

Shale Gas Development Pacing

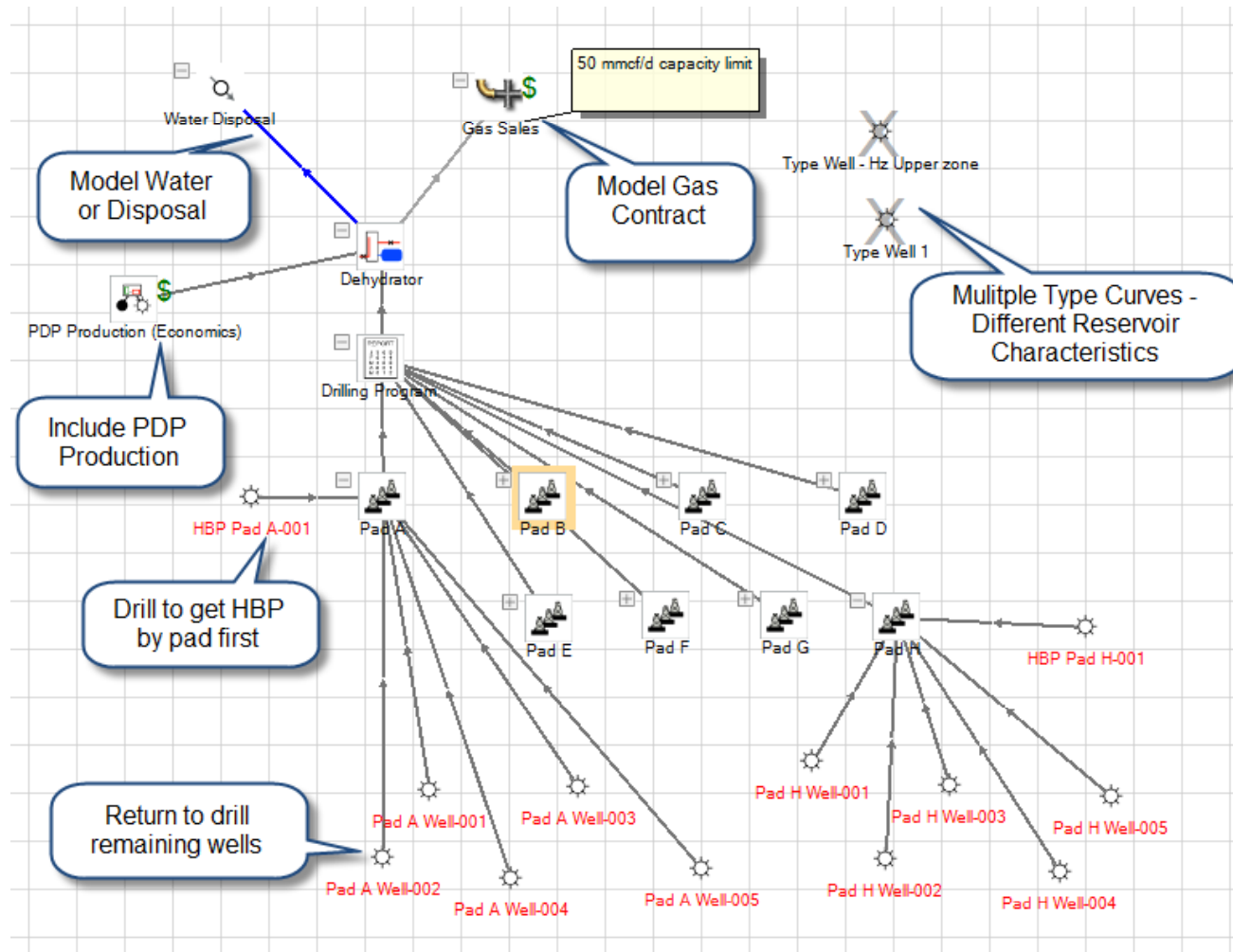
Problem

- Development planning for shale gas resource plays over several decades

Challenges

- Drill HBP locations first, then drill by Pad
- Rig and frac spread scheduling
- Pipeline capacity limitations
- Several Thousand Well locations

Flow Diagram – Shale Gas Development Pacing



Assign Drill Order and Rigs to Specific Wells

Well Name	Well Count	Template Name	Decline Set Name	Flows To	Inherits From	Step 1 Start Date (mm/dd/yyyy)	Step 2 Start Date (mm/dd/yyyy)	Step 3 Start Date (mm/dd/yyyy)	Step 1 Duration (Days)	Step 2 Duration (Days)	Step 3 Duration (Days)	Step 1 Required Resource	User Parm 1 (State)	User Parm 2 (Reserve Cat)
HBP Pad A	1	Type Well - Hz Upper zone		Pad A		1/12/2010		4/30/2010	35	8		Precision Rig A	PA	PROB
HBP Pad B	1	Type Well - Hz Upper zone		Pad B		2/20/2010		4/30/2010	31	7		Precision Rig A	PA	PROB
HBP Pad C	1	Type Well - Hz Upper zone		Pad C		3/21/2010			28	7		Precision Rig A	PA	PROB
HBP Pad D	1	Type Well - Hz Upper zone		Pad D		4/19/2010			25	6		Precision Rig A	PA	PROB
HBP Pad E	1	Type Well - Hz Upper zone		Pad E		1/22/2010		3/27/2010	33	8		Precision Rig B	PA	PROB
HBP Pad F	1	Type Well - Hz Upper zone		Pad F		2/15/2010			31	7		Precision Rig B	PA	PROB
HBP Pad G	1	Type Well - Hz Upper zone		Pad G		3/29/2010			28	7		Precision Rig B	PA	PROB
HBP Pad H	1	Type Well - Hz Upper zone		Pad H		4/20/2010			25	6		Precision Rig B	PA	PROB

Specify Actual Drill and/or Completion Start Dates

Can set the Date the Gathering System will be available (no production before this date)

Specific Drill and Completion Time by Well

Specify the Actual Rig (if known)

Page 1 of 2		2010	2011	Start	Duration	Finish	Rig Name	Gas Reserves
HBP Drilling Program								
<input type="checkbox"/>	HBP Pad A-001 (Drilling)			01/12/2010	35 Days	02/15/2010	Precision Rig A	3,253.2 mmcf
<input type="checkbox"/>	Completion			02/16/2010	8 Days	02/23/2010	Precision Rig A	3,253.2 mmcf
	On Production			04/30/2010	0 Days	04/30/2010	Precision Rig A	3,253.2 mmcf
<input type="checkbox"/>	HBP Pad E-001 (Drilling)			01/22/2010	33 Days	02/23/2010	Precision Rig B	3,344.0 mmcf
<input type="checkbox"/>	Completion			02/24/2010	8 Days	03/03/2010	Precision Rig B	3,344.0 mmcf
<input type="checkbox"/>	HBP Pad B-001 (Drilling)			02/20/2010	31 Days	03/22/2010	Precision Rig A	3,299.0 mmcf
<input type="checkbox"/>	Completion			03/29/2010	7 Days	03/29/2010	Precision Rig A	3,299.0 mmcf
	On Production			04/30/2010	0 Days	04/30/2010	Precision Rig A	3,299.0 mmcf
<input type="checkbox"/>	HBP Pad F-001 (Drilling)			02/24/2010	31 Days	03/26/2010	Precision Rig B	3,390.9 mmcf
<input type="checkbox"/>	HBP Pad C-001 (Drilling)			03/23/2010	28 Days	04/19/2010	Precision Rig A	3,362.5 mmcf
<input type="checkbox"/>	HBP Pad G-001 (Drilling)			03/29/2010	28 Days	04/25/2010	Precision Rig B	3,380.9 mmcf
<input type="checkbox"/>	HBP Pad D-001 (Drilling)			04/20/2010	25 Days	05/14/2010	Precision Rig A	3,421.4 mmcf
<input type="checkbox"/>	HBP Pad H-001 (Drilling)			04/26/2010	25 Days	05/20/2010	Precision Rig B	3,218.8 mmcf
Pad Drilling Program								
<input type="checkbox"/>	Pad A Well-001 (Drilling)			05/28/2010	25 Days	06/18/2010	Precision Rig A	2,333.6 mmcf
<input type="checkbox"/>	Pad A Well-002 (Drilling)			06/22/2010	25 Days	07/17/2010	Precision Rig A	2,331.7 mmcf
<input type="checkbox"/>	Pad A Well-003 (Drilling)			07/17/2010	25 Days	08/10/2010	Precision Rig A	2,329.7 mmcf

Step Durations

On-Production Dates

Specific Rigs

- Copy Well Details from Excel
- Define wells to establish HBP for early Drilling

Assign Drill Order and Rigs to Specific Pads

Well Name	Well Count	Template Name	Decline Set Name	Flows To	Inherits From	Step 1 Start Date (mm/dd/yyyy)	Step 2 Start Date (mm/dd/yyyy)	Step 3 Start Date (mm/dd/yyyy)	Step 1 Duration (Days)	Step 2 Duration (Days)	Step 3 Duration (Days)	Step 1 Required Resource	User Parm 1 (State)	User Parm 2 (Reserve Cat)
Pad A Well	5	Type Well 1		Pad A					25	6		Precision Rig A	PA	PROB
Pad B Well	5	Type Well 1		Pad B					25	6		Precision Rig B	PA	PROB
Pad C Well	5	Type Well 2		Pad C					24	6		Precision Rig A	PA	PROB
Pad D Well	5	Type Well 2		Pad D					24	6			PA	PROB
Pad E Well	5	Type Well 1		Pad E					25	6			PA	PROB
Pad F Well	5	Type Well 3		Pad F					25	6			PA	PROB
Pad G Well	5	Type Well 3		Pad G					24	6			PA	PROB
Pad H Well	5	Type Well 1		Pad H					24	6			PA	PROB

Specify the Number of Wells on a Pad

Specify the Type Curve for each Pad

Can Specify the Land Interest Information

Expected Drilling & Completion Duration

Specify the Rig if known, otherwise use first available.

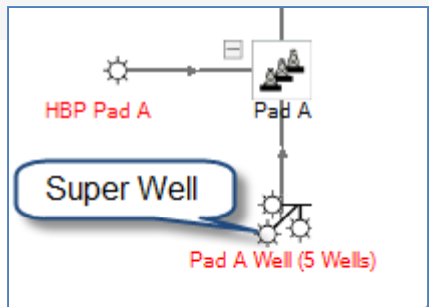
Set User Data information

Program creates Super Wells ? :

Delay All Production Until this Task is Finished : Start Well Production as Drilled

Additional Production Delay : 0 d

in this Scenario from Calculations before Starting: (Schedule Wide Setting)



- Follow up with Pad based program after Assets are HBP
- Super-Wells allows 1000's of wells to be economically modeled as groups of individual wells.
- Automated Well Grouping significantly improves calculation performance, with no less rigor in the well planning.

Results – Shale Gas Development Pacing

- Easily define additional Drilling or Completion Resources
- Define Hunting or Environmental Access Restrictions

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	2010	2011	2012	2013
+ Precision Rig A	[Gantt chart showing resource usage]			
+ Frac Spread 1	[Gantt chart showing resource usage]			
+ Precision Rig B	[Gantt chart showing resource usage]			
+ Additional Drilling Rig	[Gantt chart showing resource usage]			

Name	Is Active	Support Resources Types	Cost Per Day (m\$/day)	Drilling Costs (\$/ft)	Rig Count	Max Jobs	Availability
Precision Rig A	Active	Drilling Rig	0	0	1		Is Available from 01/01/2009 to 12/31/9999 repeating 1 times
Frac Spread 1	Active	Frac Spread	0	0	1		Is Available from 01/01/2009 to 12/31/9999 repeating 1 times
Precision Rig B	Active	Drilling Rig	0	0	1		Is Available from 01/01/2010 to 06/01/2010 repeating 100 times

Resource Name :

Is Active :

- Drilling Rig : Define what tasks a resource can perform

- Completion Rig :

- Frac Spread :

- Pad Construct :

Cost Per Day (m\$/day) : fn

Drilling Costs (\$/ft) : fn Define Resource Rates

Resource Schedule :

Status	Resources Available	From mm/dd/yyyy	To mm/dd/yyyy	Max Jobs	Repeat
Available	1 <small>fn</small>	01/01/2011	12/31/9999	0	times 1 times ✗
Unavailable	1 <small>fn</small>	10/15/2011	11/30/2011	0	times 100 times ✗

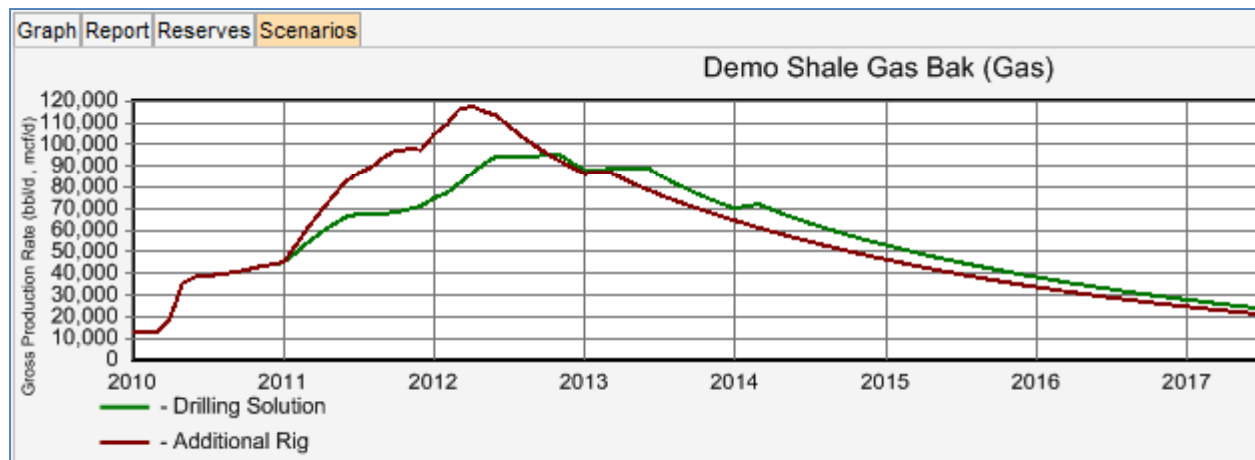
Define when resources are not available

Results - Easily Compare Development Options

- Quickly create different pacing scenarios and evaluate incremental impacts

Summary Report : Demo Shale Gas Development

	Gross	W.I.	Net		Gross		
					0 % D.F.	10% D.F.	15% D.F.
Reserves				Net Present Value	m\$	m\$	m\$
Oil	0.00	0.00	0.00	B.T. Cash Flow	(118.79)	1,635.04	694.56
Gas	95.35	71.52	57.21	A.T. Cash Flow	(77.21)	556.45	(448.44)
NGL	0.00	0.00	0.00	Total Capital	0.00	12,721.24	16,895.83
				BT DPI (\$/\$)	0.00	0.13	0.04



- Report Incremental Values
- Visually Compare Scenarios