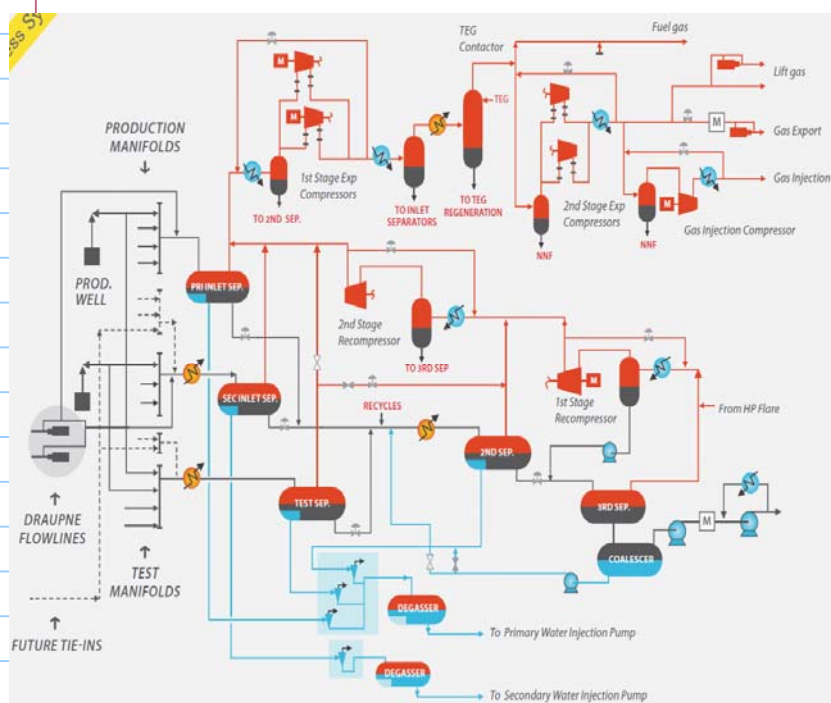
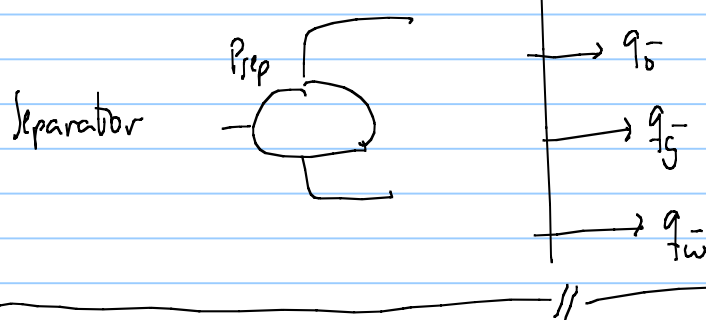
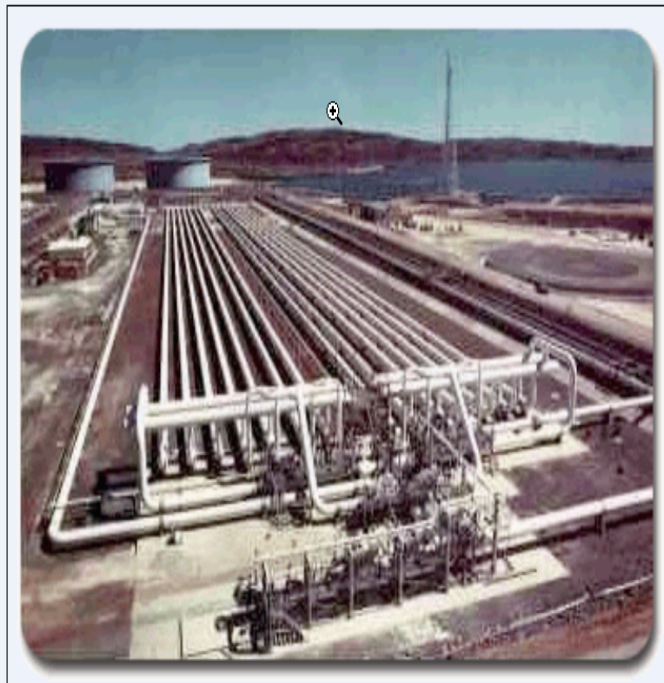
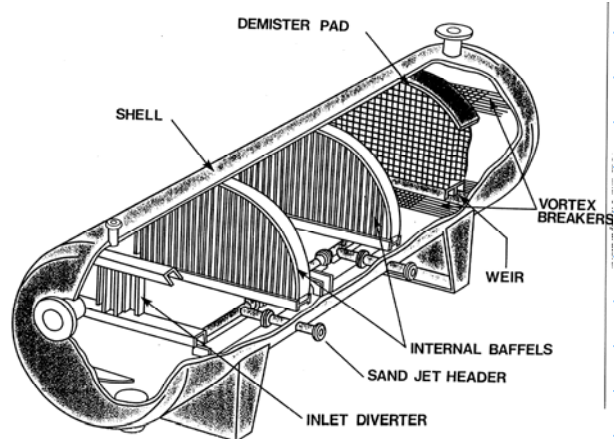


menu: • Production potential : = how to estimate production profile from q_{pp} vs Q_p

- Excel implementation



Horizontal separator



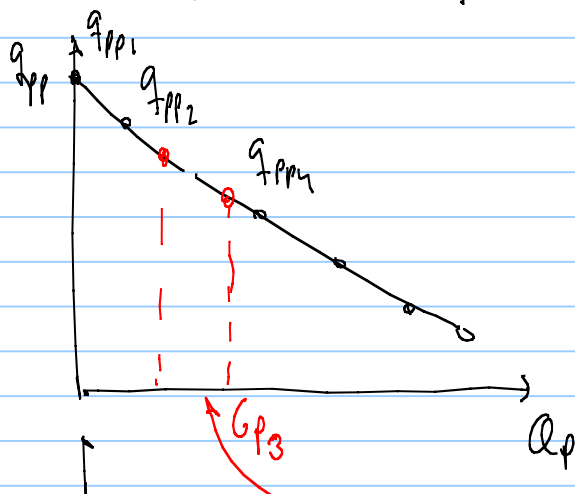


look how the equipment looks
like in real life!

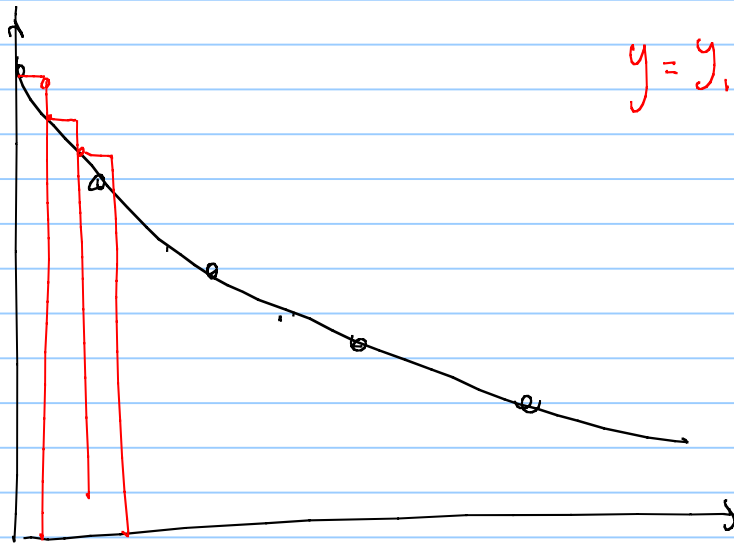
• Production potential

segmental calculations

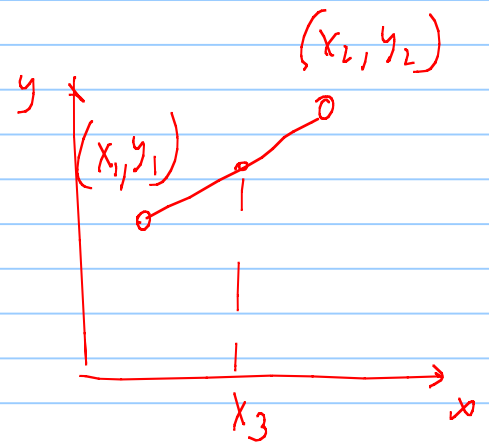
open choke



t	q	G _p	q _{pp}	0 → 0.5 q _{pp1} operational days in a year = 355
0	q _{pp1}	0	q _{pp1}	
0.5	q _{pp2}	q _{pp1} (0.5-0)355	q _{pp2}	
1	q _{pp3}	1 + q _{pp2} (1-0.5)355	q _{pp3}	



$$y = y_1 + \frac{(y_2 - y_1)(x - x_1)}{(x_2 - x_1)}$$

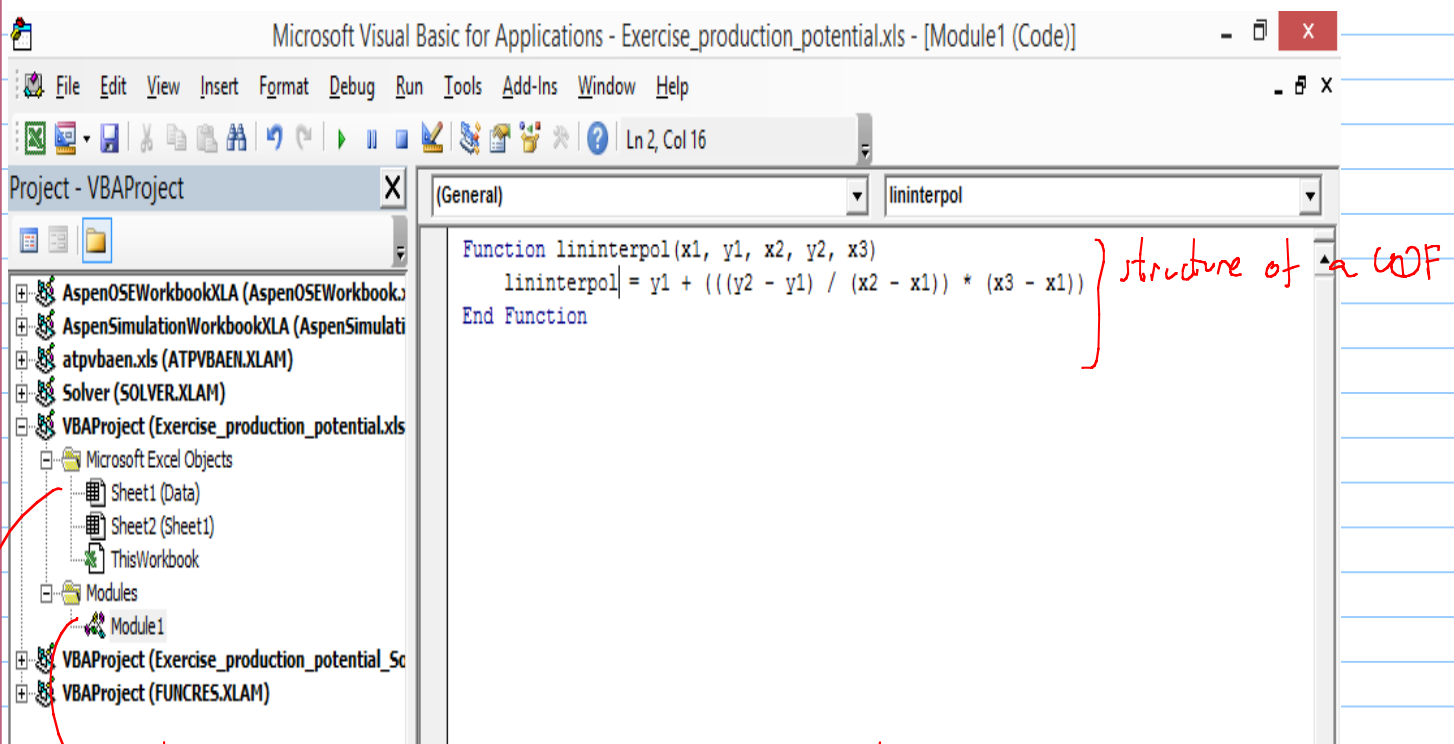


Excel + VBA (visual basic for applications)

Reduce trust settings to minimum - enable all macros

Alt + F11 to access VBA environment

UDF.. User defined function



when placed in a module, it is available for all sheets in an excel file.

when placed in a sheet, it is only available for that sheet.

Exercise_production_potential.xls [Compatibility Mode] - Excel

FILE HOME INSERT PAGE LAYOUT FORMULAS DATA REVIEW VIEW DEVELOPER Aspen ASW ADD-INS POWERPivot Milan Sta...

Clipboard Font Alignment Number Styles Cells Editing

18 \times \checkmark fx =lininterpol(A7,D7,A8,D8,H8)

you usually detect that is between these two values, x_1 , x_2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
4														
5	Gp	pR	Well qpp	Field qpp		time	qfield	Gp	qppf					
6	[Sm ³]	[bara]	[Sm ³ /d]	[Sm ³ /d]		[years]	[sm ³ /d]	[sm ³]	[sm ³ /d]					
7	0.00E+00	276	9.55E+06	9.55E+06		0.0	9.55E+06	0	9.55E+06					
8	7.29E+09	269	9.27E+06	9.27E+06		0.5	9482768	1.69E+09	9482768					
9	1.46E+10	260	8.94E+06	8.94E+06		1.0								
10	2.19E+10	251	8.61E+06	8.61E+06		1.5								
11	2.92E+10	242	8.29E+06	8.29E+06		2.0								
12	3.65E+10	234	7.97E+06	7.97E+06		2.5								
13	4.37E+10	226	7.66E+06	7.66E+06		3.0								
14	5.10E+10	218	7.36E+06	7.36E+06		3.5								
15	5.83E+10	210	7.06E+06	7.06E+06		4.0								
16	6.56E+10	202	6.77E+06	6.77E+06		4.5								
17	7.29E+10	194	6.48E+06	6.48E+06		5.0								
18	8.02E+10	187	6.19E+06	6.19E+06		5.5								
19	8.75E+10	179	5.91E+06	5.91E+06		6.0								
20	9.48E+10	172	5.63E+06	5.63E+06										
21	1.02E+11	165	5.36E+06	5.36E+06										
22	1.09E+11	157	5.09E+06	5.09E+06										
23	1.17E+11	150	4.82E+06	4.82E+06										

Function Arguments

lininterpol

X1 A7 = 0

Y1 D7 = 9547666.318

X2 A8 = 7290000000

Y2 D8 = 9268499.782

X3 H8 = 1694710771

= 9482768.302

No help available.

X1

Formula result = 9482768.302

Help on this function

OK Cancel

100 %

$x = G_p$
 $y = q_{pp}$
 i want to obtain q_{pp} with G_p

the drawback of this approach is that i have to go manually to each timestep and detect x_1, y_1, x_2, y_2 .

Function tabinterpol(x, col, Matrix As Range)

'function to perform linear interpolation in tables for properties VAR1, VAR2,

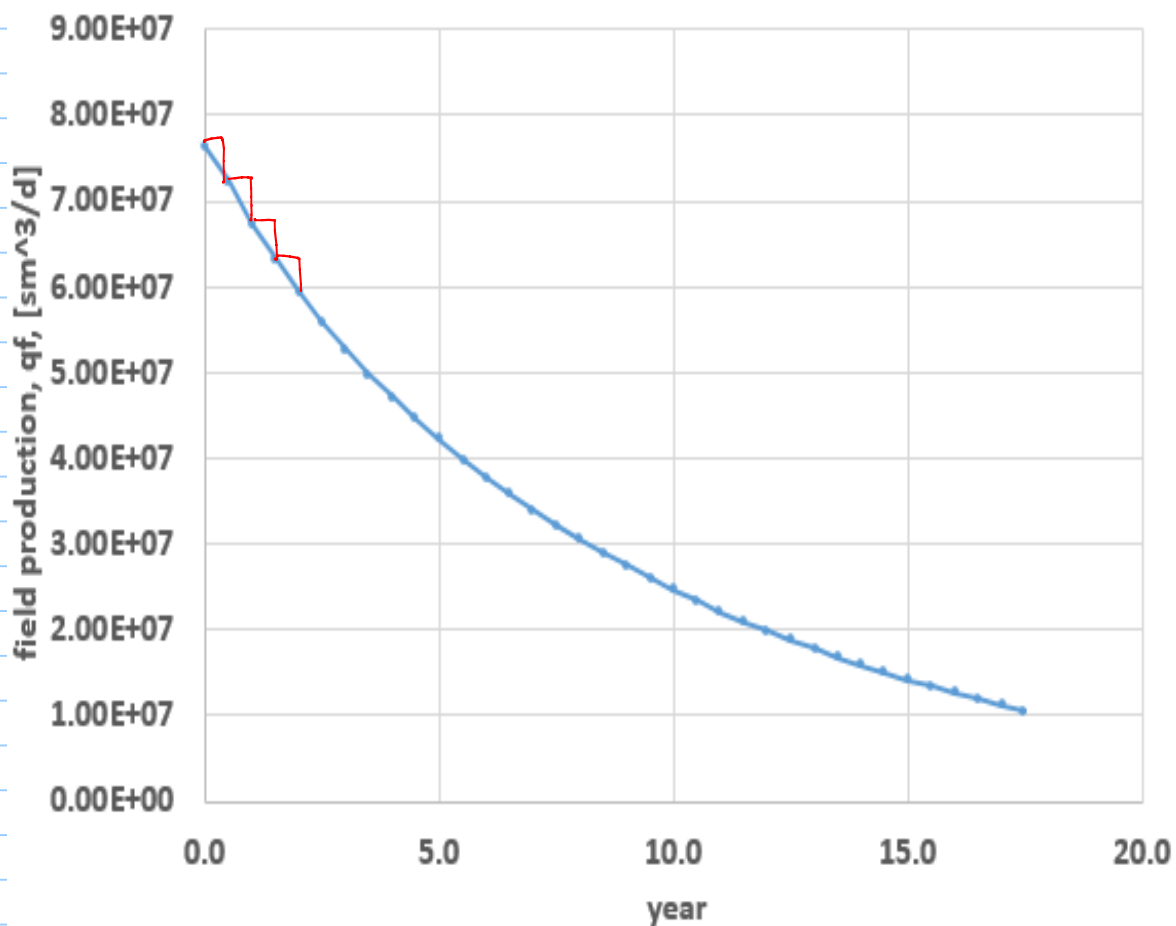
'INPUT:

B_0 b_5 M_0

X	VAR1	VAR2	VAR3
x_1			
x_2			
\vdots			
x_n			

1 2

SUM	:	X	✓	f_x	=tabinterpol(H10,4,SA\$7:SD\$37)				
	A	B	C	D	E	F	G	H	I
1	N Wells		8						
2	G	[Sm³]	2.7E+11						
3	Field production	[Sm³/d]	2.00E+07						
4									
5	Gp	pR	Well qpp	Field qpp		time	qfield	Gp	qppf
6	[Sm³]	[bara]	[Sm³/d]	[Sm³/d]		[years]	[sm³/d]	[sm³]	[sm³/d]
7	0.00E+00	276	9.55E+06	7.64E+07		0.0	7.64E+07	0	7.64E+07
8	7.29E+09	269	9.27E+06	7.41E+07		0.5	7.19E+07	1.36E+10	7.19E+07
9	1.46E+10	260	8.94E+06	7.15E+07		1.0	6.73E+07	2.63E+10	6.73E+07
10	2.19E+10	251	8.61E+06	6.89E+07		1.5	6.32E+07	3.83E+10	=tabinterpo
11	2.92E+10	242	8.29E+06	6.63E+07		2.0	5.94E+07	4.95E+10	5.94E+07
12	3.65E+10	234	7.97E+06	6.38E+07		2.5	5.59E+07	6.00E+10	5.59E+07
13	4.37E+10	226	7.66E+06	6.13E+07		3.0	5.28E+07	7.00E+10	5.28E+07
14	5.10E+10	218	7.36E+06	5.89E+07		3.5	4.98E+07	7.93E+10	4.98E+07
15	5.83E+10	210	7.06E+06	5.65E+07		4.0	4.71E+07	8.82E+10	4.71E+07
16	6.56E+10	202	6.77E+06	5.41E+07		4.5	4.45E+07	9.65E+10	4.45E+07
17	7.29E+10	194	6.48E+06	5.18E+07		5.0	4.22E+07	1.04E+11	4.22E+07
18	8.02E+10	187	6.19E+06	4.95E+07		5.5	3.99E+07	1.12E+11	3.99E+07
19	8.75E+10	179	5.91E+06	4.73E+07		6.0	3.78E+07	1.19E+11	3.78E+07
20	9.48E+10	172	5.63E+06	4.51E+07		6.5	3.58E+07	1.26E+11	3.58E+07
21	1.02E+11	165	5.36E+06	4.29E+07		7.0	3.40E+07	1.32E+11	3.40E+07
22	1.09E+11	157	5.09E+06	4.07E+07		7.5	3.22E+07	1.38E+11	3.22E+07
23	1.17E+11	150	4.82E+06	3.85E+07		8.0	3.05E+07	1.44E+11	3.05E+07
24	1.24E+11	143	4.55E+06	3.64E+07		8.5	2.90E+07	1.49E+11	2.90E+07
25	1.31E+11	136	4.28E+06	3.42E+07		9.0	2.74E+07	1.54E+11	2.74E+07
26	1.39E+11	129	4.01E+06	3.21E+07		9.5	2.60E+07	1.59E+11	2.60E+07
27	1.46E+11	122	3.75E+06	3.00E+07		10.0	2.47E+07	1.64E+11	2.47E+07
28	1.46E+11	122	3.75E+06	3.00E+07		10.5	2.34E+07	1.68E+11	2.34E+07
29	1.53E+11	115	3.48E+06	2.78E+07		11.0	2.21E+07	1.72E+11	2.21E+07
30	1.60E+11	108	3.21E+06	2.57E+07		11.5	2.10E+07	1.76E+11	2.10E+07
31	1.68E+11	101	2.94E+06	2.35E+07		12.0	1.99E+07	1.80E+11	1.99E+07
32	1.75E+11	94	2.67E+06	2.14E+07		12.5	1.88E+07	1.84E+11	1.88E+07
33	1.82E+11	87	2.40E+06	1.92E+07		13.0	1.78E+07	1.87E+11	1.78E+07
34	1.90E+11	80	2.13E+06	1.70E+07		13.5	1.68E+07	1.90E+11	1.68E+07
35	1.97E+11	73	1.85E+06	1.48E+07		14.0	1.59E+07	1.93E+11	1.59E+07
36	2.04E+11	66	1.56E+06	1.25E+07		14.5	1.51E+07	1.96E+11	1.51E+07
37	2.11E+11	59	1.27E+06	1.02E+07		15.0	1.42E+07	1.99E+11	1.42E+07
38						15.5	1.34E+07	2.01E+11	1.34E+07



Calculations for plateau mode. Plateau rate of 20 E6 Sm^3/d

time [years]	q_{field} [sm^3/d]	G_p [sm^3]	q_{ppf} [sm^3/d]
0.0	2.00E+07	0	7.64E+07
0.5	2.00E+07	3.55E+09	7.53E+07
1.0	2.00E+07	7.10E+09	7.42E+07
1.5	2.00E+07	1.07E+10	7.29E+07
2.0	2.00E+07	1.42E+10	7.17E+07
2.5	2.00E+07	1.78E+10	7.04E+07
3.0	2.00E+07	2.13E+10	6.91E+07
3.5	2.00E+07	2.49E+10	6.78E+07
4.0	2.00E+07	2.84E+10	6.66E+07
4.5	2.00E+07	3.20E+10	6.54E+07
5.0	2.00E+07	3.55E+10	6.41E+07
5.5	2.00E+07	3.91E+10	6.29E+07
6.0	2.00E+07	4.26E+10	6.17E+07
6.5	2.00E+07	4.62E+10	6.05E+07
7.0	2.00E+07	4.97E+10	5.93E+07
7.5	2.00E+07	5.33E+10	5.82E+07
8.0	2.00E+07	5.68E+10	5.70E+07
8.5	2.00E+07	6.04E+10	5.58E+07
9.0	2.00E+07	6.39E+10	5.47E+07
9.5	2.00E+07	6.75E+10	5.36E+07
10.0	2.00E+07	7.10E+10	5.24E+07
10.5	2.00E+07	7.46E+10	5.13E+07
11.0	2.00E+07	7.81E+10	5.02E+07
11.5	2.00E+07	8.17E+10	4.91E+07

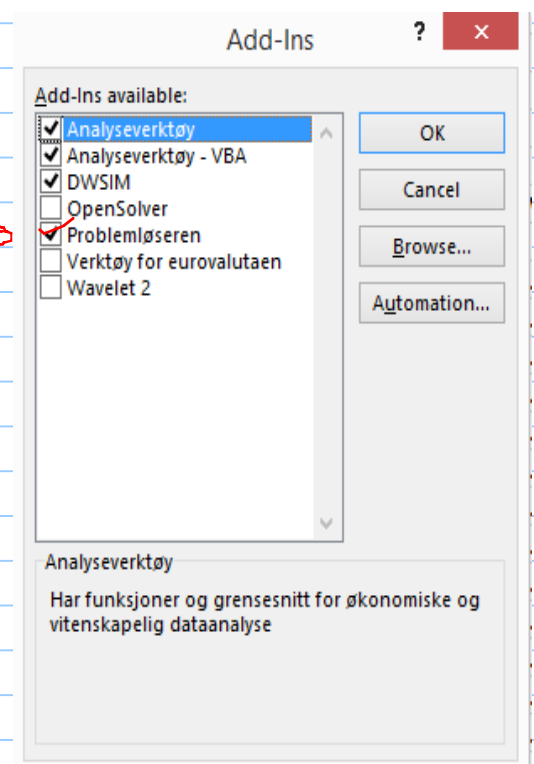
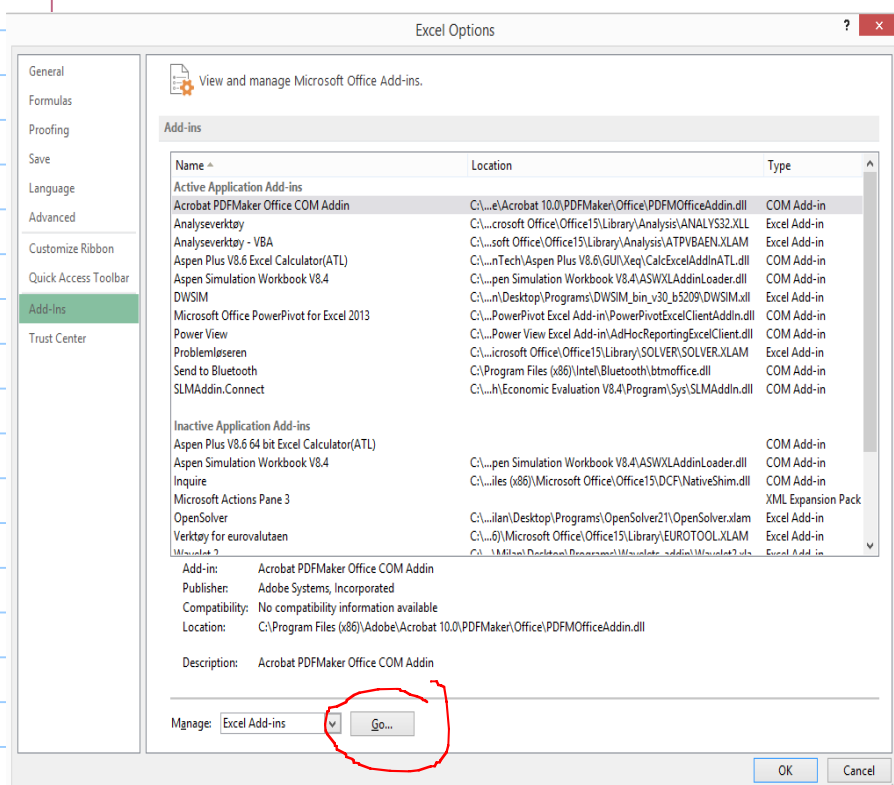
For all these years, production potential is greater than plateau rate, that means that it is feasible to produce it!

How to find plateau duration with Excel solver?

24.0	2.00E+07	1.70E+11	2.27E+07
24.5	2.00E+07	1.74E+11	2.17E+07
25.0	2.00E+07	1.78E+11	2.06E+07
25.2	2.00E+07	1.79E+11	2.02E+07
26.0		1.85E+11	1.85E+07
26.5		1.85E+11	1.85E+07

should be the same, by changing

Activate the solver in Excel: File, options---Add-ins



Problemløserparametere

Angi mål:

Til: ☒ Maks ☐ Min ☐ Verdi av:

Ved å endre variabelceller:

Underlagt begrensningene:

☒ Gjør ubegrensede variabler ikke-negative

Velg en løsningsmetode:

Løsningsmetode

Velg Ikke-lineær GRG for Problemløser-problemer som er jevne og ikke-lineære. Velg LP (simpleks) for lineære problemer, og velg Evolusjonær for problemer som er ujevne.

Hjelp Løs Lukk

objective cell, max, min,
drive to a certain value

tells to change, variables

constraints:

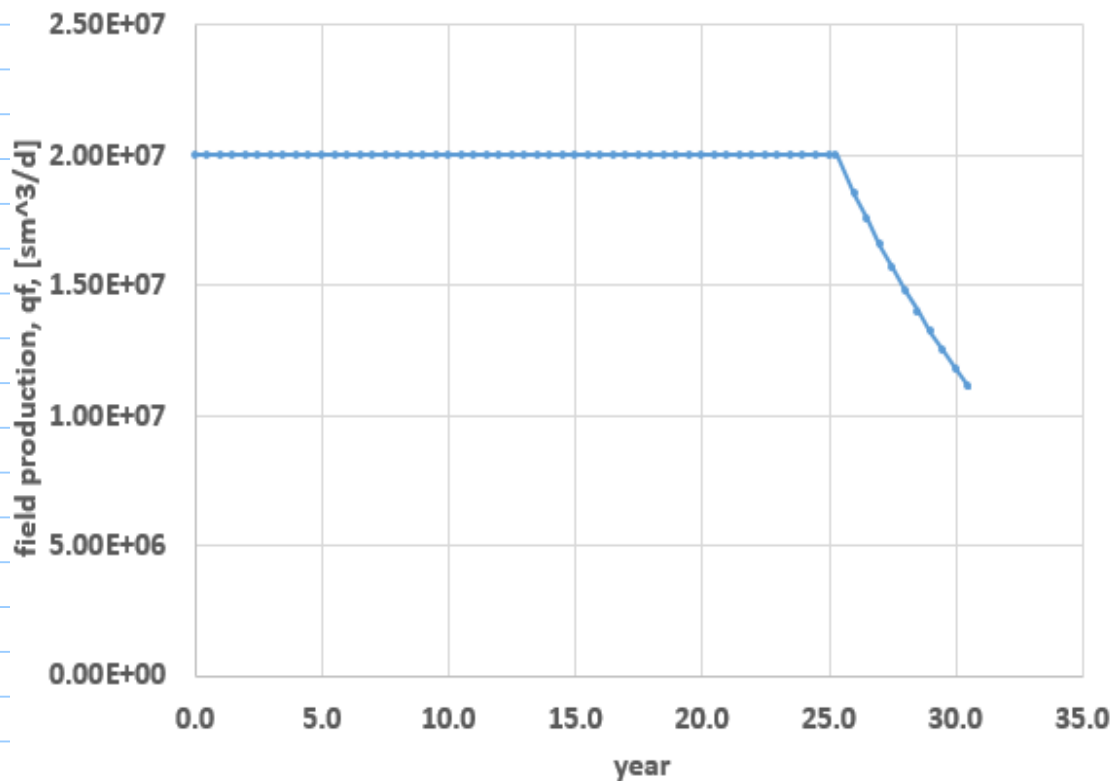
• operational constraints

• variable bounds
to help the solver

	22.5	2.00E+07	1.60E+11	2.59E+07	
	23.0	2.00E+07	1.63E+11	2.48E+07	
	23.5	2.00E+07	1.67E+11	2.38E+07	
	24.0	2.00E+07	1.70E+11	2.27E+07	
	24.5	2.00E+07	1.74E+11	2.17E+07	
	25.0	2.00E+07	1.78E+11	2.06E+07	Error
End of plateau	25.291	2.00E+07	1.80E+11	2.00E+07	=(158-G58)*2
	26.0	1.85E+07	1.85E+11	1.85E+07	
	26.5	1.75E+07	1.88E+11	1.75E+07	

After plateau, the field its producing at is production potential

End of plateau	25.291	2.00E+07	1.80E+11	2.00E+07	1.38778E-17
	26.0	1.85E+07	1.85E+11	1.85E+07	
	26.5	1.75E+07	1.88E+11	1.75E+07	
	27.0	1.66E+07	1.91E+11	1.66E+07	
	27.5	1.57E+07	1.94E+11	1.57E+07	
	28.0	1.48E+07	1.97E+11	1.48E+07	
	28.5	1.40E+07	1.99E+11	1.40E+07	
	29.0	1.32E+07	2.02E+11	1.32E+07	
	29.5	1.25E+07	2.04E+11	1.25E+07	
	30.0	1.18E+07	2.06E+11	1.18E+07	
	30.5	1.11E+07	2.08E+11	1.11E+07	



it might not be possible to produce at the production potential (specially for early times)

- damage to the formation (sand production)
- gas coning, water coning
- erosion problems
- Critical flow \leadsto limitation in the maximum rate

But it is important to estimate the behavior of the production potential to estimate plateau duration.