP Huron/9 Actual	Di	b	
		USD		2018-02-03 Frac Huron/9 Actual	Î.		1
	2018-06-2	75000	2018-	2018-06-22 ESP Huron/9 Actual	2.2	2][

Description: ESP upgrade to GN10000





Figure 56. All well "9" enhancements on a single plot in the E&P Portal



Displaying all well enhancements results

In the left menu open the "Enhancement Tracking" page, scroll down to the table and select "Huron" filed in the field column filter and well "9" in the well column filter:



Figure 57. Selecting well "9" enhancements in the filter

The enhancement analysis results are displayed in the left part of the table:

]		D	C BA	SE		[DC E	NHA	NCE	D				
	q _{oi}	Di	b	Q ab	Start Day	q _{oi}	Di	b	Start Day	End Day	IOR Plan	IOR	Diff	Cost/IOR
J	bbl			bbl		bbl					bbl	bbl	%	USD/bbl
)	4000	2	2	10.00	1,565	3600	2	2	1,700	2,500	55019 4	<mark>87</mark> 814	-	0.85
ŀ	400.0	1.50	0.60	10.00	1,300	4000	2	2	1,565	1,657	869681	399903	-54	1.38
	2700	1.50	0.60	10.00	0	2800	1.50	0.60	120	557	<mark>288</mark> 237	192 623	-33	0.23
Ĵ						I					1708113	680340	-60	0.98

Figure 58. Well "9" enhancement analysis results in the E&P Portal

The total well incremental oil recovery reached by all well enhancements is **680,340 bbl** at total cost of **\$670,000** which is **0.98 USD/bbl**. The achieved IOR is about 60% less than planned.

Scroll up to inspect the well "9" Scorpion Plot:



Figure 59. Well "9" Scorpion Plot in the E&P Portal



Enhancement campaign analysis

Scorpion Plot (Figure 60) and **Enhancements table** (Figure 61) are used to analyze the enhancement campaign after all wells enhancements are processed through the **Enhancement Tracking** workflow.

Below the following questions are answered:

- What is the campaign total incremental oil recovery (IOR) vs total cost?
- Which enhancement campaign has better \$/bbl performance?
- Which well has better **\$/bbl** performance?



Figure 60. Enhancement Tracking page. Scorpion Plot in the E&P Portal

											I PI	AN	ACT	TUAL	Ĭ.	DC	BASE		1 0	C EN	HANCE	D	1			
	Country	Field	Pad	Well	Date 1 ^z	Flag	Туре	PlotDescriptionReport	Cost	Production Forecast	Well Stop Date	Well Start Date	Well Stop Date	Well Start Date	q _{oi}	Di	0 Q.	Star Day	t q _{ol}	Di	b Star Day	t End Day	IOR Plan	IOR	DiffC	ost/IORM
	(C 1)			-					USD	C T		-	-		DDI		bb	1	DDI				DDI	DDI	% U	JSD/DDI
	- *	*	*				- *												_					_		
1	United States	Huron	1	9	2018-06-22	2 Actual	ESP	GN10000	75000	Frac campaign(2013-01-01)	2018-06-1	22018-06-30	2018-06-12	22018-06-30	4000	2	2 10.0	001,56	5 3600	2	2 1,70	02,50	0650194	87814	-84	0.85
1	United States	Huron	1	5	2018-05-24	4 Actual	ESP	upgrade to GN8200	65000	ESP campaign(2013-01-01)	2018-05-2	12018-05-28	2018-05-21	2018-05-28	3360	0.80	1 10.0	001,47	73360	1	1 1,66	32,50	0421457	243488	-42	0.27
1	United States	Huron	1	4	2018-05-16	6 Actual	ESP	ESP upgrade to GN6200	75000	ESP campaign(2013-01-01)	2018-05-1	22018-05-21	2018-05-12	22018-05-21	2600	1	1 10.0	00 756	3516	2.50	1 880	1,880	14469	1676	-99	44.74
1	United States	Huron	1	14	2018-03-0	1 Actual	Frac	good 80 ton job	480000	Frac campaign(2013-01-01)	2017-08-2	02018-03-07	2017-08-20	02018-03-07	0	0	0 0	750	750.0	2	1 950	1,500	13057	193391	71	2.48
1	United States	Huron	1	9	2018-02-03	3 Actual	Frac	nice 130 ton job	550000	Frac campaign(2013-01-01)	2018-01-2	32018-02-14	2018-01-28	32018-02-14	400.0	1.500	6010.0	01,30	4000	2	2 1,56	51,65	86968	39990	-54	1.38
1	United States	Huron	1	4	2017-11-1	1 Actual	ESP	ON4300	65000	ESP campaign(2013-01-01)	2017-11-0	2017-11-17	2017-11-09	92017-11-17	800.0	1	1 10.0	0 560	600.0	2	2 756	757	331991	231407	-30	0.28
1	United States	Huron	1	3	2017-09-06	6 Actual	Frac	56 tons	300000	Frac campaign(2013-01-01)	2017-08-2	52017-09-17	2017-08-26	52017-11-10	157.2	0.100	2610.0	00 900	3500	3	0 1,31	23,000	4317	645707	99	0.46
1	United States	Huron	1	4	2017-06-19	9 Actual 0	Choke Open	Choke size changed from 22 mm to 65	100	Choke campaign(2013-01-01	2017-06-1	2017-06-19	2017-06-19	2017-06-19	1258	2	1 10.0	0 0	817.7	2	1 580	580	37886	\$ 3136	-13	0.00
1	United States	Huron	1	6	2017-06-18	8 Actual	ESP	ESP upgrade to paysed?	60000	ESP campaign(2013-01-01)	2017-06-1	32017-06-21	2017-06-18	32017-06-21	3200	0.50	1 10.0	01.03	4580	2.50	1 1,38	72,000	8020	436834	-46	0.14
1	United States	Huron	1	6	2017-01-13	3 Actual	ESP	3000 bb/d ESP	55000	ESP campaion(2013-01-01)	2017-01-1	2017-01-16	2017-01-11	2017-01-16	2070	0.50	1 10.0	00 600	3100	1	1 1.03	91,039	1573813	7317	-89	0.31
1	United States	Huron	1	5	2016-10-29	9 Actual	ESP	o upgrade to	40000	ESP campaion(2013-01-01)	2016-10-2	32016-11-07	2016-10-23	32016-11-07	1800	0.80	1 10.0	0 820	3360	0.80	1 1.47	71.54	7 383109	639489	67	0.06
1	United States	Huron	1	11	2016-05-2	4 Actual	Frac	50 ton + 20 m3	350000	Frac campaion(2013-01-01)	2016-05-2	2016-06-16	2016-05-2	2016-06-16	0	0	0 0	115	0	0	0 290	290	31288	7260	-77	48.21
1	United States	Huron	1	5	2016-05-1	1 Actual	FSP	2500 NN/H ESP	35000	ESP campaign(2013-01-01)	2016-05-0	2016-05-10	2016-05-08	2016-05-14	2053	0.80	1 10.0	0 380	1800	0.80	1 820	980	3109	R7564	-77	0.40
1	United States	Huron	1	10	2016-04-20	4 Actual	Frac	50 ton frac no	350000	Frac campaign(2013-01-01)	2016-04-2	2016-04-24	2016-04-24	2016-04-24	1000.0) 1	1 10.0	0 0	0	1	1 9	100	-426.8	-81349		-4.30
1	United States	Huron	1	3	2016-02-03	7 Actual	FSP	OI ESP	50000	ESP campaign(2013-01-01)	2016-02-0	2016-02-12	2016-02-03	2016-02-12	1887	0.440	2610.0	0 0	1384	0.460	25 540	720	55138	68911	7	0.85
-	United States	Huron	1	11	2016-01-20	D Actual	Frac	20 ton frac	250000	Erac campaign(2013-01-01)	2015-12-1	2016-02-02	2015-12-12	2016-02-02	0	0	0 0	0	100.0	1	1 137	137	31288	1214	-96	205.93
1	United States	Huron	1	4	2016-01-13	2 Actual	Frac	15 ton	200000	Frac campaign(2013-01-01)	2016-01-1	2016-03-16	2016-01-10	2016-03-16	0	0	0 0	0	1350	2	1 11	436	18745	2006	37	0.67
1	United States	Huron	1	8	2015-12-1	5 Actual	ESP	1000 HN/H ESP	25000	ESP campaign(2013-01-01)	2015-12-1	2015-12-22	2015-12-11	2015-12-22	960.0	2	2 10.0	0 140	900.0	1	1 800	800	48879	21328	-56	1.17
1	United States	Huron	1	14	2015-08-0	1 Actual	ESP	1000 bb/d ESP	30000	ESP campaign(2013-01-01)	2015-07-2	2015-08-10	2015-07-28	2015-08-10	450.0	2 0	50100	0 0	1300	2 800	50 40	750	05307	149224	42	0.20
1	United States	Huron	1	5	2015-01-29	Actual (Choke Open	Choke full coen	1	Choixe campaign(2013-01-01)	2015-01-2	2015-01-29	2015-01-29	2015-01-20	2650	0.80	1 100	0 100	2053	0.80	1 380	813	80000	65705	-18	0.00
1	United States	Huron	1	6	2014-09-24	4 Actual (Choke Open	45 to 55 mm	1000	Choke campaign(2013-01-01	2014-09-2	12014-09-24	2014-09-24	12014-09-24	2750	1.50	1 10 0	0 0	2300	1	1 80	200	14314	0719	45	0.05
1	United States	Huron	1	13	2014-06-16	6 Actual	ESP	1000 bbl/d FSP	35000	ESP campaion/2013-01-011	2014-06-1	52014-06-19	2014-06-15	52014-06-19	850.0	0.600	1010.0	0 0	790.0	0.80	0 100	500	50456	-5232	-110	-6.69
1	United States	Huron	1	5	2014-04-20	Actual (Choke Open	0	5000	Choke campaign/2013-01-01	2014-04-2	2014-04-20	2014-04-20	2014-04-20	2516	0.80	1 10.0	0 0	2650	0.80	1 100	380	032499	3425	-82	0.04
	United States	Huron	1	9	2013-10-1	1 Actual	ESP	0 2000 HN/H ESP	45000	ESP campaign(2013-01-01)	2013-10-1	2013-10-16	2013.10.10	2013-10-21	2700	1 500	60100	0 0	2800	1 500	60 120	557	88237	100623	.33	0.23
Total	l.	, iston		9	2010-10-1		201	Service over d EdP	3141101	Los campagnizoro di fori		2010110-10		2010-10-21	2700	1.500	00 10.0		2000			551	746086	8402224	6.46	0.79

Figure 61. Enhancement Tracking page. Enhancements table in the E&P Portal

What is the campaign total **IOR** vs total cost?

In the left menu open the "Enhancements" page of the "Enhancement Tracking" module. Scorpion Plot and enhancement table will be displayed on the page.



Set the "Group By" setting to "Field" at the bottom of the plot.

Figure 62. Huron field Scorpion Plot in the E&P Portal

The total campaign **IOR** is **4,022,246 bbl** at total cost of **\$ 3,141,101** which is **0.78 USD/bbl**. The achieved **IOR** is about 45% less than planned.



Which enhancement campaign has better \$/bbl performance?

In the left menu open the "Enhancements" page of the "Enhancement Tracking" module. Scorpion Plot and enhancement table will be displayed on the page.



Set the "Group By" setting to "Enhancement Type" at the bottom of the plot.



Campaign	IOR, bbl	Cost, USD	Performance USD/bbl
Choke Open	232,985	6,101	0.03
ESP	2,322,443	655,000	0.28
Frac	1,466,819	2,480,000	1.69
Total	4,022,247	3,141,101	0.78

The enhancement campaign performance is:

Table 2 . Enhancement campaign performance

The Choke Open campaign has the lowest cost per added bbl, however it produced only 5% of the total **IOR**.

The ESP campaign produced about 60% of the total IOR.



Which well has better \$/bbl performance?

In the left menu open the "Enhancements" page of the "Enhancement Tracking" module. Scorpion Plot and enhancement table will be displayed on the page.



Set the "Group By" setting to "Well" at the bottom of the plot.



Well	IOR, bbl	Cost, USD	Performance USD/bbl
5	1,149,671	145,001	0.13
6	634,870	116,000	0.18
3	704,618	350,000	0.50
4	566,912	340,100	0.60
9	680,340	670,000	0.98
8	21,328	25,000	1.17
14	342,615	510,000	1.49
11	8,474	600,000	70.80
13	(5,232)	35,000	-6.69
10	(81,349)	350,000	-4.30
Total	4,022,247	3,141,101	0.78

The wells performance is:

Table 3 . Wells enhancement performance



Saving and exporting the analysis results

In the left menu open the "Enhancements" page of the "Enhancement Tracking" module. Scroll down to the enhancement table.

Click to the export button on the top right corner of the table and select the output format you want the data in:

												I F	LAN	AC	TUAL	1	DC	BASE		1 1	DC E	NHA	NCE	HTML
	Country	Field	Pad	Well	Date 12	Flag	Туре	Plo	tDescription Report	Cost	Production Forecast	Well Sto	p Well Start	Well Stop	Well Start	qoi	Di	b Q	star	t qoi	Di	b	Star	CSV
										USD		Date	Date	Date	Date	bbl		bt	ol	bbl			Da	Text
	*	*	*				*						1		1									HR TON
11	United States	Huron	1	9	2018-06-22	Actual	ESP	0	ESP upgrade to GN10000	75000	Frac campaign(2013-01-01)	2018-06-1	122018-06-3	2018-06-1	22018-06-30	4000	2	2 10.	001,56	5 3600	2	2	1,70	PDF
11	United States	Huron	1	5	2018-05-24	Actual	ESP	0	upgrade to	65000	ESP campaign(2013-01-01)	2018-05-2	212018-05-20	2018-05-2	12018-05-28	3360	0.80	1 10.	001.47	7 3360	1	1	1.66	Excel 9
11	United States	Huron	1	4	2018-05-16	Actual	ESP	0	ESP upgrade	75000	ESP campaign(2013-01-01)	2018-05-1	122018-05-2	12018-05-1	22018-05-21	2600	1	1 10.	00 756	3516	2.50	1	880	Excel a
11	United States	Huron	1	14	2018-03-01	Actual	Frac	0	good 80 ton	480000	Frac campaign(2013-01-01)	2017-08-2	202018-03-0	2017-08-2	02018-03-07	0	0	0 0	750	750.0	12	1	950	1,500.1
11	United States	Huron	1	9	2018-02-03	Actual	Frac	0	nice 130 ton	550000	Frac campaign(2013-01-01)	2018-01-2	282018-02-14	2018-01-2	82018-02-14	400.0	1.500	6010.	001.30	0 4000	2	2	1.565	1.65786
11	United States	Huron	1	4	2017-11-11	Actual	ESP		DN4300	65000	ESP campaign(2013-01-01)	2017-11-0	092017-11-1	2017-11-0	92017-11-17	800.0	1	1 10.	00 560	600.0	2	2	756	757 33
11	United States	Huron	1	3	2017-09-06	Actual	Frac	0	56 tons	300000	Frac campaign(2013-01-01)	2017-08-2	262017-09-1	2017-08-2	62017-11-10	157.2	0.100	2610.	00 900	3500	3	0	1,312	3,000 32
/ 1	United States	Huron	1	4	2017-06-19	Actual	Choke Oper	1 💿	Choke size changed from 22 mm to 65	100	Choke campaign(2013-01-01	2017-06-1	192017-06-1	2017-06-1	92017-06-19	1258	2	1 10.	00 0	817.7	2	1	580	580 37
1	Inited States	Huron	1	6	2017-06-18	Actual	ESP	0	ESP upgrade	60000	ESP campaign(2013-01-01)	2017-06-1	182017-06-2	12017-06-1	82017-06-21	3200	0.50	1 10	001.03	9 4580	2.50	1	1.387	2 000 80
11	Inited States	Huron	1	6	2017-01-13	Actual	ESP	0	3000 bbl/d	55000	ESP campaign(2013-01-01)	2017-01-1	112017-01-1	2017-01-1	12017-01-16	2070	0.50	1 10	00 600	3100	1	1	1.039	1 039 1
1	Jnited States	Huron	1	5	2016-10-29	Actual	ESP	۲	upgrade to 3000 bbl/d ESP	40000	ESP campaign(2013-01-01)	2016-10-2	232016-11-0	72016-10-2	32016-11-07	1800	0.80	1 10.	00 820	3360	0.80	1	1,477	1,54738
11	United States	Huron	1	11	2016-05-24	Actual	Frac	0	50 ton + 20 m3	350000	Frac campaign(2013-01-01)	2016-05-2	242016-06-1	2016-05-2	42016-06-16	0	0	0 0	115	0	0	0	290	290 31
1	United States	Huron	1	5	2016-05-11	Actual	ESP	0	2500 bbl/d	35000	ESP campaign(2013-01-01)	2016-05-0	082016-05-10	2016-05-0	82016-05-14	2053	0.80	1 10.	00 380	1800	0.80	1	820	980 38
11	United States	Huron	1	10	2016-04-24	Actual	Frac	0	50 ton frac no	350000	Frac campaign(2013-01-01)	2016-04-2	242016-04-24	2016-04-2	42016-04-24	1000.0	1	1 10.	00 00	0	1	1	9	100 -4:
11	United States	Huron	1	3	2016-02-07	Actual	ESP	0	ESP	50000	ESP campaign(2013-01-01)	2016-02-0	022016-02-12	2016-02-0	22016-02-12	1887	0.440	2610.	0 00	1384	0.46	0.25	540	720 55
11	United States	Huron	1	11	2016-01-20	Actual	Frac	0	20 ton frac	250000	Frac campaign(2013-01-01)	2015-12-1	122016-02-02	2015-12-1	22016-02-02	0	0	0 0	0	100.0	1	1	137	137 31
11	United States	Huron	1	4	2016-01-12	Actual	Frac	0	15 ton	200000	Frac campaign(2013-01-01)	2016-01-1	102016-03-1	2016-01-1	02016-03-16	0	0	0 0	0 0	1350	2	1	11	436 21
11	United States	Huron	1	8	2015-12-15	Actual	ESP	۲	1000 bbl/d ESP	25000	ESP campaign(2013-01-01)	2015-12-1	112015-12-23	2015-12-1	12015-12-22	960.0	2	2 10.	00 140	900.0	1	1	800	800 48
11	United States	Huron	1	14	2015-08-01	Actual	ESP	۲	1000 bbl/d ESP	30000	ESP campaign(2013-01-01)	2015-07-2	282015-08-10	2015-07-2	82015-08-10	450.0	2 0	5010.	0 00	1300	2.80	0.50	40	750 0
11	United States	Huron	1	5	2015-01-29	Actual	Choke Oper	1 0	choke full open	1	Choke campaign(2013-01-01	2015-01-2	292015-01-2	2015-01-2	92015-01-29	2650	0.80	1 10.	00 100	2053	0.80	1	380	813 80
11	United States	Huron	1	6	2014-09-24	Actual	Choke Oper	1 👁	45 to 55 mm	1000	Choke campaign(2013-01-01	2014-09-2	242014-09-24	42014-09-2	42014-09-24	2750	1.50	1 10.	0 00	2300	1	1	80	200 14
1 1	United States	Huron	1	13	2014-06-16	Actual	ESP	۲	1000 bbl/d ESP	35000	ESP campaign(2013-01-01)	2014-06-1	152014-06-19	2014-06-1	52014-06-19	850.0	0.600	1010.	00 00	790.0	08.00	0	100	500 50
10	United States	Huron	1	5	2014-04-20	Actual	Choke Oper	1 0		5000	Choke campaign(2013-01-01	2014-04-2	202014-04-20	2014-04-2	02014-04-20	2516	0.80	1 10.	0 00	2650	0.80	1	100	380 63
11	United States	Huron	1	9	2013-10-11	Actual	ESP	0	3000 bbl/d ESP	45000	ESP campaign(2013-01-01)	2013-10-1	102013-10-10	2013-10-1	02013-10-21	2700	1.500	6010.	0 00	2800	1.50	0.60	120	557 28
otal:										3141101		1		1		1				1				74

Figure 65. Exporting the enhancements table from the E&P Portal

Open the downloaded file "epDataExport.xlsx":

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2 United States	Huron	1	9 2018-06-22	Actual	ESP	ESP upgrade to GN10000				75000	Frac camp	paign(2013-01-01)	2018-06-12	2018-06-30	2018-06-12	2018-05-30	440	2.2	2	10 1,565
3 United States	Huron	1	5 2018-05-24	Actual	ESP	upgrade to GN6200				65000	ESP camp	aign(2013-01-01)	2018-05-21	2018-05-28	2018-05-21	2018-05-28	336	0.8	1	10 1,477
4 United States	Huron	1	4 2018-05-16	Actual	ESP	ESP upgrade to GN6200				75000	ESP camp	aign(2013-01-01)	2018-05-12	2018-05-21	2018-05-12	2018-05-21	260	1 1	1	10
5 United States	Huron	1	14 2018-03-01	Actual	Frac	good 80 ton job				480000	Frac camp	paign(2013-01-01)	2017-08-20	2018-03-07	2017-08-20	2018-03-07		0 0	0	0
6 United States	Huron	1	9 2018-02-03	Actual	Frac	nice 130 ton job				550000	Frac camp	paign(2013-01-01)	2018-01-28	2018-02-14	2018-01-28	2018-02-14	40	1.5	0.6	10 1,300
7 United States	Huron	1	4 2017-11-11	Actual	ESP	DN4300				65000	ESP camp	aign(2013-01-01)	2017-11-09	2017-11-17	2017-11-09	2017-11-17	80	1 20	1	10
8 United States	Huron	1	3 2017-09-06	Actual	Frac	56 tons				300000	Frac camp	paign(2013-01-01)	2017-08-26	2017-09-17	2017-08-26	2017-11-10	157.	2 0.1	0.26	10
9 United States	Huron	1	4 2017-06-19	Actual	Choke Open	Choke size changed from 22	1 mm to 65 mm			100	Choke car	mpaign(2013-01-01)	2017-06-19	2017-06-19	2017-06-19	2017-05-19	125	8 2	1	10
10 United States	Huron	1	6 2017-06-18	Actual	ESP	ESP upgrade to DN5850				60000	ESP camp	aign(2013-01-01)	2017-06-18	2017-06-21	2017-06-18	2017-05-21	320	0.5	1	10 1,039
11 United States	Huron	1	6 2017-01-13	Actual	ESP	3000 bbl/d ESP				55000	ESP camp	aign(2013-01-01)	2017-01-11	2017-01-16	2017-01-11	2017-01-16	207	0.5	1	10
12 United States	Huron	1	5 2016-10-29	Actual	ESP	upgrade to 3000 bbl/d ESP				40000	ESP camp	aign(2013-01-01)	2016-10-23	2016-11-07	2016-10-23	2016-11-07	180	0.8	1	10
13 United States	Huron	1	11 2016-05-24	Actual	Frac	50 ton + 20 m3 acid				350000	Frac camp	paign(2013-01-01)	2016-05-24	2016-06-16	2016-05-24	2016-05-16		0 (0	0	0
14 United States	Huron	1	5 2016-05-11	Actual	ESP	2500 bbl/d ESP				35000	ESP camp	saign(2013-01-01)	2016-05-08	2016-05-10	2016-05-08	2016-05-14	205	3 0.8	1	10
15 United States	Huron	1	10 2016-04-24	Actual	Frac	50 ton frac no oil				350000	Frac camp	paign(2013-01-01)	2016-04-24	2016-04-24	2016-04-24	2016-04-24	100	0 1	1	10
16 United States	Huron	1	3 2016-02-07	Actual	ESP	ESP				50000	ESP camp	aign(2013-01-01)	2016-02-02	2016-02-12	2016-02-02	2016-02-12	188	0.44	0.26	10
17 United States	Huron	1	11 2016-01-20	Actual	Frac	20 ton frac				250000	Frac camp	paign(2013-01-01)	2015-12-12	2016-02-02	2015-12-12	2016-02-02		0 0	0	0
18 United States	Huron	1	4 2016-01-12	Actual	Frac	15 ton				200000	Frac camp	paign(2013-01-01)	2016-01-10	2016-03-16	2016-01-10	2016-03-16		0 0	0	0
19 United States	Huron	1	8 2015-12-15	Actual	ESP	1000 bbl/d ESP				25000	ESP camp	aign(2013-01-01)	2015-12-11	2015-12-22	2015-12-11	2015-12-22	96	2	2	10
20 United States	Huron	1	14 2015-08-01	Actual	ESP	1000 bbl/d ESP				30000	ESP camp	aign(2013-01-01)	2015-07-28	2015-08-10	2015-07-28	2015-08-10	45	2 2	0.5	10
21 United States	Huron	1	5 2015-01-29	Actual	Choke Open	choke full open				1	Choke car	mpaign(2013-01-01)	2015-01-29	2015-01-29	2015-01-29	2015-01-29	265	0.8	1	10
22 United States	Huron	1	6 2014-09-24	Actual	Choke Open	45 to 55 mm				1000	Choke car	mpaign(2013-01-01)	2014-09-24	2014-09-24	2014-09-24	2014-09-24	275	1.5	1	10
23 United States	Huron	1	13 2014-06-16	Actual	ESP	1000 bbl/d ESP				35000	ESP camp	aign(2013-01-01)	2014-06-15	2014-06-19	2014-06-15	2014-06-19	85	0.6	0.1	10
24 United States	Huron	1	5 2014-04-20	Actual	Choke Open					5000	Choke car	mpaign(2013-01-01)	2014-04-20	2014-04-20	2014-04-20	2014-04-20	251	5 0.8	1	10
25 United States	Huron	1	9 2013-10-11	Actual	ESP	3000 bbl/d ESP				45000	ESP camp	aign(2013-01-01)	2013-10-10	2013-10-16	2013-10-10	2013-10-21	300	1.5	0.6	10
26																				

Figure 66. Exported enhancements table in Excel spreadsheet

The exported file is attached as:

- Attachment 8 "epDataExport.xlsx".
- Now enhancement data is successfully exported.



Conclusions

This Case Study demonstrated application of the **Enhancement Tracking** workflow to track and evaluate the benefits of executed enhancements using the **E&P Portal**.

A step by step guide was presented to assist users along the way of using the **E&P Portal** and **Enhancement Tracking** workflow.

The following steps were covered:

- Input the required data to the **E&P Portal**;
- Apply the Enhancement Tracking workflow to track and benchmark enhancements;
- Save and export the analysis results.

As usual, data preparation and upload step took the most time an effort, while the analysis part once data is processed was relatively easy and quick.

Imagine the power of the **E&P Portal** then data continually flows to the system for the hundreds and thousands of wells and ready for the analysis like the **Enhancement Tracking** in the live mode!

With the help of the **E&P Portal** you can quickly analyze the big number of wells saving the engineering time while increasing the well's and field's production and company's revenues.

E&P Portal. Case Study Enhancements Tracking



References

Martins, J. P., MacDonald, J. M., Stewart, C. G., & Phillips, C. J. (1995). The Management and Optimization of a Major Wellwork Program at Prudhoe Bay. *Society of Petroleum Engineers*, SPE-30649-MS.

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Attachments

•	Attachment 1"Huron 9 Pump Design Report.pdf".	9
•	Attachment 2"Huron 9 Frac Design Report.pdf"	10
•	Attachment 3"Huron 9 ESP upgrade Report.pdf".	11
•	Attachment 4"Huron wells.csv".	16
•	Attachment 5"Huron wells daily measures.csv".	18
•	Attachment 6 "Huron wells production forecast data.csv".	20
•	Attachment 7 "Huron wells enhancement data.csv":	22
•	Attachment 8 "epDataExport.xlsx"	37