

### 1. Snohvit subsea gas well modeling in Prosper

#### Fluid information:

Use the black oil model for your PVT behavior.

WGR = 0 Sm<sup>3</sup>/Sm<sup>3</sup>

CGR = 0 Sm<sup>3</sup>/Sm<sup>3</sup>

Condensate density = 751 Kg/m<sup>3</sup>

Gas gravity = 0.55

Formation Water salinity = 0 ppm

No H<sub>2</sub>S, CO<sub>2</sub>, N<sub>2</sub>.

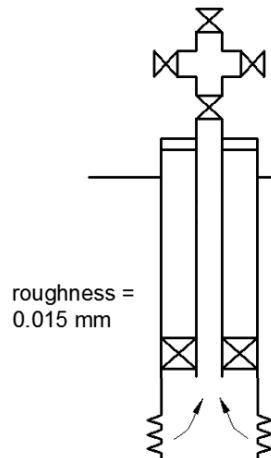
#### Well layout:

Deviation survey

MD [m]	TVD [m]
0	0
2100	2100

Geothermal gradient

MD [m]	T [C]
0	4
2100	92



Flow in tubing, tubing diameter 0.15 m

Overall wellbore heat transfer coefficient = 45 W/m<sup>2</sup> K

#### Reservoir info:

Producing from a single layer

Reservoir pressure = 276 bara

Reservoir temperature = 92 C

Backpressure coefficient = 1000 Sm<sup>3</sup>/d/bara

Backpressure exponent = 1

**Tasks:**

- Set up a prosper model of a subsea oil well.
- Estimate the producing rate using flow equilibrium assuming that the well is producing against a constant wellhead pressure of 100 bara
- Generate and export lift curves to be used in GAP (in the following exercise).  $p_{wh}$  range: 30-276 bara

**1. Creating MBAL file of Snohvit reservoir****Fluid information:**

Use the black oil model to represent your PVT behavior.

Gas gravity = 0.55

Condensate gravity = 751 Kg/m<sup>3</sup>

At initial conditions no water.

Formation Water salinity = 0 ppm

No H<sub>2</sub>S, CO<sub>2</sub>, N<sub>2</sub>.

**Temperature:** 92 C

**Initial pressure:** 276 bara

**Porosity:** 0.15

**Connate water saturation:** 0.25

**Original oil in place:** 270 000 E6 Sm<sup>3</sup>

**Start of production:** 10.02.2020

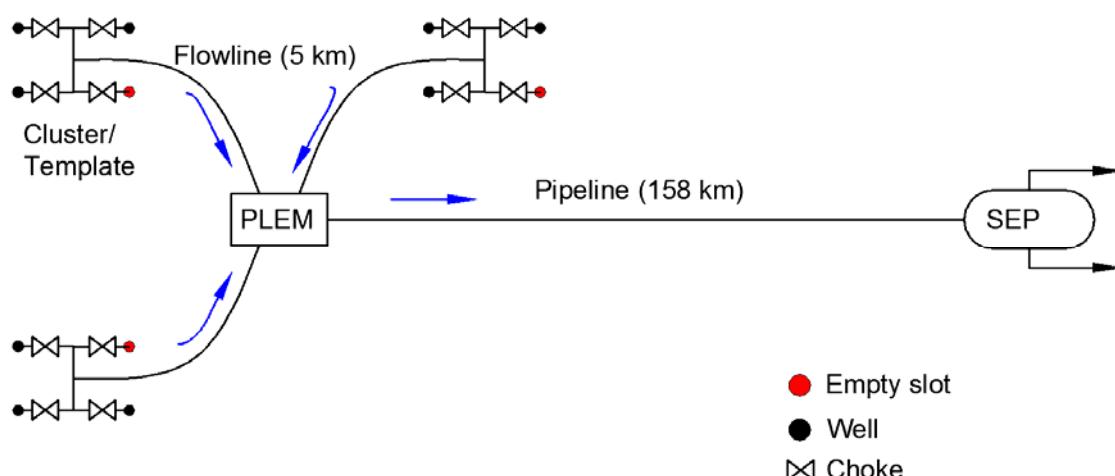
**Water influx:** No aquifer

**Rel Perm:** Corey Functions

Rel Perm. from	Corey Functions		
Hysteresis	No		
Water Sweep Eff. 100 percent			
Normalise End Points			
Residual Saturation	End Point	Exponent	
fraction	fraction		
K <sub>w</sub>	0.25	0.3	2.5
K <sub>g</sub>	0.1	0.8	1.5

**2. Modeling of a subsea network with nine gas wells in GAP**

The layout of the production network layout is shown below.



All wells are identical

Pipeline and flowline heat transfer coefficient: 5 W/m<sup>2</sup> K

Pipeline ID: 0.680 m, roughness 1.5e-5 m

Flowline ID: 0.355 m, roughness 1.5e-5 m

**Tasks:**

- Build the GAP model of three subsea wells producing to the LNG plan in Melkøya.
- Adding a rate constraint to the separator of 20E06 Sm<sup>3</sup>/d, and run an “optimization”.
- Run in prediction mode to find field rate with time.



Kunnskap for en bedre verden

# Introduction to PETEX

10 February 2020

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# Outline

- Licensing
- PROSPER
- MBAL
- GAP: Set up Production Network
- GAP: Solve Production Network

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## Licensing

Licensing Setup Wizard MF



IPM programs require a licensing system to run.

The licensing system can either be a bitlock that is plugged into your computer that only you can use OR a server on your network that shares licenses with other users on your network.

The license setup wizard is used to help you configure your PC to use your chosen licensing system.

You will be asked questions about your licensing system and PC. The Wizard will try to configure your PC to use the licensing system.

If you wish to stop the Wizard at any time, click Cancel.

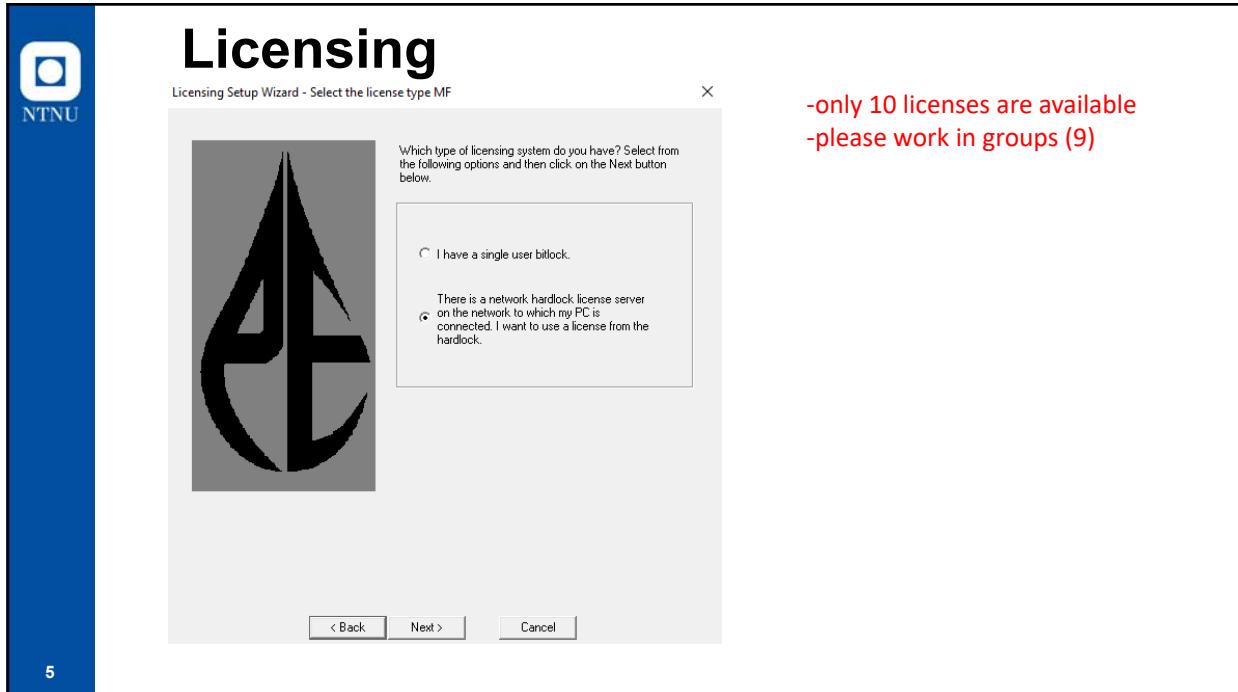
If you want to re-run the Wizard in the future, select Start-Programs-Petroleum Experts IPM X-Utilities-Setup Licensing Wizard

-only 10 licenses are available  
-please work in groups (9)

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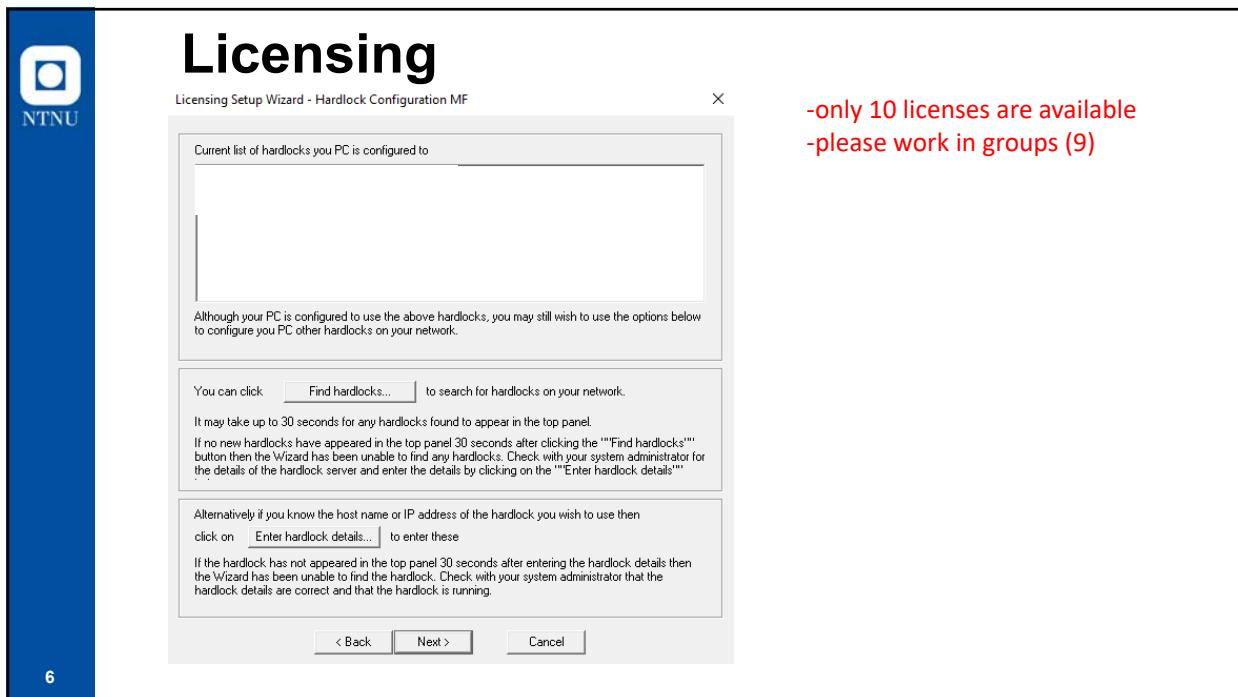
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-only 10 licenses are available  
-please work in groups (9)



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The screenshot shows a window titled "Licensing" from the "Licensing Setup Wizard - Test hardlock MF". The main pane displays a list of available licenses:

- GAP (09-dec-2019 - version 12.0) (10 licenses) <no checkout allowed> <Educational>
- PVTIP (09-dec-2019 - version 13.0) (10 licenses) <no checkout allowed> <Educational>
- MBAL (09-dec-2019 - version 14.0) (10 licenses) <no checkout allowed> <Educational>
- REVEAL (09-dec-2019 - version 8.0) (10 licenses) <no checkout allowed> <Educational>
- RESOLVE (09-dec-2019 - version 8.0) (10 licenses) <no checkout allowed> <Educational>

To the right of the list, red text reads: "-only 10 licenses are available -please work in groups (9)".

Below the list, there is a note: "To view the licenses on all the hardlocks, click the Test button." followed by a "Test..." button.

At the bottom of the window, there is explanatory text: "The panel above displays all the licenses available on all the hardlocks that your PC is configured to use. If no hardlocks appear in the above panel, then it is possible that the hardlocks that your PC is configured to use, are no longer running. Please check with your systems administrator. Even if you can view licenses in the above panel, remember that these licenses are shared by all the users on your network. So it is possible that when you try to run an IPM program, all licenses will be in use by other users."

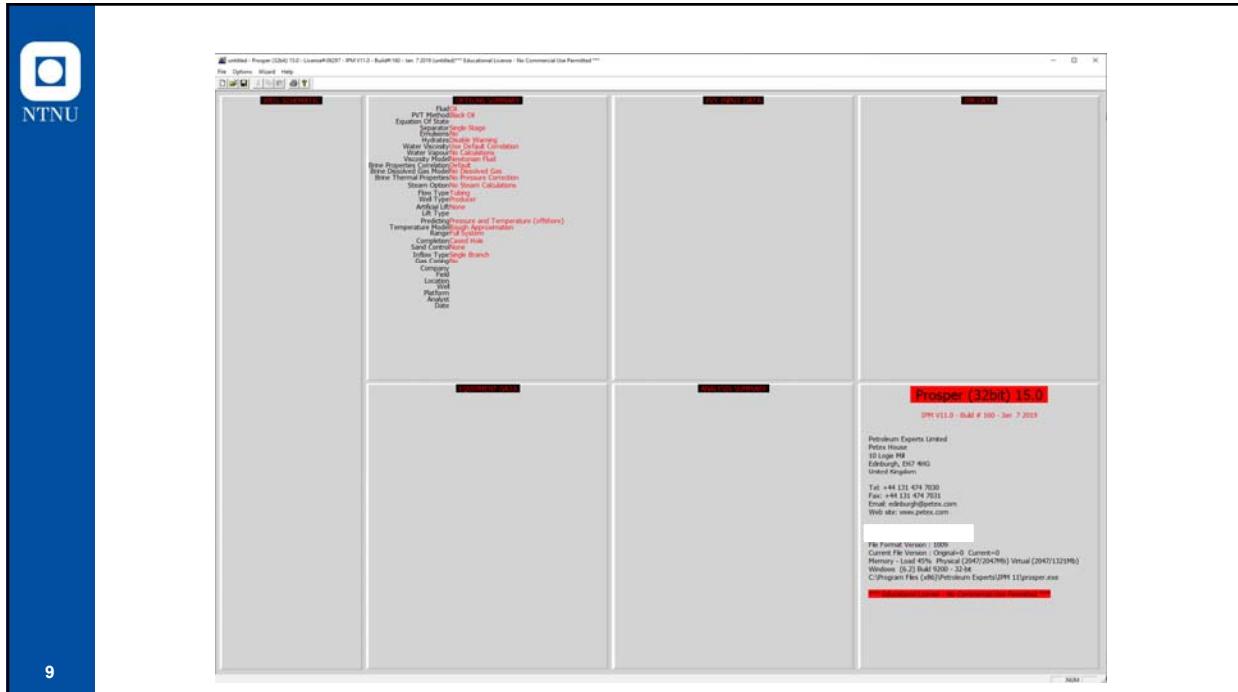
At the bottom right are buttons for "< Back", "Finish", and "Cancel".

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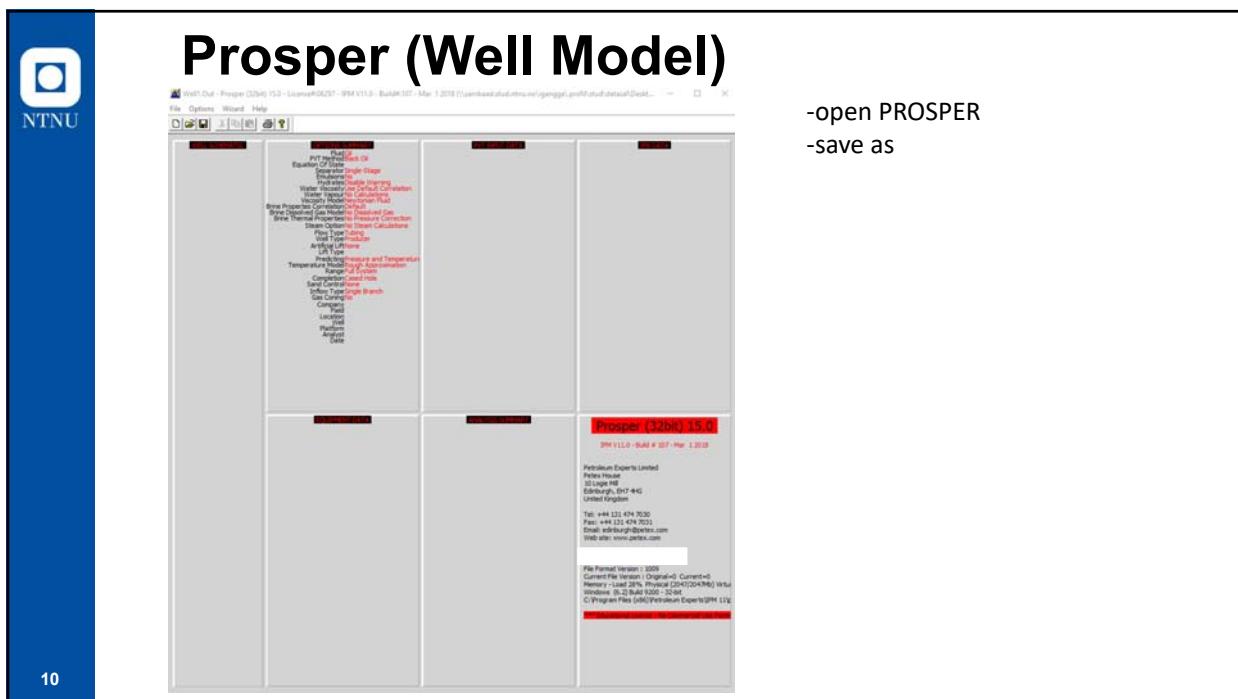
# Outline

- Licensing
- PROSPER
- MBAL
- GAP: Set up Production Network
- GAP: Solve Production Network

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-open PROSPER

-save as

**Prosper – System Summary**

The screenshot shows the 'System Summary (well\_1.out)' window. It includes sections for Fluid Description (Fluid: Dry and Wet Gas, Method: Black Oil), Calculation Type (Predict Pressure and Temperature (offshore), Model: Rough Approximation, Range: Full System), Brine Modeling (Brine Properties Correlation: Default), Well (Flow Type: Tubing Flow, Well Type: Producer), Well Completion (Type: Cased Hole, Sand Control: None), Reservoir (Inflow Type: Single Branch), and User Information (Company, Field, Location, Well, Platform, Analyst, Date: onsdag 5. februar 2020). A red note on the right side of the window lists: -use default setting, -Fluid: dry and wet gas, -Method: Black Oil, and -change unit system to Norwegian S.I.

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**Prosper – PVT Input Data**

The screenshot shows the 'PVT - INPUT DATA (well\_1.out)' window. It features an 'Input Data' table with fields like Gas Gravity (0.55), Separator Pressure (30), Condensate Gas Ratio (0), Condensate Gravity (75), Water Gas Ratio (0), Water Salinity (0), Mole Percent H2S (0), Mole Percent CO2 (0), and Mole Percent N2 (0). To the right are sections for Z Factor, Gas Viscosity Correlations (Lee et al., Carr et al.), and Matching Data (Table 4, Z Factor Plot, Gas Viscosity Plot, Gas PVF Plot). A red note on the right side of the window lists: -input PVT data (gas gravity, psep, condensate gravity) and -choose PVT correlation.

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**Prosper – PVT Input Data**

-calculate PVT properties  
-input Tres & Pres

The screenshot shows the Prosper PVT input interface. On the left, there's a blue sidebar with the NTNU logo. The main window has tabs for 'Data Points' and 'Ranges/Values'. Under 'Ranges/Values', there's a table for Temperature and Pressure with 'From' 50, 'To' 92, and 'No.Of Steps' 10. To the right is a large table titled 'PVT Calculations (well 1, Out)' with columns for various properties like Head, Saturation, Gas Viscosity, etc., for multiple data points.

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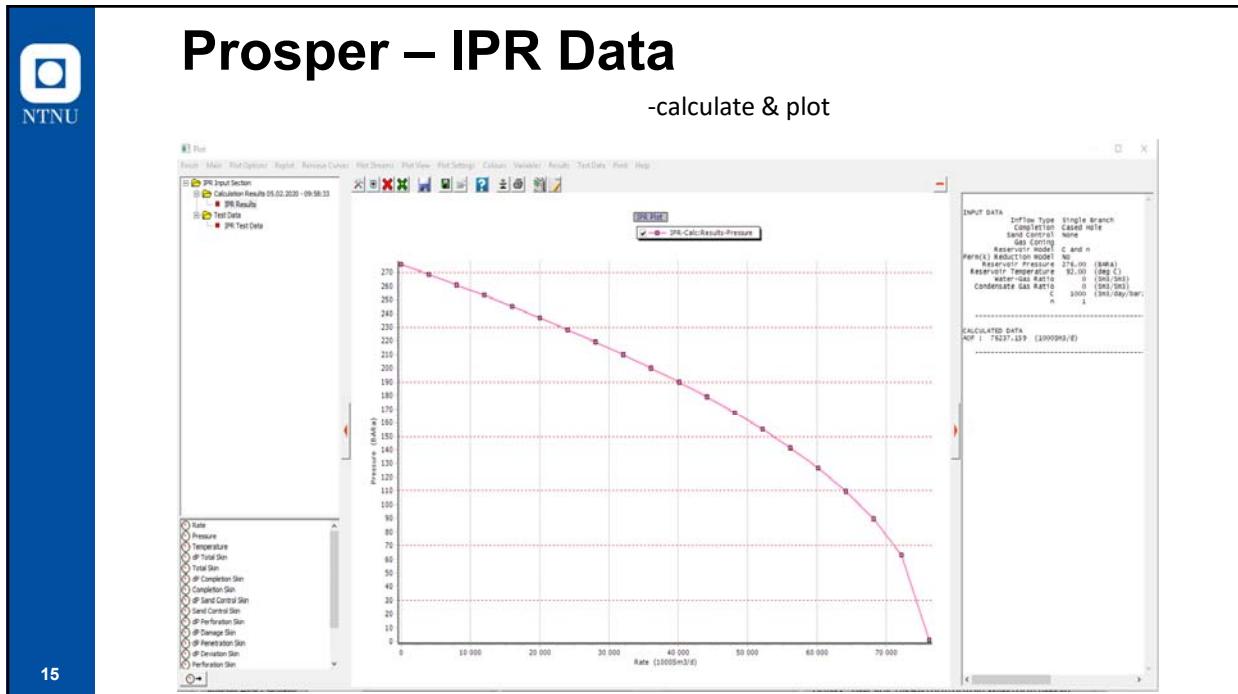
**Prosper – IPR Data**

-Reservoir model: C and n  
-input reservoir data (Pres, Tres, C, n)

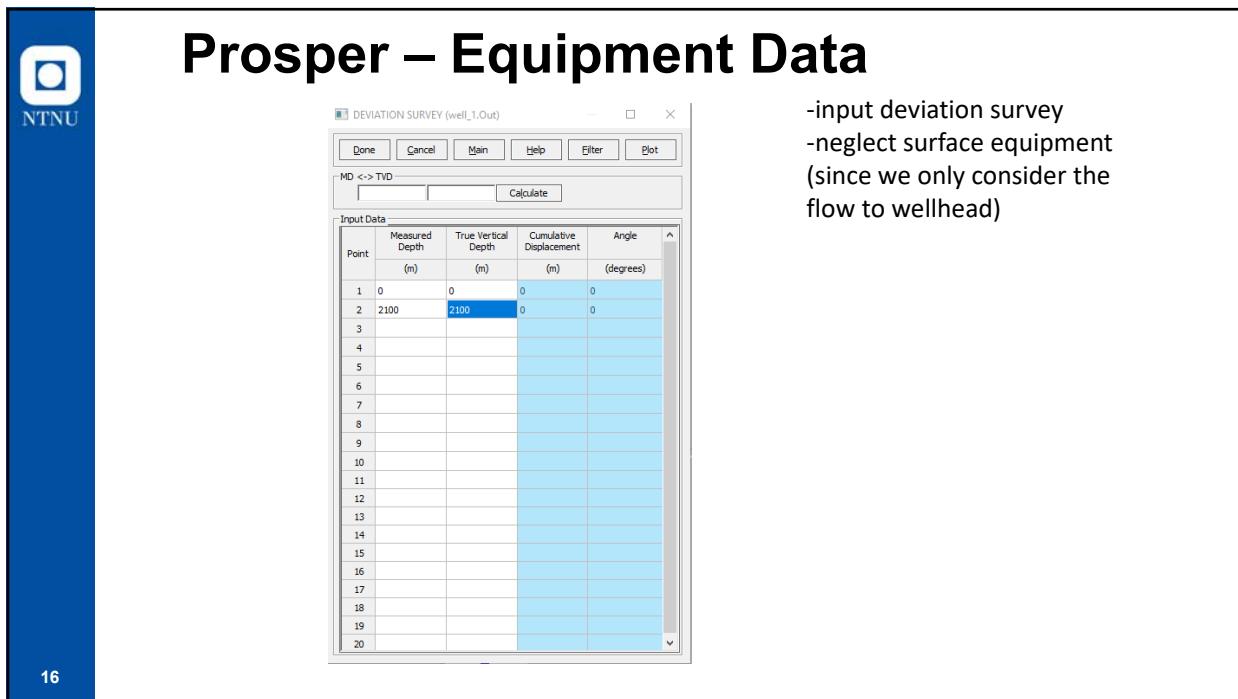
The screenshot shows the Prosper IPR input interface. It includes tabs for 'Reservoir Data' and 'Model Data'. In 'Reservoir Data', fields are filled with values like Reservoir Pressure (276), Reservoir Temperature (30), Water Gas Ratio (0), and Condensate Gas Ratio (0). In 'Model Data', it shows 'C and n Reservoir Model' with values C=2000 and n=1.

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**Prosper – Equipment Data**

- input downhole equipment
- pay attention with the measured depth, unit of tubing ID, & roughness

Point	Label	Type	Measured Depth (m)	Tubing Inside Diameter (m)	Tubing Inside Roughness (m)	Tubing Outside Diameter (m)	Tubing Outside Roughness (m)	Casing Inside Diameter (m)	Casing Inside Roughness (m)	Rate ^ Multipl
1	Xmas Tree	0								
2	Tubing	2100	0.15	1.524e-5						1
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										

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**Prosper – Equipment Data**

- input geothermal gradient & overall heat transfer coefficient

Point	Formation TVD (m)	Formation Measured Depth (m)	Formation Temperature (deg C)
1	0	0	4
2	2100	2100	92
3			
4			
5			
6			
7			

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**Prosper – Equipment Data**

- input average heat capacities
- neglect gauge details

Cp Oil	2.219	KJ/Kg/K
Cp Gas	2.1353	KJ/Kg/K
Cp Water	4.1868	KJ/Kg/K

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**Prosper – Analysis Summary**

- Estimate the producing rate using flow equilibrium assuming that the well is producing against a constant wellhead pressure of 100 bar.

- select “system” option
- input Pwh,
- use default tubing equation
- “Rate method”---User selected

Point	Gas Rate	Water Rate	VLP Pressure	IPR Pressure	dP Total Skin	dP Perforation	dP Damage	dP Completion	Completion Skin
1	2.817e-5	0	115.382	276	0	0	0	0	0
2	2500	0	126.469	271.437	0	0	0	0	0
3	5000	0	170.003	266.796	0	0	0	0	0
4	7500	0	222.49	262.073	0	0	0	0	0
5	10000	0	281.251	257.263	0	0	0	0	0
6	12500	0	344.451	252.361	0	0	0	0	0

Label	Value	Units
Liquid Rate	0	(m³/day)
Solution Node Pressure	259.076	(bar)
dP Friction	15.417	(bar)
dP Gravity	21.9318	(bar)
dP Total Skin	0	(bar)
dP Perforation	0	(bar)
dP Damage	0	(bar)
dP Completion	0	(bar)
Total Skin	0	
Wellhead Liquid Density	727.333	(kg/m³)
Wellhead Gas Density	58.9469	(kg/m³)
Wellhead Liquid Viscosity	0.38659	(mPa.s)
Wellhead Gas Viscosity	0.013179	(mPa.s)
Wellhead Superficial Liquid Velocity	0	(m/sec)
Wellhead Superficial Gas Velocity	68.1122	(m/sec)
Wellhead Z Factor	0.3104	
Wellhead Interfacial Tension	6.97203	(mN/m)
Wellhead Pressure	100	(bar)
Wellhead Temperature	80.076	(deg C)
First Node Liquid Density	727.333	(kg/m³)
First Node Gas Density	58.9469	(kg/m³)
First Node Liquid Viscosity	0.38659	(mPa.s)
First Node Gas Viscosity	0.013179	(mPa.s)
First Node Superficial Liquid Velocity	0	(m/sec)
First Node Superficial Gas Velocity	68.1122	(m/sec)

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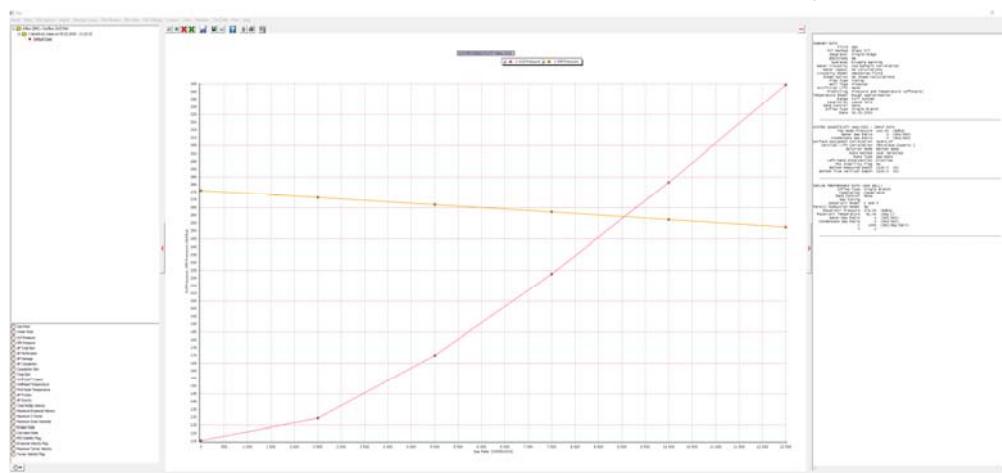
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## Prosper – Analysis Summary

- Estimate the producing rate using flow equilibrium assuming that the well is producing against a constant wellhead pressure of 100 bar.
- calculate
- plot → system plot → plot all cases → X-axis: liquid rate, Y-axis: VLP & IPR pressure



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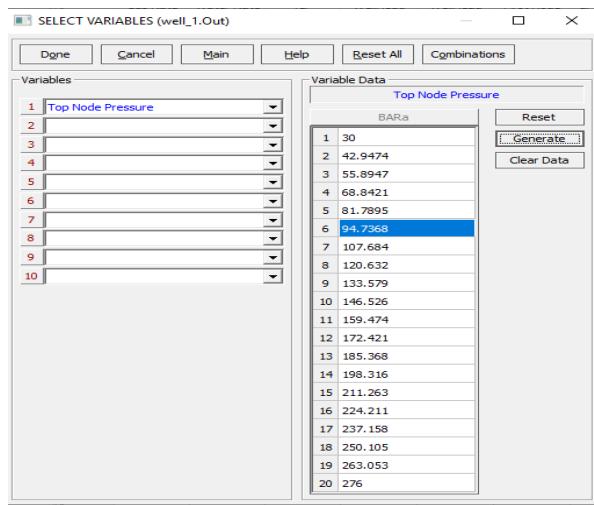
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## Prosper – Analysis Summary

- Generate and export lift curves to be used in GAP (in the following exercise).  $p_{wh}$  range: 30-276 bara



- generate VLP table
- select "VLP" option
- go to "cases"
- select variables & generate variable data (you can use linear spacing & 20 breakpoints). Then you have 20 cases

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## Prosper – Analysis Summary

-input Pwh = 100 bara (just to avoid it complaining)  
-calculate  
-select “export lift curve” → choose “Petroleum Experts – GAP/MBAL” → save in the same directory as your prosper file, and with the same name  
-done

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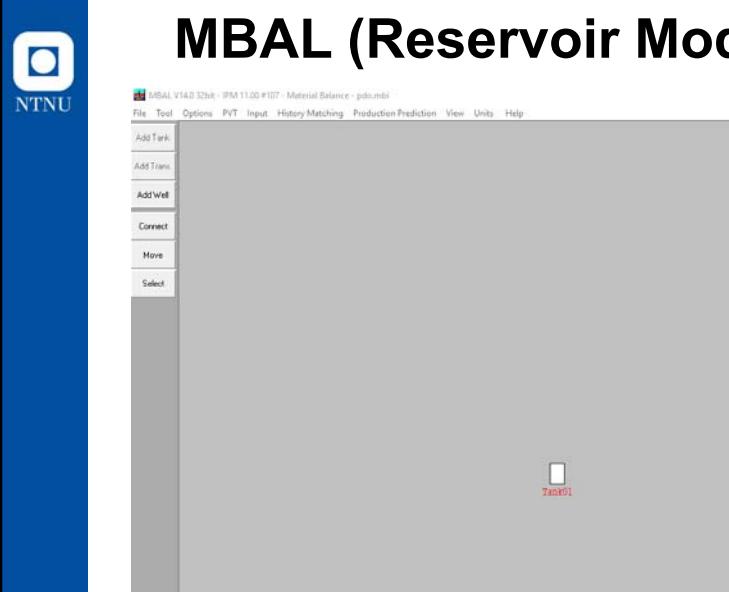
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## Outline

- Licensing
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- GAP: Solve Production Network

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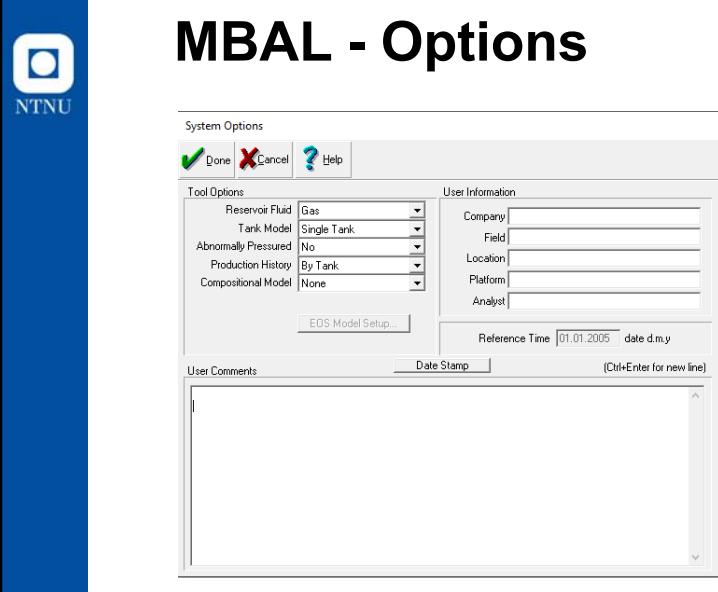


**MBAL (Reservoir Model)**

- open MBAL
- save as
- select “tool” → “material balance”

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**MBAL - Options**

- select “options”
- use default setting

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**MBAL – Unit System**

-select “Units”  
 -change unit system to Norwegian S.I.

Unit Name	Unit Selections		Validation (Input Units)			Details	
	Input	Sh/Mu	Output	Sh/Mu	Minimum		Maximum
Compressibility	1/bar	Sh/Mu	1/bar	Sh/Mu	0	0.014503774	Details
Critical Pressure	BARa	Sh/Mu	BARa	Sh/Mu	0.94430591872	2069.440353489	Details
Critical Temperature	deg C	Sh/Mu	deg C	Sh/Mu	-272.7777505	1648.888724	Details
Critical Volume	m³/kg.mole	Sh/Mu	m³/kg.mole	Sh/Mu	0	624.3	Details

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**MBAL - PVT**

-select “PVT” → fluid properties  
 -input PVT data  
 -select PVT correlations

Input Parameters		Correlations
Gas gravity	0.55	sp. gravity
Separator pressure	30	BARa
Condensate to gas ratio	0	Sm3/Sm3
Condensate gravity	751	Kg/m3
Water salinity	0	ppm
Mole percent H2S	0	percent
Mole percent CO2	0	percent
Mole percent N2	0	percent

Correlations:

- Gas viscosity: Lee et al
- Use Tables
- Use Matching
- Model Water Vapour

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## MBAL - Input

Tank Input Data - Tank Parameters

Done  Cancel  Help  Import

Tank Parameters	Water Influx	Rock Compress.	Rock Compaction	Pore Volume vs Depth	Relative Permeability	Production History	
Tank Type	Gas						
Name	Snowwhite						
Temperature	92	deg C					
Initial Pressure	276	BARa					
Porosity	0.15	fraction					
Connate Water Saturation	0.25	fraction					
Water Compressibility	Use Corr	1/bar					
Original Gas In Place	27000	MSm <sup>3</sup>					
Start of Production	10.02.2020	date d.m.y					

Monitor Contacts  
 Gas Storage  
 Model Water Pressure Gradient  
 Use Fractional Flow Table (instead of rel perms)  
 Coalbed Methane  
 Model Coal Permeability Variation

<< Prior | Next >> | Validate |

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## MBAL - Input

Tank Input Data - Water Influx

Done  Cancel  Help

Tank Parameters	Water Influx	Rock Compress.	Rock Compaction	Pore Volume vs Depth	Relative Permeability	Production History
Model	None					

<< Prior | Next >> |

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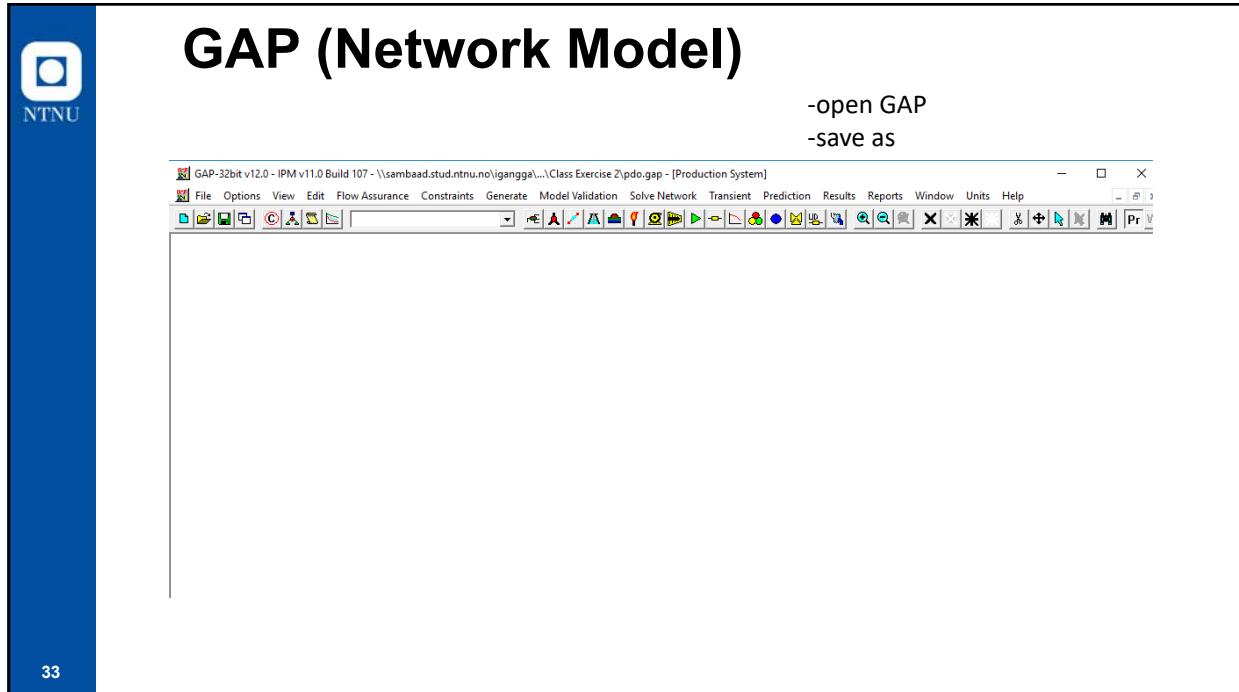
The screenshot shows the 'MBAL - Input' window. At the top, there is a toolbar with icons for Done, Cancel, Help, Print, Copy, and Paste. Below the toolbar, a menu bar includes 'Tank Parameters', 'Water Influx', 'Rock Compress.', 'Rock Compaction', 'Pore Volume vs Depth', 'Relative Permeability', and 'Production History'. The main area is titled 'Tank Input Data - Relative Permeabilities'. It contains several input fields: 'Rel Perm. from' dropdown set to 'Grey Functions', 'Hysteresis' dropdown set to 'No', 'Water Sweep Eff.' input field set to '100 percent', and a table for 'Residual Saturation' and 'End Point Exponent'. The table has two rows: one for K<sub>w</sub> with values 0.25, 0.3, 2.5, and another for K<sub>ag</sub> with values 0.1, 0.8, 1.5. A 'Normalize End Points' button is also present. At the bottom, there are navigation buttons: '<< Prior' and 'Next >>'.

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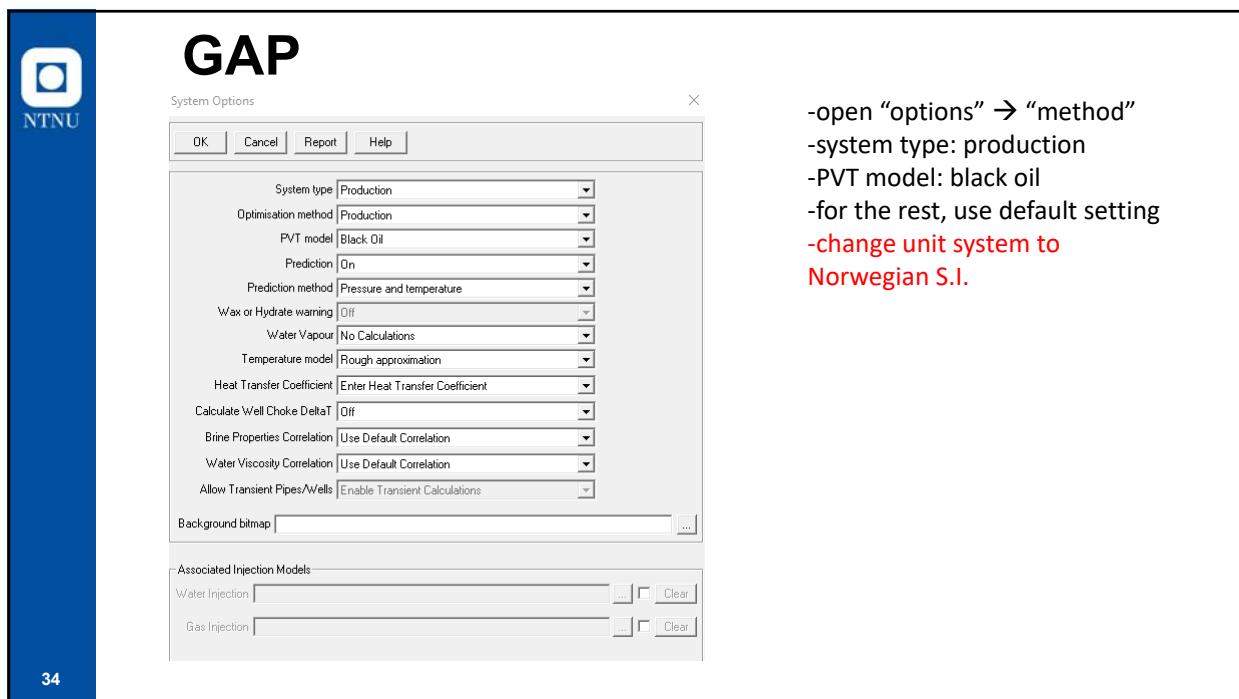
The screenshot shows the 'Outline' section of the MBAL software. The title 'Outline' is displayed prominently. Below the title, there is a bulleted list of steps:

- Licensing
- PROSPER
- MBAL
- GAP: Set up Production Network
- GAP: Solve Production Network

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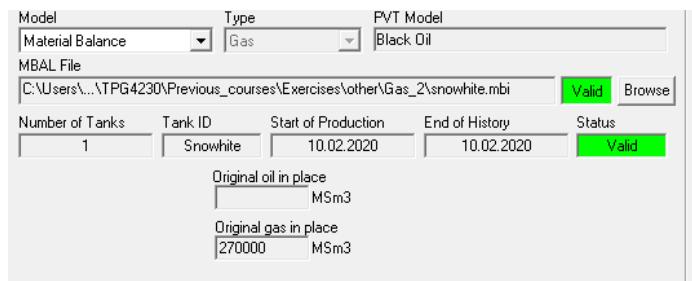


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## GAP: Reservoir: Summary tab



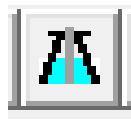
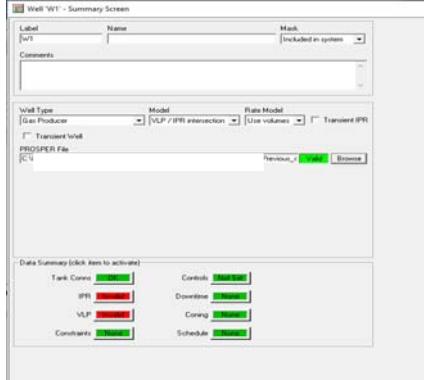
- add tank icon → rename the tank
- double click to edit tank properties
- include MBAL model
- done



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## GAP: Well: Summary tab

- add well icon → rename the well
- double click to edit well properties
- 'summary' tab → change welltype and add path to prosper file

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## GAP: Well: Input tab: VLP Tab

VLP Details  
VLP File Name: C:\Users\valve\Documents\TPG4230-2020\well\_W1.vlp  
Import Export Inspect Generate  
Turn off # unstable  
Force left hand side intersection (sober)  
Allow left hand side intersection (optimized)   
Safe VLP/IPR intersection (much slower)  
VLP Information  
Type : Gas Producer  
Sensitivity Variables : Gas Rate, Manifold Pressure  
Calculated Variables : FBH Pressure, PvH Temperature, C Factor, Mature Velocity, Erosional Velocity, Max Grain Diameter, Turner Velocity, Erosion Flag, Turner Flag, Erosion Rate, Corrosion Rate  
Surface Correlation: Hydro-2P  
Vertical Correlation: Petroleum Experts 2

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- 'input' tab → 'VLP' tab →
- 'import' VLP table in **TPD format**
- done

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## GAP: Well: Input tab: IPR Tab

Select Layer [Layer 1 - Invalid] Add Layer Remove Layer Duplicate Layer  
Label Layer Type Gas Mask Included in system  
Inflow Performance Tank Connection [None] IPR Match  
IPR Type: C and n Layer Pressure: BARa  
C: Sm3/day/bar<sup>2</sup> Layer Temp: deg C  
n: IPR dP shift: bar  
Permeability Compaction Correction  
Crossflow Injectivity Index: Sm3/day/bar<sup>2</sup>

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- 'input' tab → "IPR" tab
- Choose IPR type to "C and n" to have the same correlation in PROSPER

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# GAP: Well

## Transfer IPR data

Menu: generate – well IPR from Prosper –All - Generate

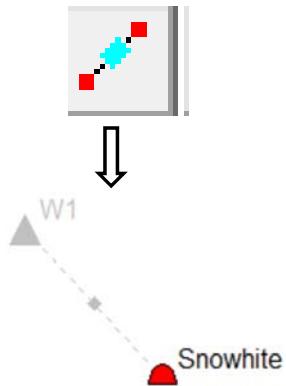
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# GAP: Well

-add connection between reservoir and well



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## GAP: Well: Input tab: IPR Tab

Well 'W1' - Input Screen

Select	Layer [Layer 1 - Invalid]	Add Layer	Remove Layer	Duplicate Layer
Label	Layer Type [Gas]	Mask [Included in system]		
Inflow Performance				
Tank Connection [Snowwhite]	IPR Match			
IPR Type [C and n]	C [1000.8203]	Sm3/day/bar2	Layer Pressure [276]	BARa
n [1]			Layer Temp [92.000003]	deg C
IPR dP shift [-]	bar			
Permeability Compaction Correction				
Crossflow Injectivity Index				
Gravel pack [Edit Gravel Pack]				
Fluid Properties				
Cond. gravity [751]	Kg/m3	Water salinity [0]	ppm	
Gas gravity [0.55]	sp. gravity	H2S [0]	percent	
CGR [0]	Sm3/Sm3	CO2 [0]	percent	
WGR [0]	Sm3/Sm3	N2 [0]	percent	<input checked="" type="checkbox"/> Use tank impurities

Checking the IPR quality:  
- 'input' tab → "IPR" tab -> IPR Match

Match IPR Data

Match Layer IPR Data	Layer Number [1]	Match Points	Gas Rate [1000Sm3/d]	FBH Pressure [BARa]
Test Layer Pressure [276]	BARa	1	296.56868	275.46266
Test WGR [0]	Sm3/Sm3	2	1482.8417	273.30271
n [1]		3	2965.683	270.57854

Match Layer IPR Results

A.O.F. [76239.499]	1000Sm3/d
C [1000.8203]	Sm3/day/bar2
n [1]	

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## GAP: Well: Input tab: IPR Tab

Well 'Well\_1' - Input Screen

Select	Layer [Layer 1 - OK]	Add Layer	IPR Match
Relative Permeability			
Prediction Fractional Flow Model	From Tank Model	Edit	
Shift Rel Perms to Breakthrough [No]			
P.I. Correction for Mobility [No]			
Use match coefficients			
Breakthrough and Perforation Depths			
Gas Saturation [ ]	percent	Gas Contact [ ]	m
Water Saturation [ ]	percent	Water Contact [ ]	m
Bottom Perf Depth [ ]	m	Top Perf Depth [ ]	m

-'input' tab → 'IPR' tab → 'More' sub-tab  
-use permeability curve as for MBAL model ('From Tank Model')

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## GAP: Well: Input tab: Control Tab



- 'input' tab → 'control' tab
- change dp Control to allow well choking
- done

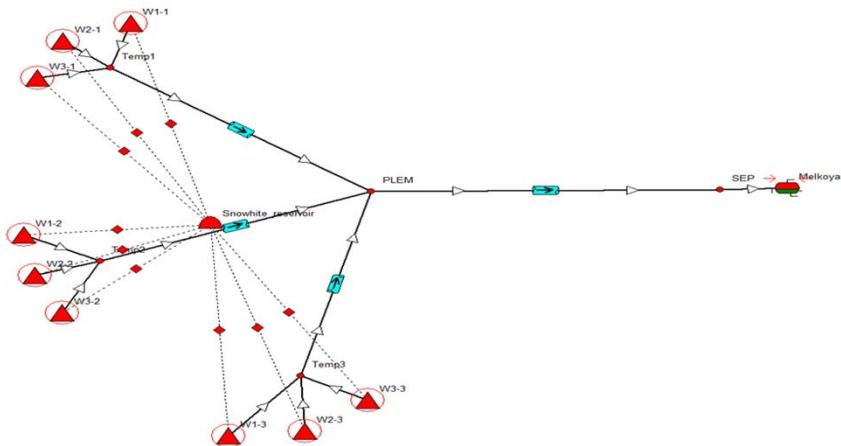
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## GAP: Production Layout



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**GAP: Separator**

The diagram shows a separator icon (a grey circle with a red dotted border) connected to a pipeline. A callout points to the icon with the text: "-add separator icon → choose 'production separator' → rename it". Below the icon is a "Choose Equipment Type" dialog box. The "Select Type" dropdown menu is open, showing "Production Separator" as the selected option, along with other options like "Water Injection Manifold", "Gas Injection Manifold", etc. At the bottom of the dialog are "OK" and "Cancel" buttons.

W1-1  
Snowwhite  
Melkoya

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**GAP: Joint (Xtree, Manifold, etc)**

The diagram shows a network of pipelines with several joints marked by red circles with a white cross. The joints are labeled: "Temp1", "Temp2", "Temp3", "Snowwhite", "Pleim", "Sep", and "Melkoya". A callout points to a joint icon with the text: "-add joint icon". Another callout points to the "Sep" joint with the text: "-Rename the joint label". A third callout points to the network of pipes with the text: "-pipeline is modelled between 2 joints".

W1-1  
Temp1  
Temp2  
Temp3  
Snowwhite  
Pleim  
Sep  
Melkoya

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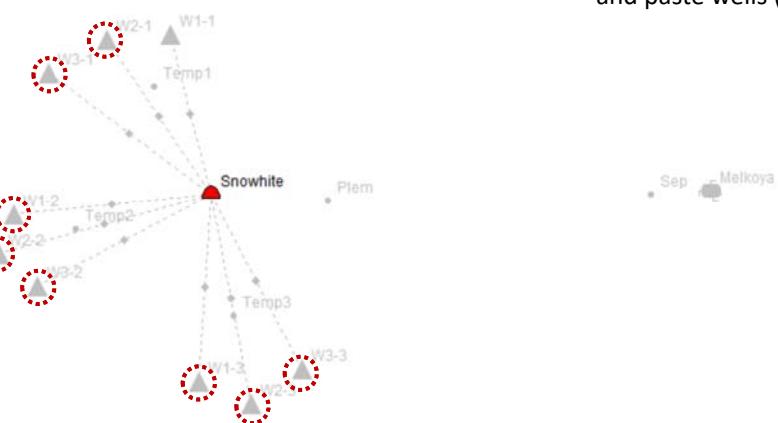
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## GAP: Adding more wells

-All wells are identical, thus, copy and paste wells (8 times)



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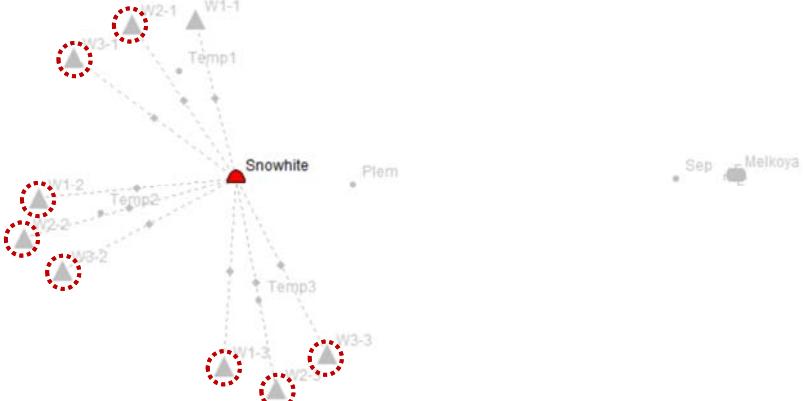
47



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## GAP: Adding more wells

-All wells are identical, thus, copy and paste wells (8 times)



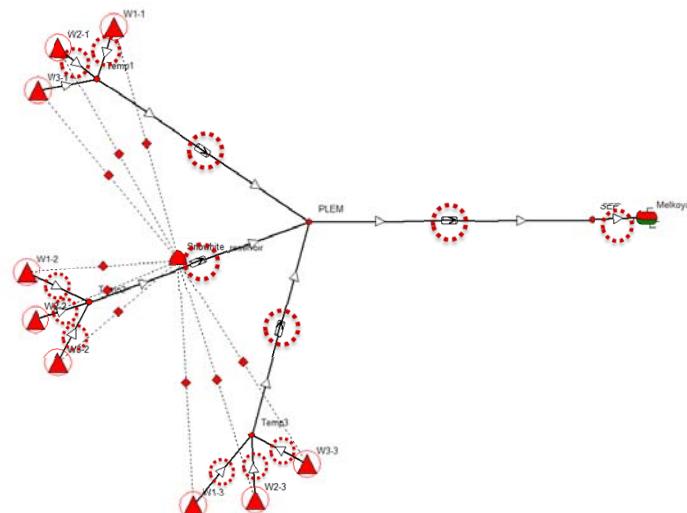
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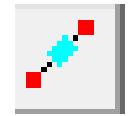


## GAP: Joint (Xtree, Manifold, etc)

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- connect the joints
- connect wells and separator to the joints



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## GAP: Pipeline: Summary tab

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**Pipe - Summary Screen**

Label	Name	Mask
<input type="checkbox"/> Included in system		
Comments		
Pipe Type		
GAP Internal Correlations		
Import		
Correlation		
Hydro-2P	Gravity Coeff	Friction Coeff
<input type="checkbox"/> Emulsion	[1]	[1]
Cross-EMI	<input type="button" value="Edit List"/>	<input type="button" value="Edit List"/>
Slug Method	<input type="button" value="System default"/>	
Oil Pb, Rx, Bo correlation		
<input type="checkbox"/> Oil Viscosity correlation		
<input type="checkbox"/> Gas Viscosity correlation		
<input type="checkbox"/> Transient		
Data Summary (click item to activate)		
Environment	Schedule	
Pipe Data	<input type="button" value="None"/>	
Match Data	<input type="button" value="None"/>	
Constraints	<input type="button" value="None"/>	
<input type="button" value="Summary"/> <input type="button" value="Input"/> <input type="button" value="Results"/>		

- double click in the selected pipeline
- open 'summary' tab → select PVT correlations
- leave the other things as defaults



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## GAP: Pipeline: Input tab

**Environment Parameters**

Calculate Heat Transfer Coefficient

Time Since Production Started  days

Surrounding Temperature  deg C

Overall Heat Transfer Coefficient  W/m<sup>2</sup>/K

Oil Heat Capacity  KJ/Kg/K

Gas Heat Capacity  KJ/Kg/K

Water Heat Capacity  KJ/Kg/K

Use Pipeline Burial     

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- open 'input' tab → open 'environment' sub-tab
- input ambient temperature (= 4 degC)
- input U (= 5 W/m<sup>2</sup>/K)



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## GAP: Pipeline: Input tab

Segment Type	Length	TVD	Dia	Roughness	K. Value	Fitting Type
1		0				Choke
2	158600	0	0.68	1.52e-5		Choke
3						Choke
4						Choke
5						Choke
6						Choke
7						Choke
8						Choke
9						Choke
10						Choke
11						Choke
12						Choke
13						Choke
14						Choke
15						Choke
16						Choke
17						Choke
18						Choke
19						Choke
20						Choke

Total length 158600 m

Enter elevations as Node TVDs      Flow Type: Tubing Flow      Calculate Heat Transfer Coefficient

Transient Pipe Step  m      Rate Multiplier       Correlation

Maximum Length Step  m      Gravity Coefficient       Friction Coefficient

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- open 'input' tab → open 'description' sub-tab
- input pipeline properties: length: 5000 m for flowline  
158600 m for pipeline
- ID:  
0.355 for flowline  
0.68 m for pipeline
- , roughness (=0.015 mm)
- done
- repeat for the other pipelines

inlet



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# GAP: Separator

## Setting up constraint

Separator 'Melkoya' - Input Screen

Constraint	Value	Binding	Potential	Unit
Maximum water rate	Yes	No	Sm3/day	
Maximum gas rate	20000	Yes <input checked="" type="checkbox"/>	No	1000Sm3/d
Maximum liquid rate	Yes	No	Sm3/day	
Maximum oil rate	Yes	No	Sm3/day	
Minimum gas injection rate	No	No	1000Sm3/d	
Maximum CO2	Yes	No	percent	
Maximum H2S	Yes	No	percent	
Maximum N2	Yes	No	percent	
Maximum oil specific gravity	Yes	No	Kg/m3	
Maximum gross heating value	Yes	No	MW	
Maximum specific gross heating value	Yes	No	kJ/sm3	
Maximum Temperature	Yes	No	deg C	
Unscheduled production deferment				percent

- double click on the separator icon
- open 'input' tab → open 'constraints' tab
- input the gas plateau rate

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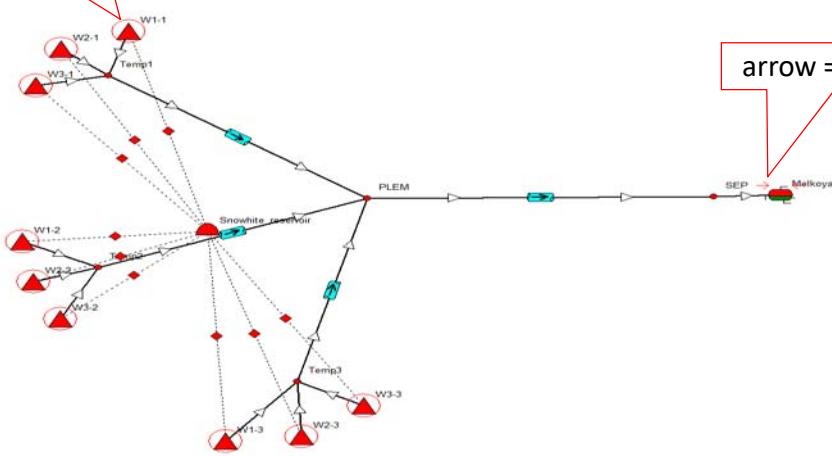
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# GAP: All System

Circle = variable



arrow = constraint

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# Outline

- Licensing
- PROSPER
- MBAL
- GAP: Set up Production Network
- GAP: Solve Production Network

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# GAP: Solve Network



-open 'solve network' to solve the production network at t = 0  
-run network solver  
-input separator pressure

Separator / Injection Manifold pressures - Production System	
	Mellkoya
	BARa
Pressure 1	30
Pressure 2	
Pressure 3	
Pressure 4	
Pressure 5	
Pressure 6	
Pressure 7	
Pressure 8	
Pressure 9	
Pressure 10	

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**GAP: Solve Network**

The screenshot shows the 'Network Solver' window. The solver has reached a solution in 1 iteration. The log output includes variables like Well V1-2 rate reduction values and solver statistics such as Max Pressure Drop Difference (0.000498455 bar) and CPU time (0.906 secs). The interface includes tabs for Log, Constraints, Limiting (selected), Script, and Messages. Configuration options include Solver mode (Optimise with all constraints selected), Optimiser progress, and various checkboxes for Run Prediction Script, Calculate Potential, and Parallelised.

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**GAP: Solve Network**

The screenshot shows the 'Results' tab open, displaying a 'Solver Summary Results' window. It includes tabs for OK, Plot, Report, and Help. The report item is set to Oil Rate (Sm3/day). The 'Total' section shows separator pressure (30 bar), oil produced (0 Sm3/day), gas produced (1899.258 Sm3/day), water produced (0 Sm3/day), liquid produced (0 Sm3/day), gross heating value (6709.4377 MJ/day), and specific gross heating value (37437.249 kJ/m3). The 'By Item' section lists various components and their rates, such as joints, pipes, and separators, all showing 0.00 Sm3/day.

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## GAP: Prediction

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## GAP: Prediction

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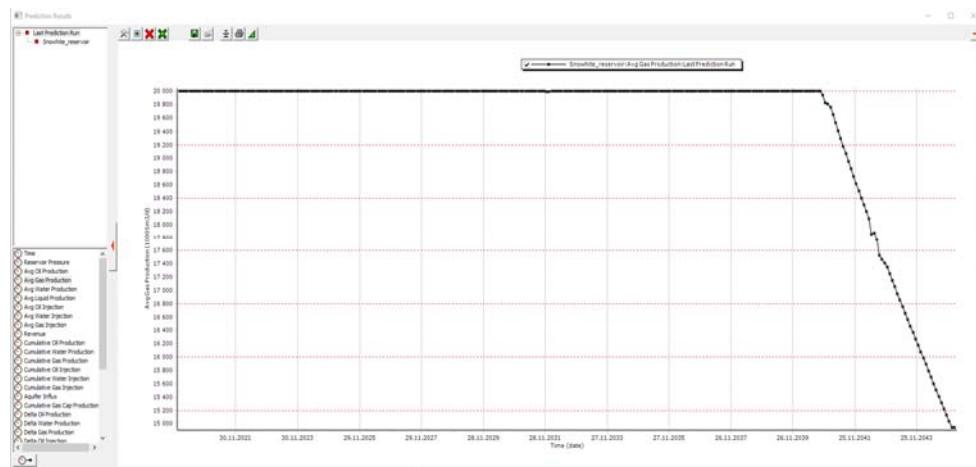
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- to generate the production profile, go to 'prediction' → 'Run prediction'
- set prediction timespan & timestep size (in this exercise, you can use dt = 1 year)



## GAP: Prediction

-to see the results, open 'prediction' → 'plot nodes prediction results' → select all equipment types → plot



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## Questions

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