

# **IDées**

## **De la pénurie à l'abondance de pétrole?**

**Les perspectives d'évolution  
de la production de pétrole au plan mondial**

**Pierre-René BAUQUIS**

**Professor TPA. Adjunct Professor IFP school**

**Former Head of strategy and planning for TOTAL Group**

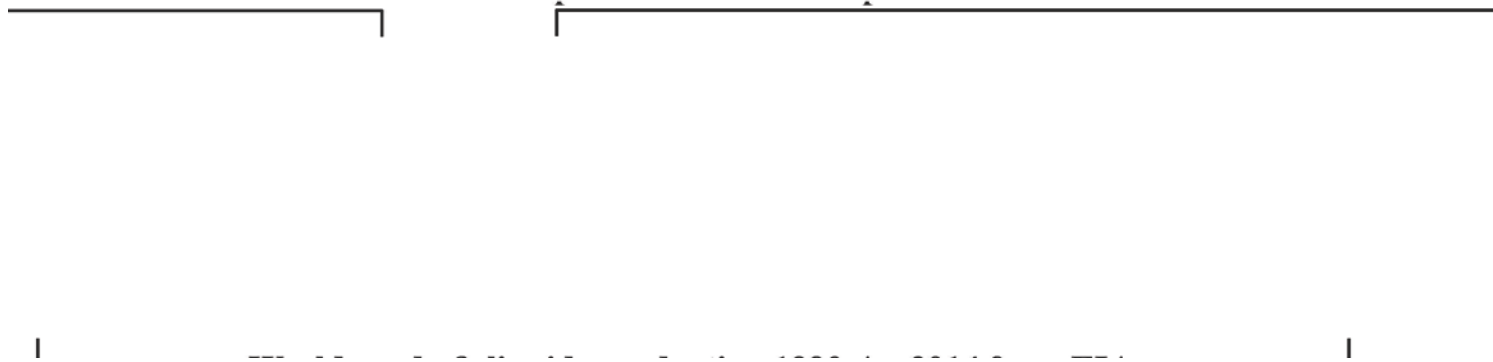
IDées 27 avril 2015



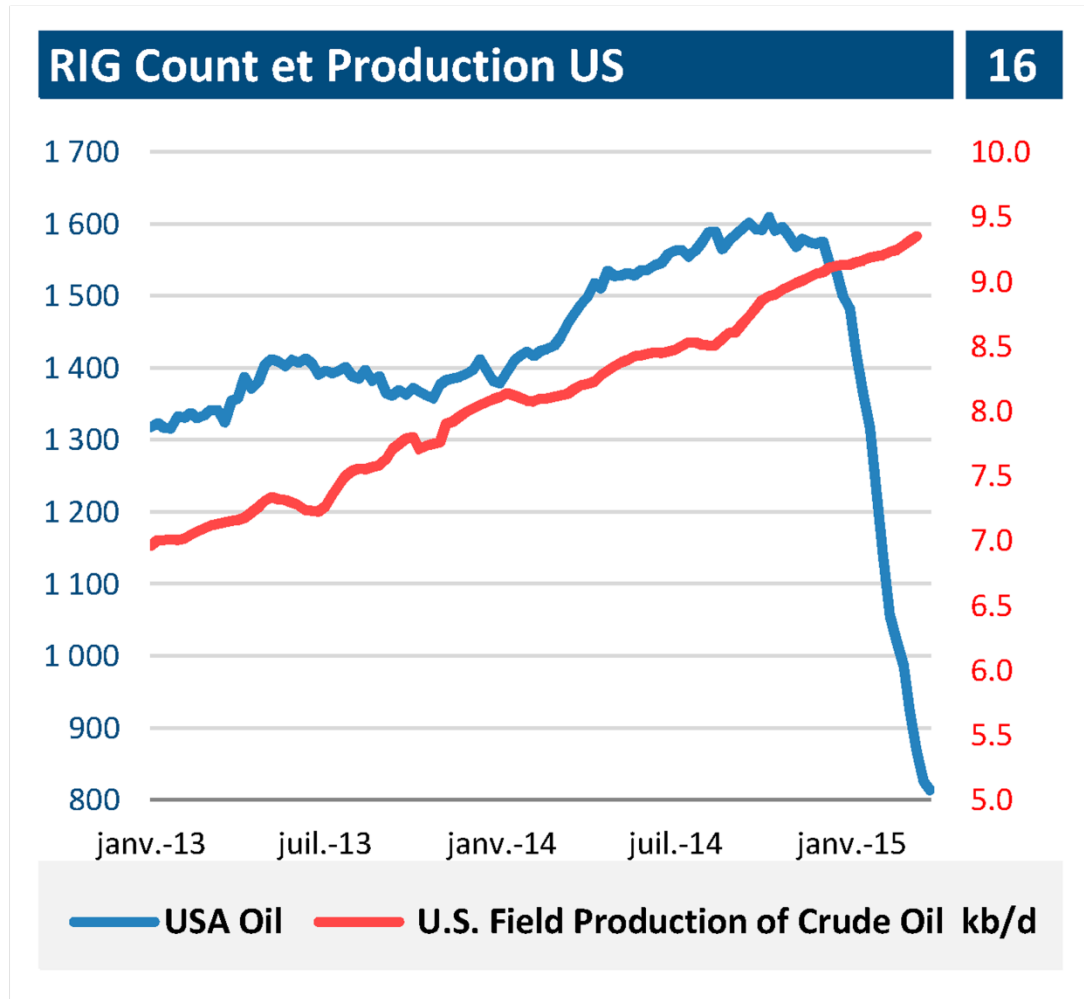
# DECEMBER 2014: A POLITICAL VIEW OF OIL PRICE COLLAPSE AS ILLUSTRATED BY MEDIAS



# ATTENTION AUX STATISTIQUES: QU'EST CE QUE LA PRODUCTION PÉTROLIÈRE MONDIALE? **UN CONCEPT FLOU...**



# A FIFTY PERCENT FALL IN US ONSHORE RIGS DRILLING FOR OIL BUT NO IMMEDIAT EFFECT ON PRODUCTION



# QUELQUES CHIFFRES SIMPLIFIÉS POUR « POSER LE PROBLÈME DES PÉTROLES DE SCHISTE » ①

	2010	2014
<b>Production pétrole USA</b>	<b>7,5 mb/d</b>	<b>12 mb/d</b>
<b>Dont shale oil/LTO</b>	<b>0,5 mb/d</b>	<b>4,5 mb/d</b>
<b>Production US en % consom<sup>t</sup></b>	<b>40%</b>	<b>60%</b>
<b>Import US en % consom<sup>t</sup></b>	<b>60%</b>	<b>40%</b>

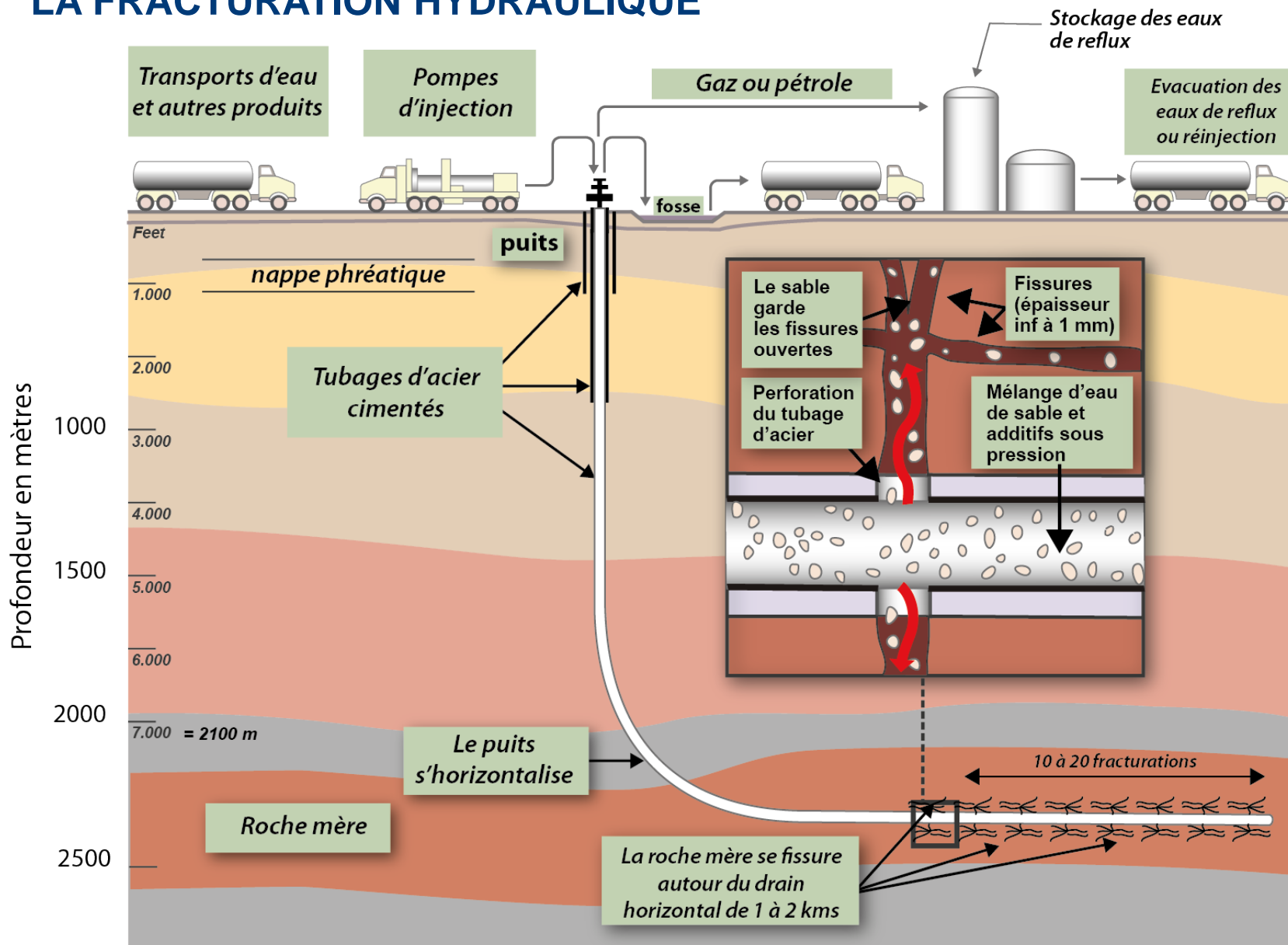
Source: PR Bauquis – 25 Avril 2015

# QUELQUES CHIFFRES SIMPLIFIÉS POUR « POSER LE PROBLÈME DES PÉTROLES DE SCHISTE » ②

	Taux de déclin annuel	Taux de récupération actuel (estimation)
US conventionnel onshore	5% / an	50%
US shale oil / LTO	50% / an	5%

Source: PR Bauquis – 25 Avril 2015

# LA FRACTURATION HYDRAULIQUE



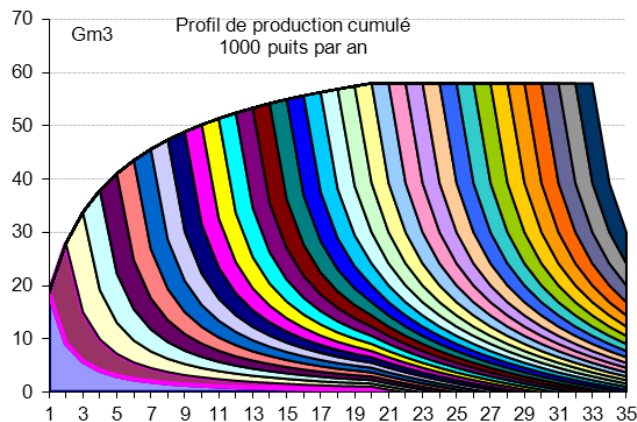
source : PR Bauquis - 15 janvier 2014

# SHALE OIL AND SHALE GAS: PRODUCTION MODELLING

- **Very high number of production wells**
  - US 2010 : 33,700 (50/50 P/G; 50% Hor.)
  - 2030 : 58,000 wells/y (80/84 : + de 80 000 wells/y)

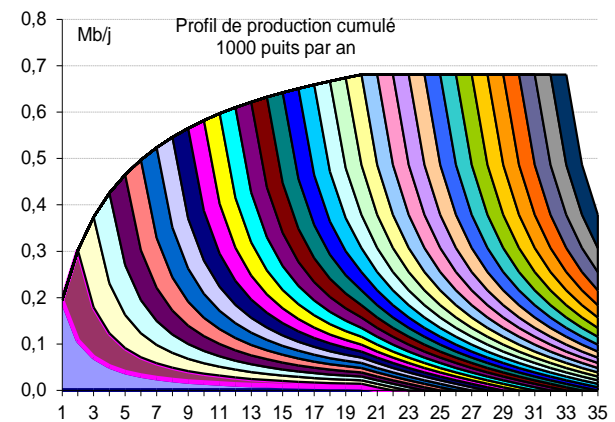
*Example development base 1,000 wells per year*

**Shale gas-> 60 Gm3**



*Recovery per well: 2 BCF/ 58 Mcm*

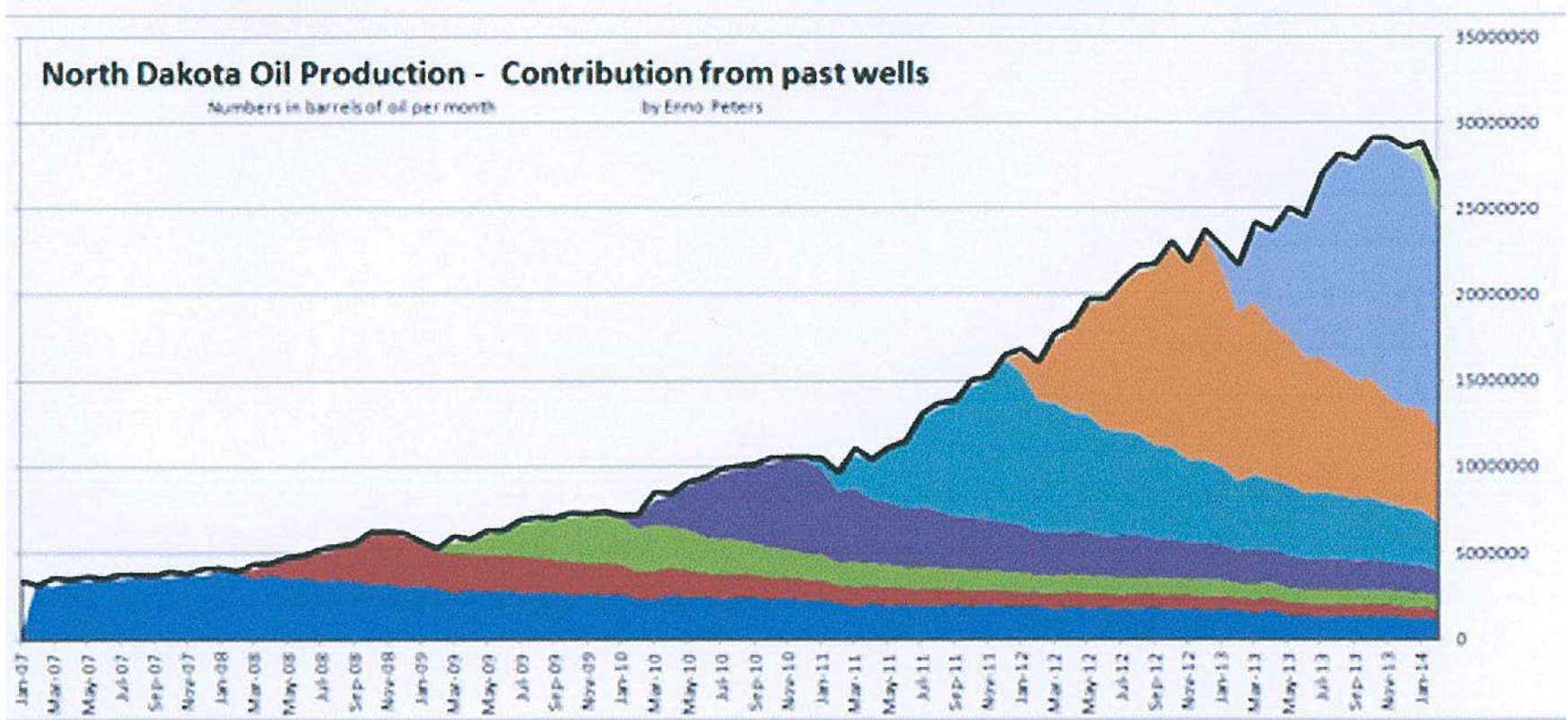
**Shale oil-> 0,7 Mb/d**



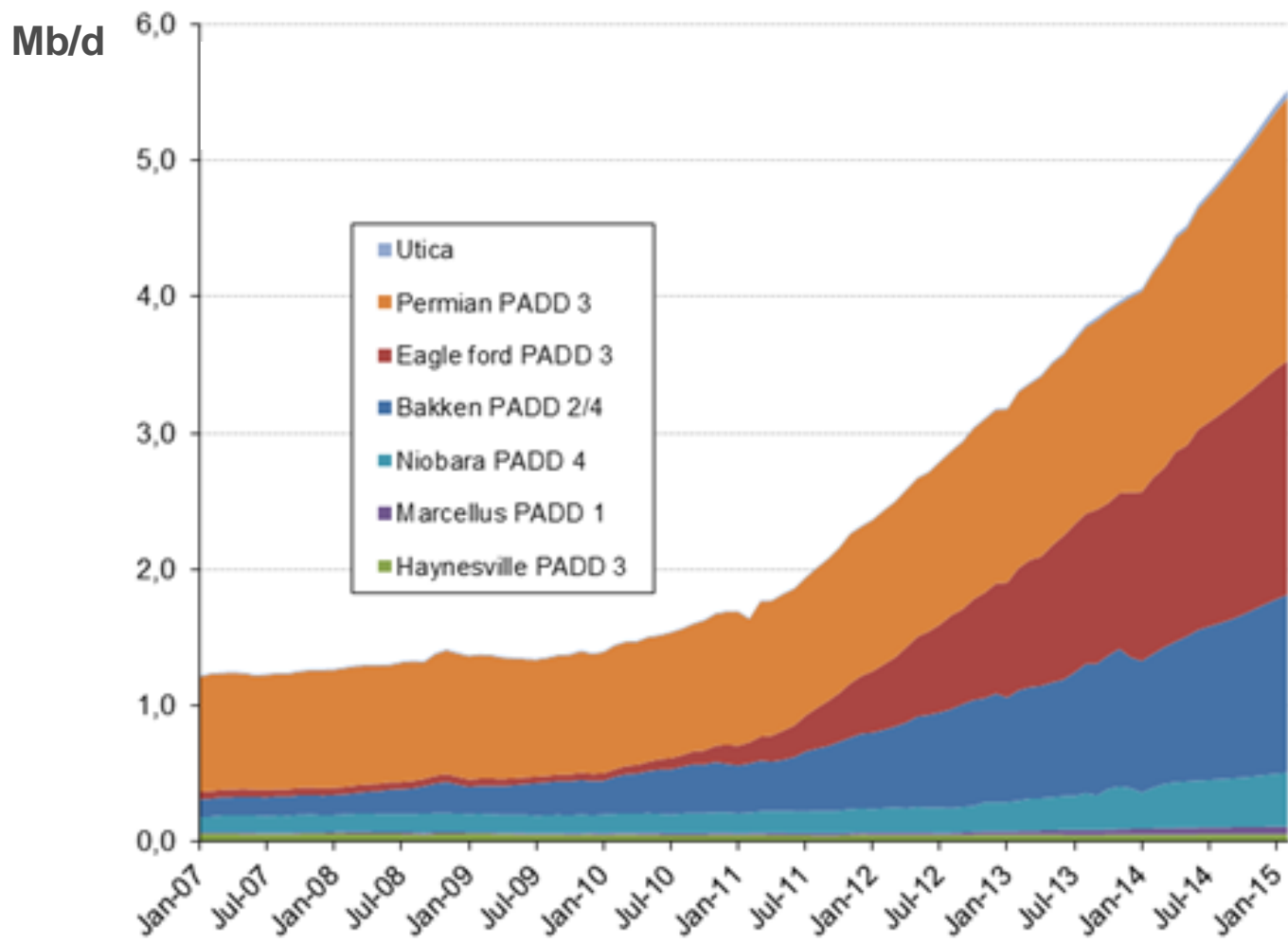
*Recovery per well: 0.25 Mbbl*



# APRÈS LA THÉORIE, UN CAS RÉEL: PUIITS, PADS & PRODUCTION DANS LE BAKKEN

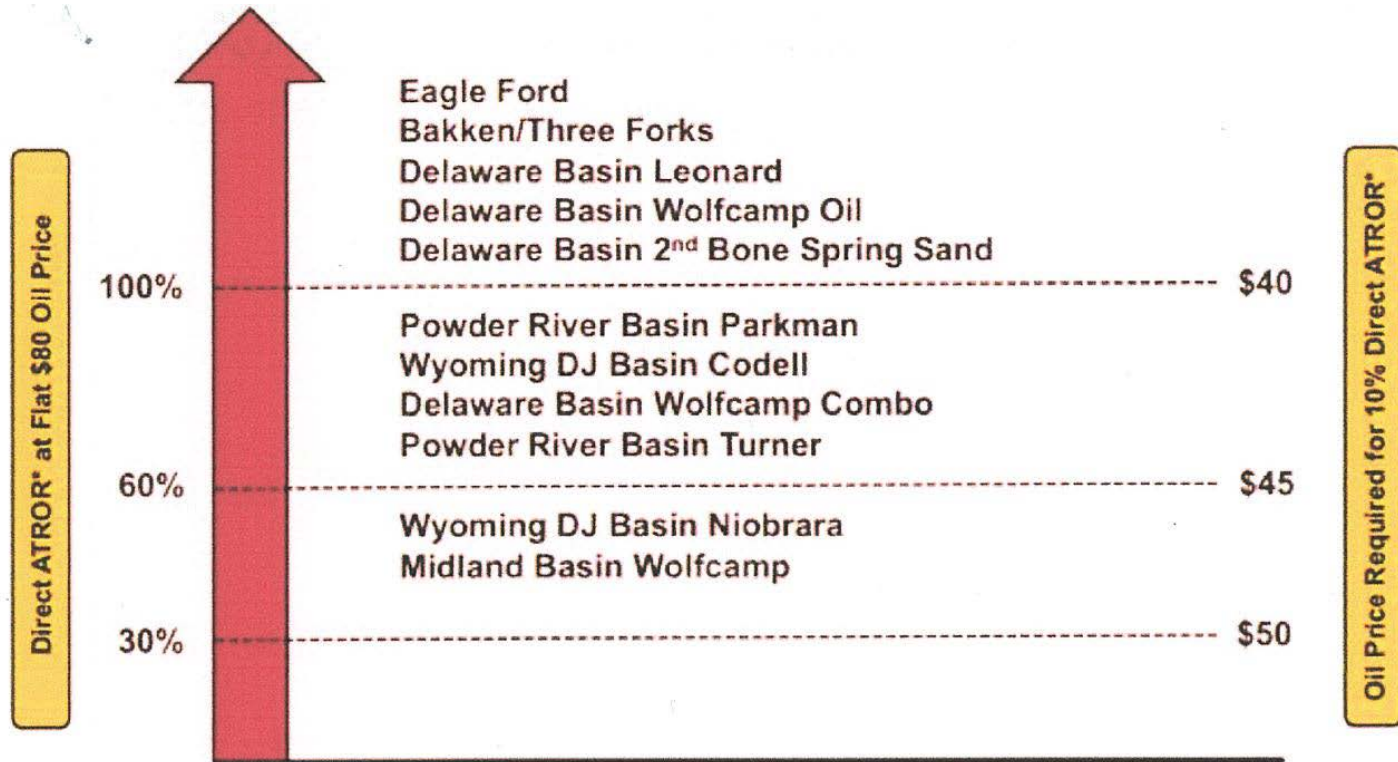


# SHALE OIL & LTO PLAY PRODUCTIONS IN THE USA (2002/2014)



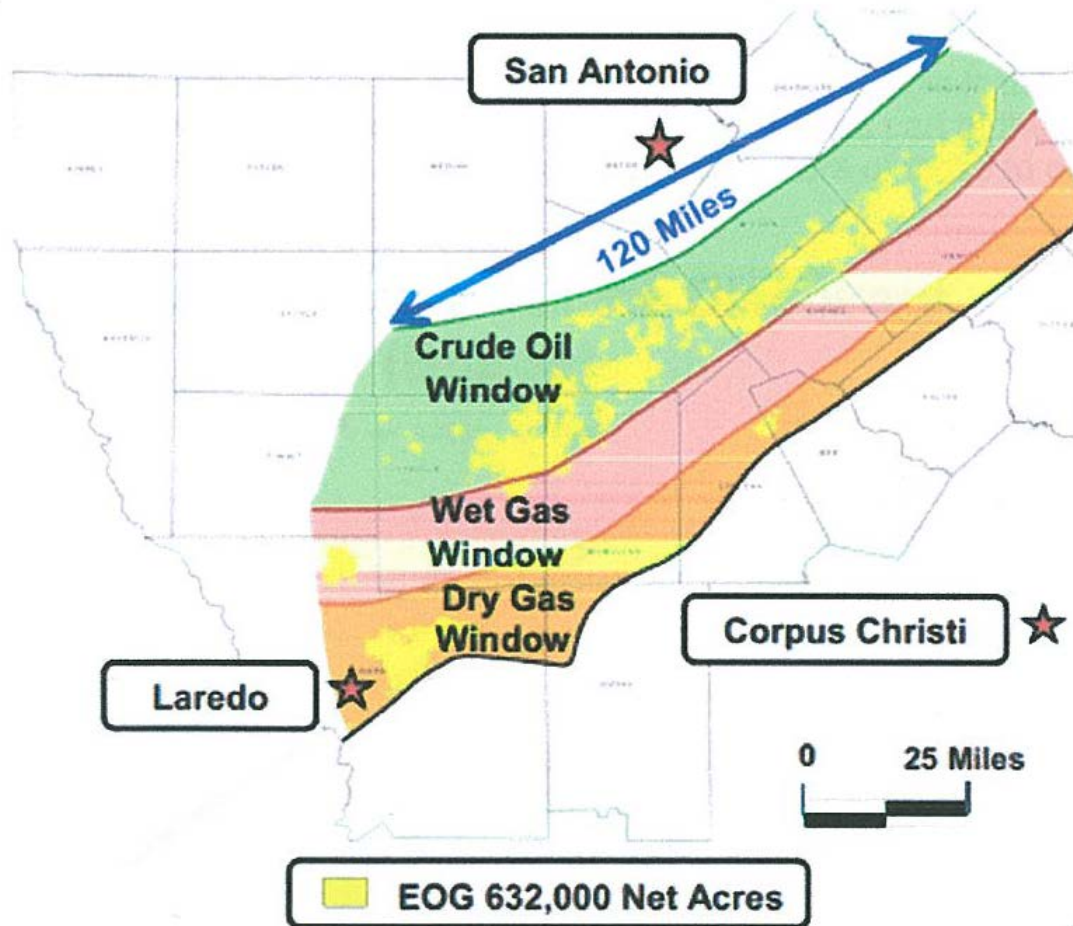
Guy Maisonnier – Septembre 2014

# TAUX DE RENTABILITÉ DES PRINCIPAUX PLAYS À HUILE (PORTEFEUILLE DE LA SOCIÉTÉ EOG 15 DÉCEMBRE 2014)



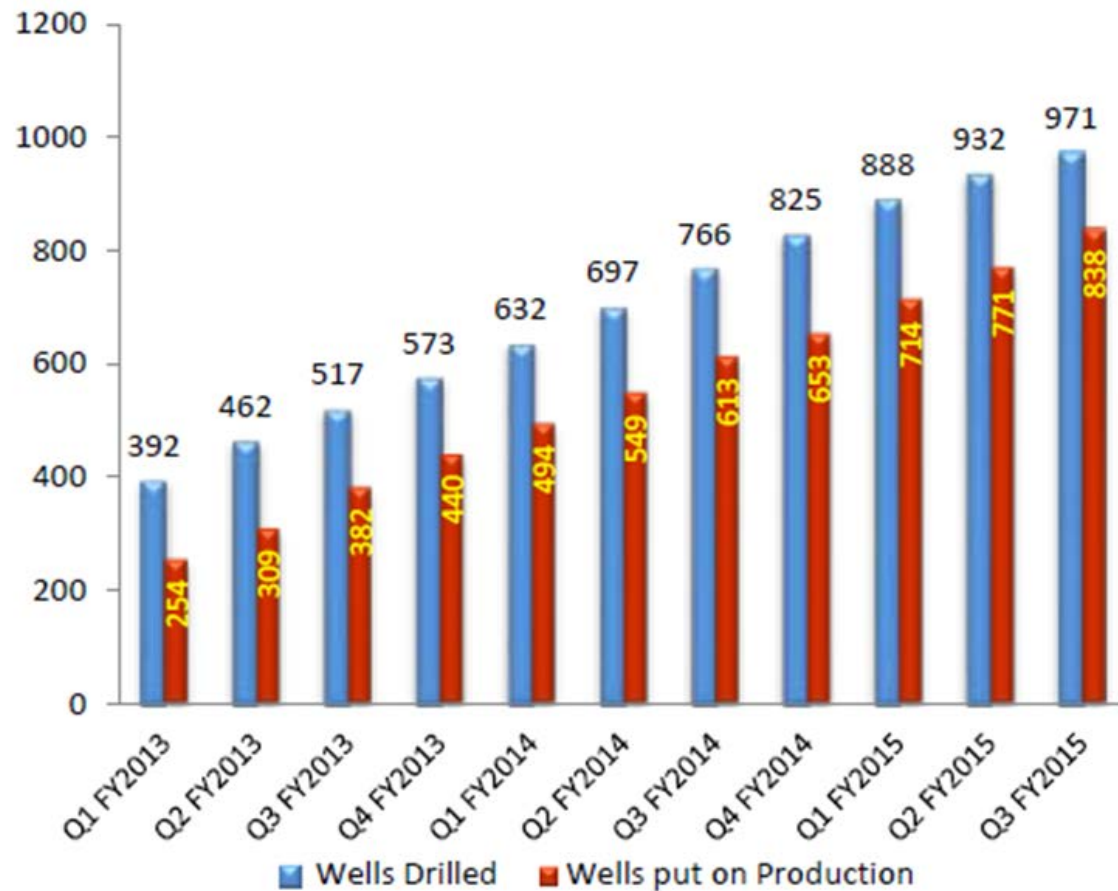
Source: EOG Resources, Investor Presentation.

# OIL WINDOW AND GAS WINDOW IN THE EAGLE FORD PLAY



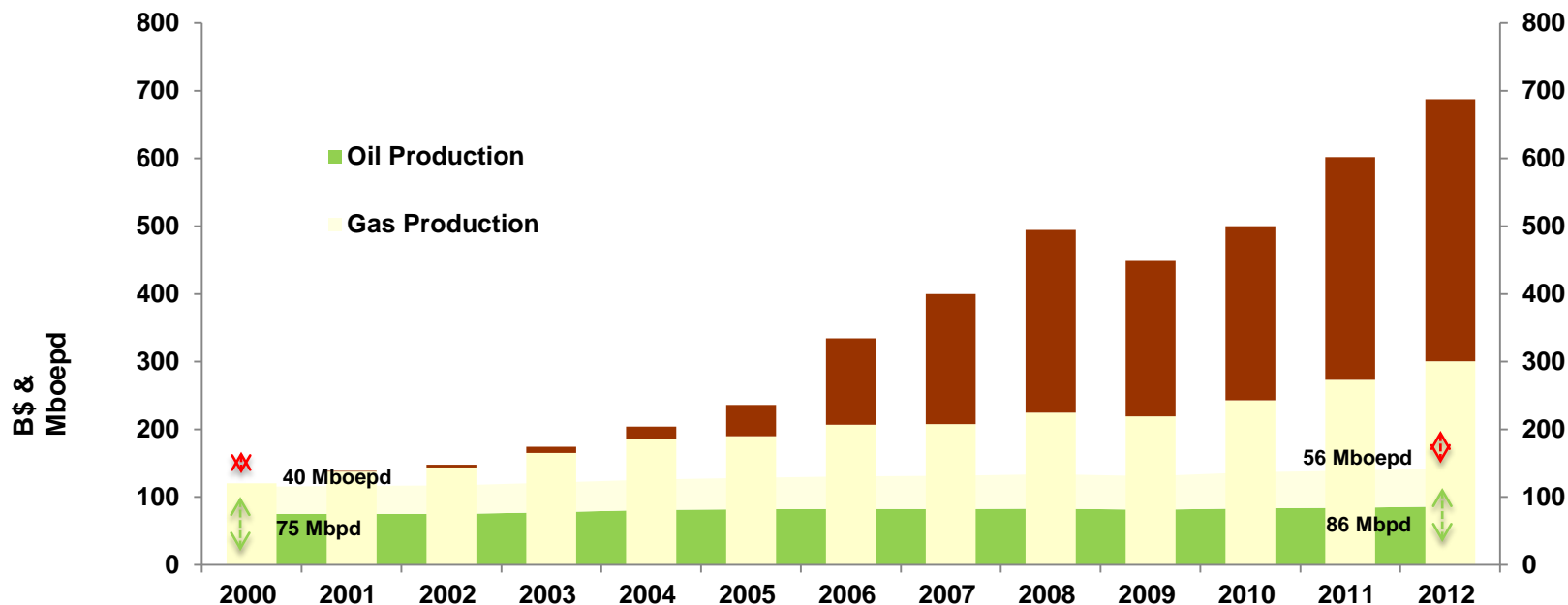
Source: EOG – 14 août 2014

# TOTAL WELLS DRILLED AND PUT ON PRODUCTION IN THE EAGLE FORD



Source: Guy Maisonnier – IFPen

# WORLD E&P CAPEX VS. PRODUCTION. STRONG DECREASE OF CAPEX IN 2015 BUT CONSEQUENCES ON WORLD OIL PRODUCTION STILL UNCLEAR



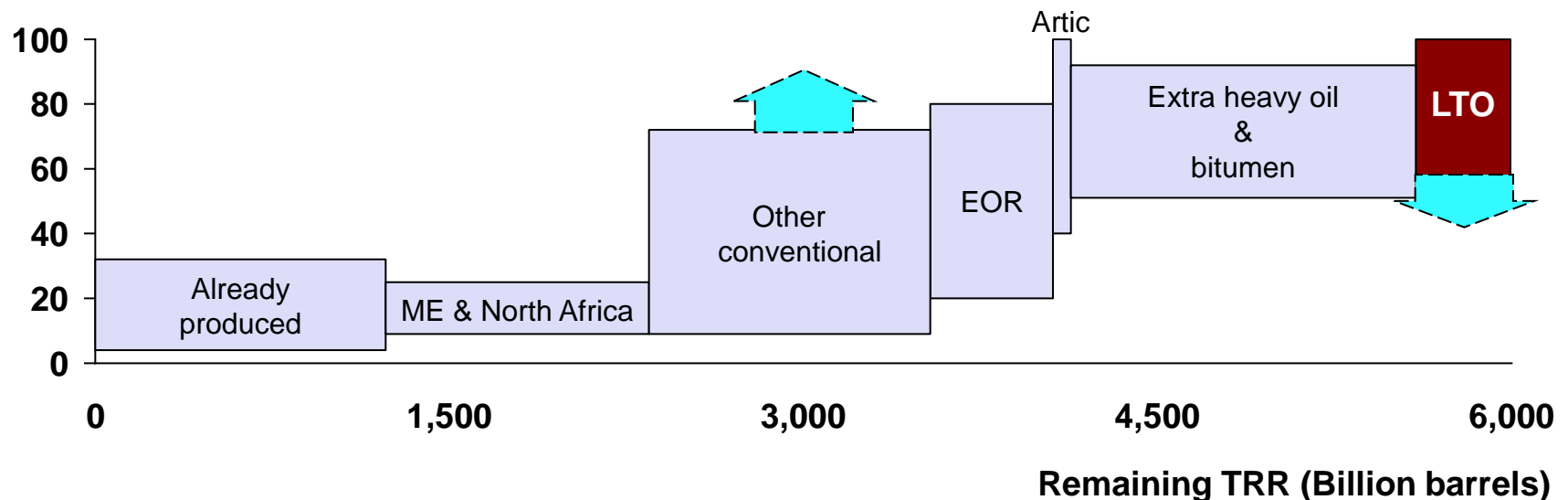
	CAGR 2000-12**	CAGR 2008-12***
<b>E&amp;P Capex</b>	<b>15,6%</b>	<b>8,6%</b>
<b>Oil &amp; gas production</b>	<b>1,8%</b>	<b>0,5%</b>
<i>Oil</i>	<i>1,2%</i>	<i>0,3%</i>
<i>Gas</i>	<i>2,8%</i>	<i>0,8%</i>

\* CERA Upstream Capital Cost Index, 2000 (base 100) \*\*Computed using 2000 as the reference year \*\*\*Computed using 2008 as the reference year

# SOURCE ROCK OIL AND OTHER LTO: A FAST DECREASE OF PRODUCTION COST

## SUPPLY COST OF LIQUID FUELS \$ per barrel, billion barrels

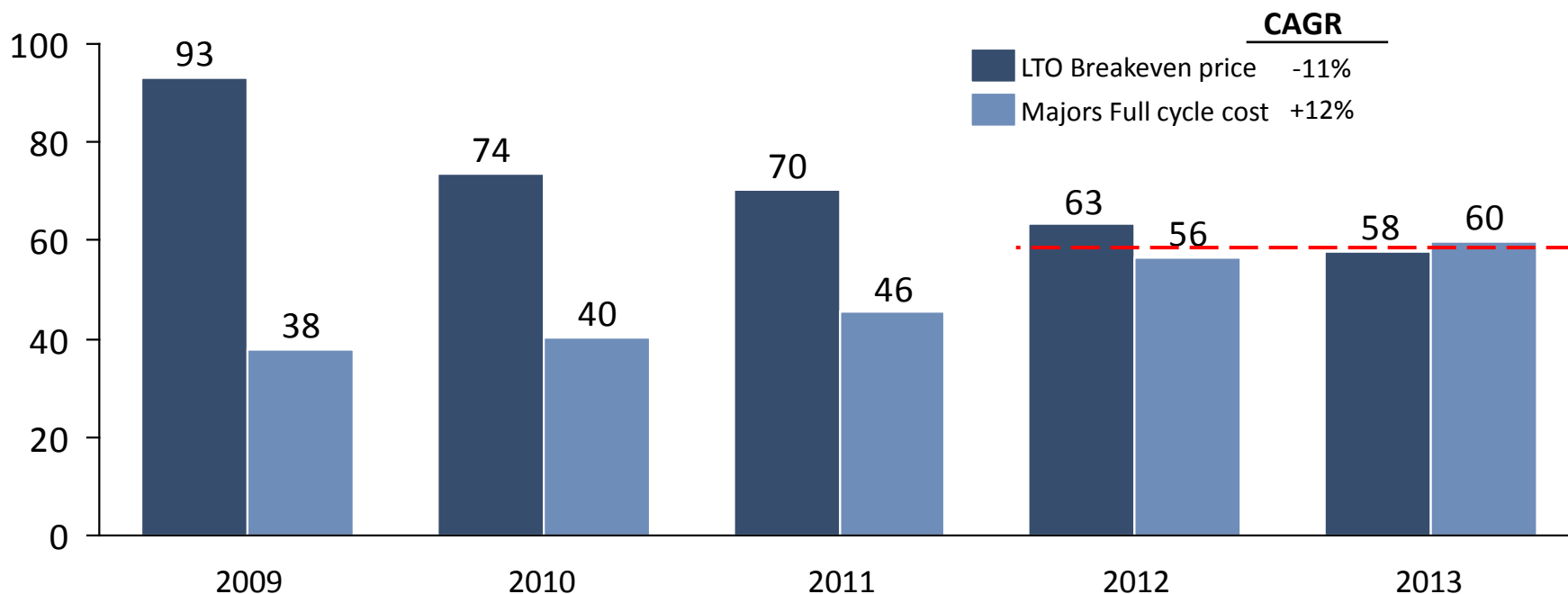
Production cost  
(2012, \$ per barrel)



Source: *Schlumberger (A. ROSTAND)*  
Conférence Oil & Money  
Londres 29-30 Octobre 2014

# SOURCE ROCK OIL AND OTHER LTO: THEIR PRODUCTION COST ARE NOW SIMILAR TO CONVENTIONAL OIL.

**HOWEVER COST STRUCTURES ARE TOTALLY DIFFERENT**



Source: **Schlumberger (A. ROSTAND)**  
 Conférence Oil & Money  
 Londres 29-30 Octobre 2014

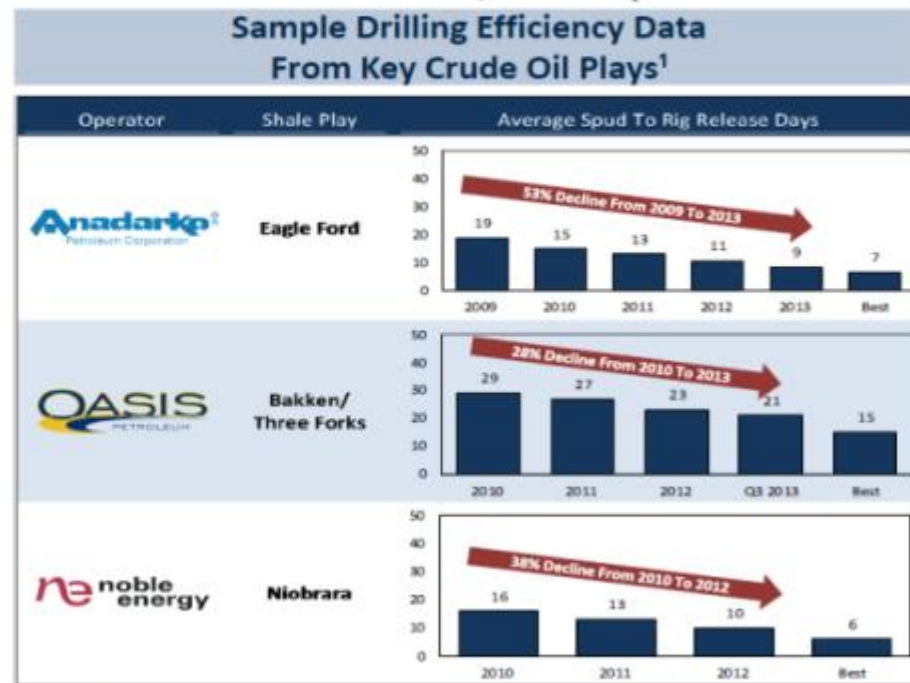
1: F&D + Lifting costs. Pure unconventional NAM players  
 2: S&GA + F&D + Total Production + WACC. Majors  
 Source: 1) Rystad, IHS; 2) Evaluate Energy; Goldman Sachs



# DRILLING TIME IS DECREASING IN UNCONVENTIONAL SHALE OIL PLAYS

## Drilling time is decreasing in unconventional shale oil plays

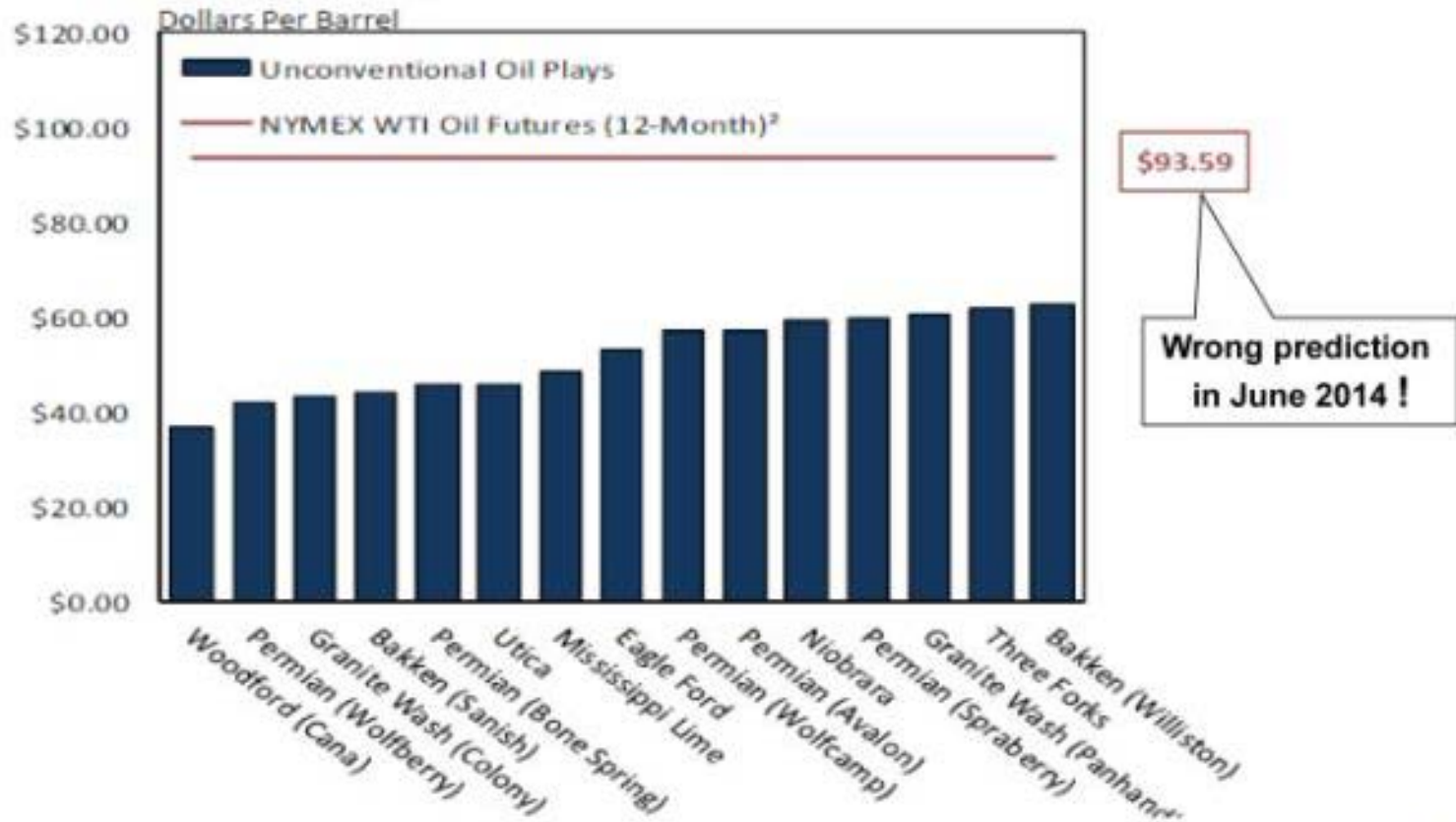
Average: 3 to 4 weeks to drill one well at 2000-2500 m deep, with an horizontal drain of 1 km. One rig = 12 to 17 wells per year



Source: Public filings and publicly available data.

<sup>1</sup> Source: Simmons Research. As of March 2014.

# ECONOMIC THRESHOLD OIL PRICE BY PLAY IN THE USA (2014)



<sup>1</sup> Source: Simmons Research. Threshold price defined as the commodity price at which an average well in a play will generate a 10% IRR.

<sup>2</sup> Source: Bloomberg. As of June 4, 2014.

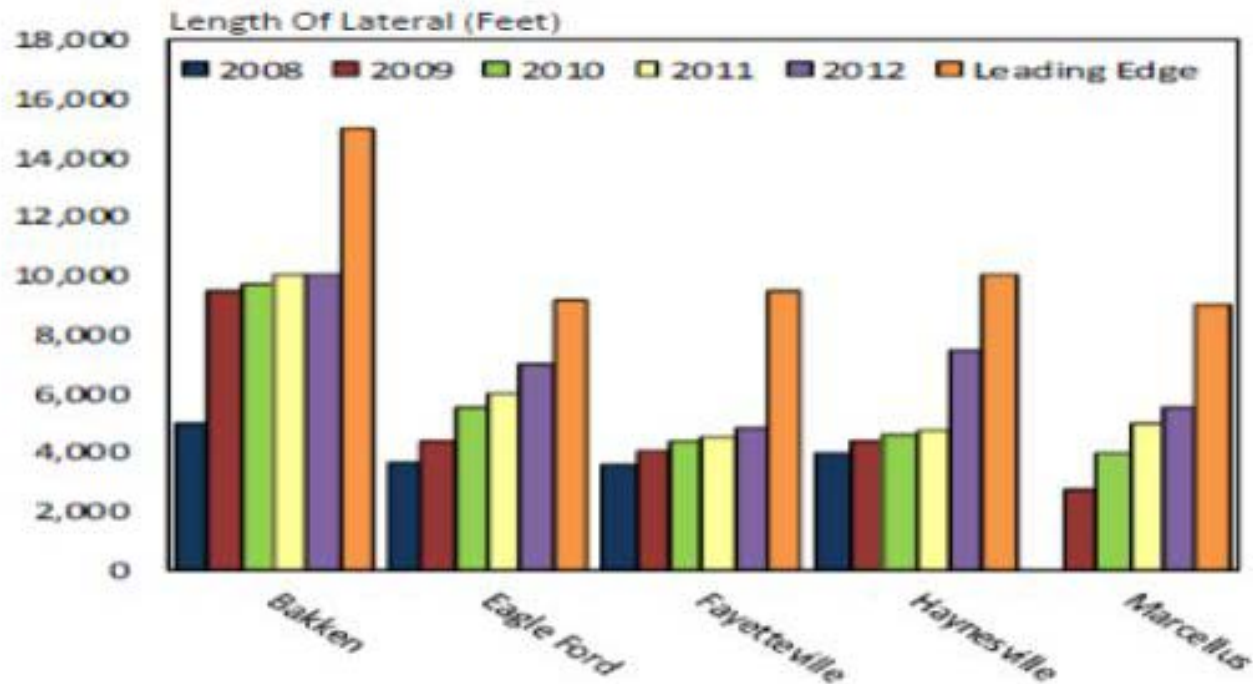
# WITHIN THE SAME SHALE PLAY « BREAK-EVEN PRICES » ARE HIGHLY VARIABLE

North Dakota Break-Even Oil Prices		
	Price (\$/bbl)	Rigs
McKenzie	\$28	66
Dunn	\$29	28
Stark	\$36	2
Williams	\$37	43
Mountrail	\$42	31
Bottineau- Renville	\$51	4
Billings	\$53	4
McClellan	\$73	1
Bowman- Slope	\$75	0
Golden Valley	\$77	0
Burke	\$81	3
Divide	\$85	8
<b>Average/Total</b>	<b>\$56</b>	<b>190</b>

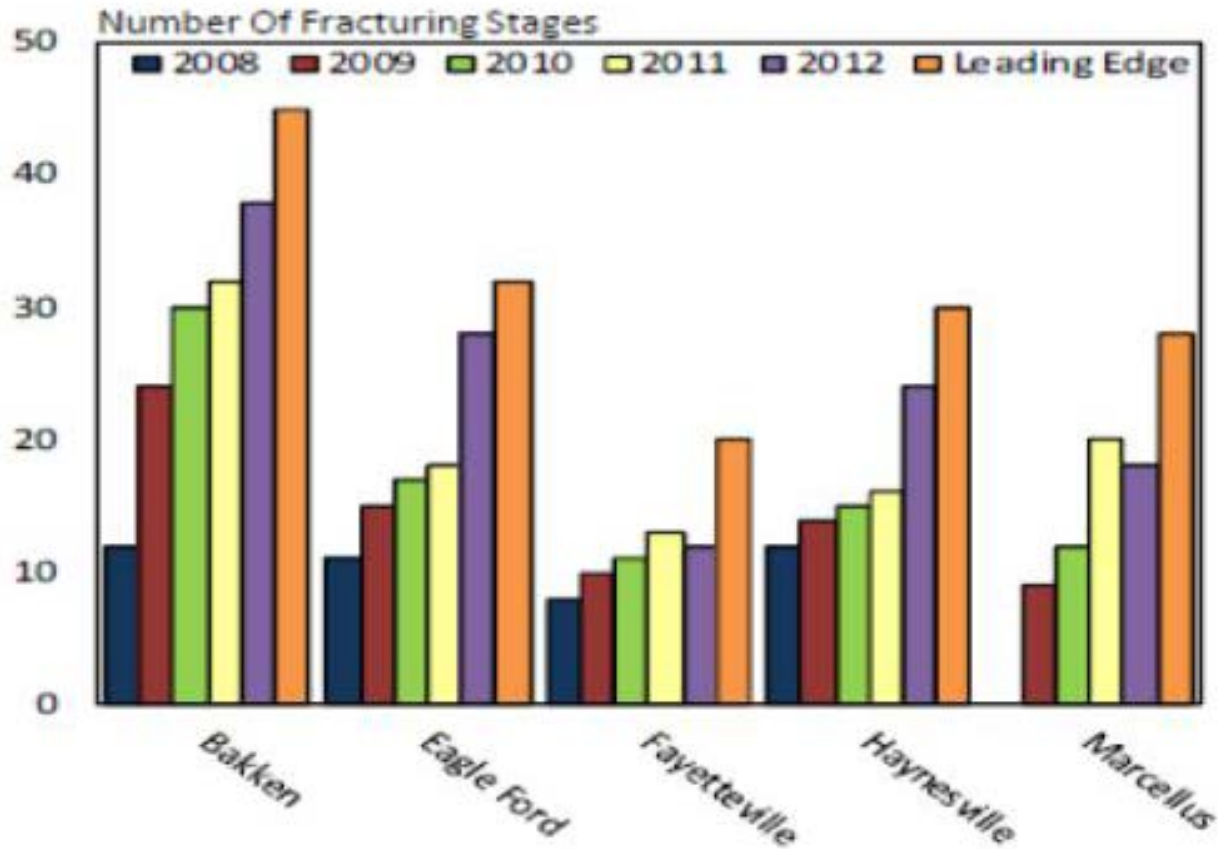
Source: North Dakota Department of Mineral Resources, 17 Octobre 2014

# LATERAL LENGHT IN UNCONVENTIONAL SHALE PLAYS

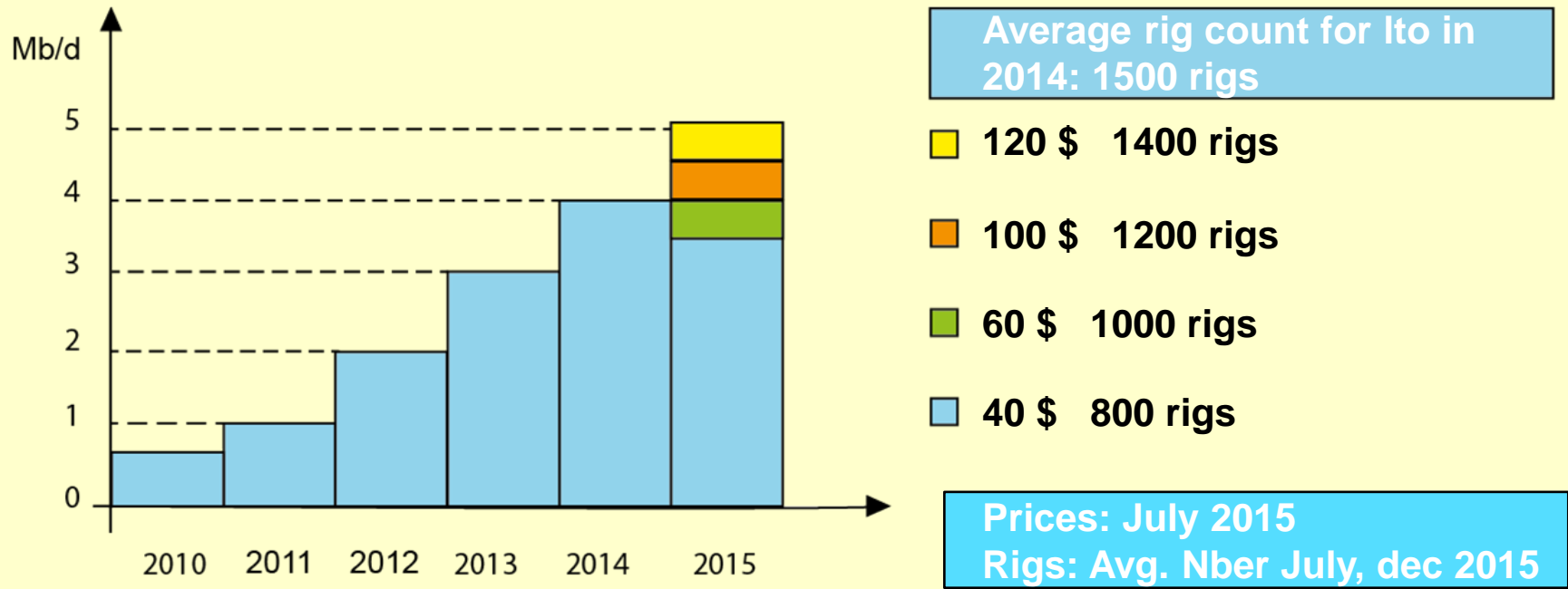
Lateral lengths (and frac stages) have continued to increase as E&P operators work to maximize production per well.



# NUMBER OF FRACKING STAGES IN UNCONVENTIONAL SHALE PLAYS



# POSSIBLE IMPACT IN 2015 OF CRUDE OIL PRICES COLLAPSE ON US SHALE OIL / LTO PRODUCTION



Source rock oil / LTO: a new « regulator » for world oil prices ?

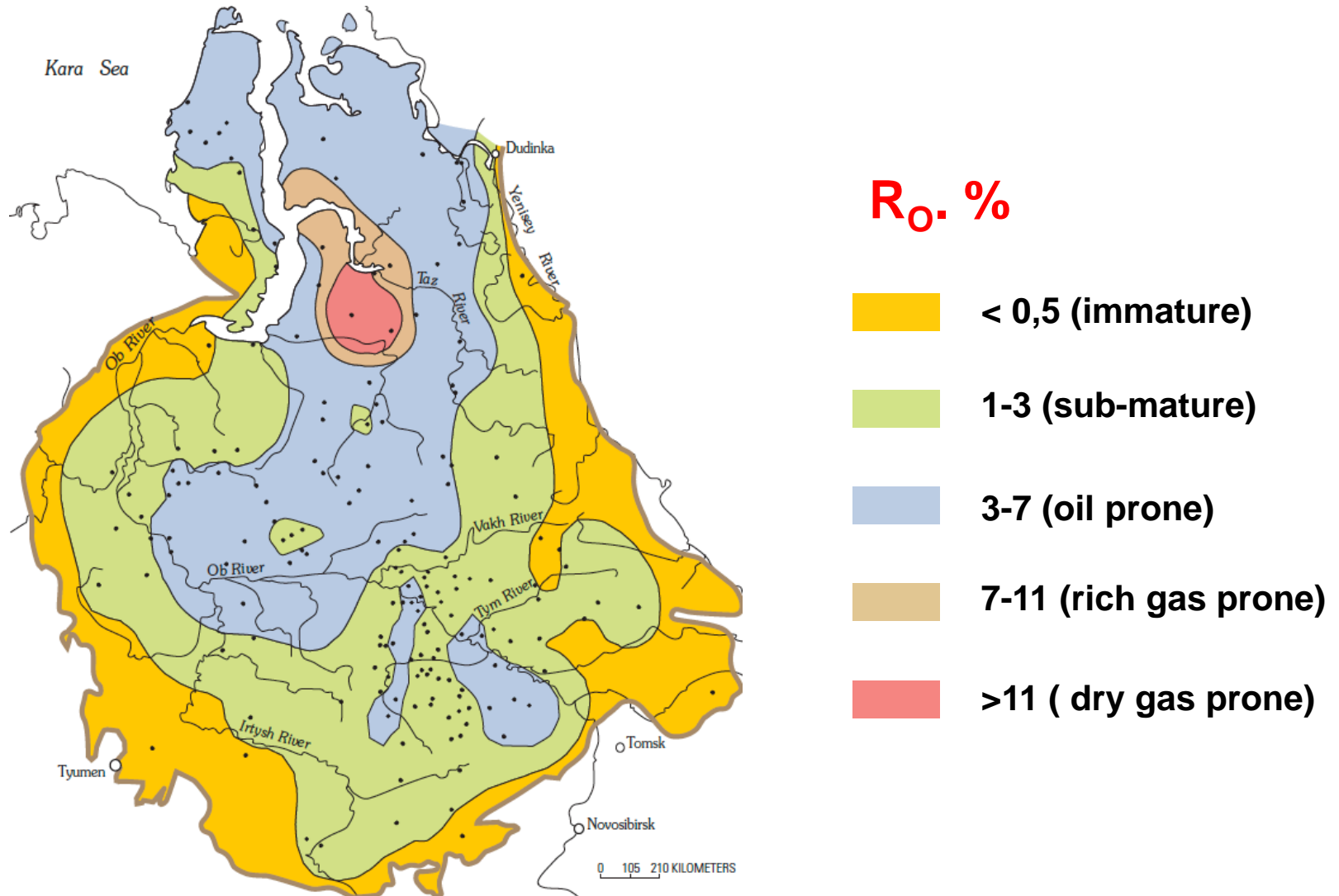
Source: Pierre René BAUQUIS – 1<sup>er</sup> février 2015

# MAJOR LTO RESOURCE HOLDERS (LIGHT TIGHT OIL – BILLION BARRELS)

Country	Areas assessed	Technical recoverable LTO resources
Russia	Bazhenov shale	76
United States	Bakken, Bone Springs, Eagle Ford, Granite Wash, Niobrara, Spraberry, Wolfcamp, Monterey and Woodford shales	58
China	Sichuan, Yangtze, Jiangnan, Greater Subei, Tarim, Junggar and Songliao basins	32
Argentina	Neuquen, San Jorge, Magallanes and Parana basins	27
Libya	Ghadames, Sirte, and Murzuq basins	26
Australia	Cooper, Maryborough, Perth, Canning, Georgina, and Beetaloo basins	18
Venezuela	Maracaibo basin	13
Mexico	Burgos, Sabinas, Tampico, Tuxpan and Veracruz basins	13
Pakistan	lower Indus basin	9
Canada	Horn River, Cordova, Liard, Deep, Alberta, Windsor basins, Duvernay, Bakken, Utica shales	9

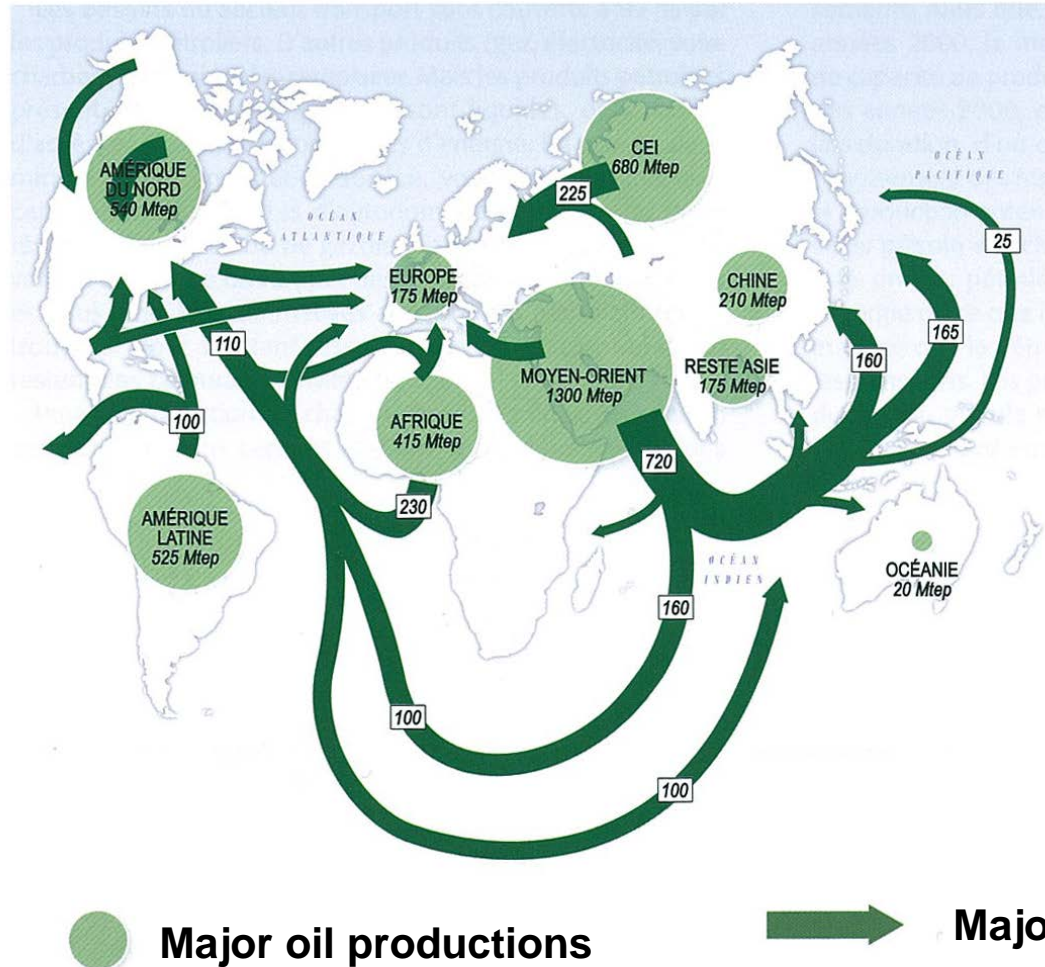
Source: US EIA (2013a).

# BAZHENOV MATURITY AS PER VITRINITE REFLECTANCE ( $R_{O.}$ %)





# 2013 MAJOR OIL ROUTES: A DRASTIC CHANGE DURING THE LAST TWENTY YEARS

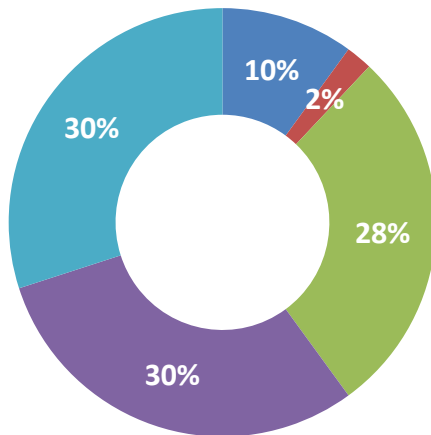


# WORLD E&P CAPEX VS. PRODUCTION

## O&G Production 2012

142 Mboe/d

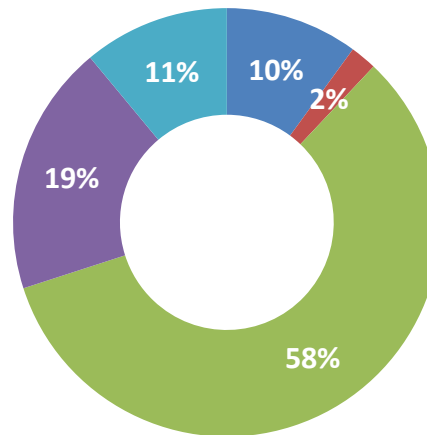
(oil 86 Mb/d - gas 56 Mboe/d)



## Reserves 2012

2809 Gboe

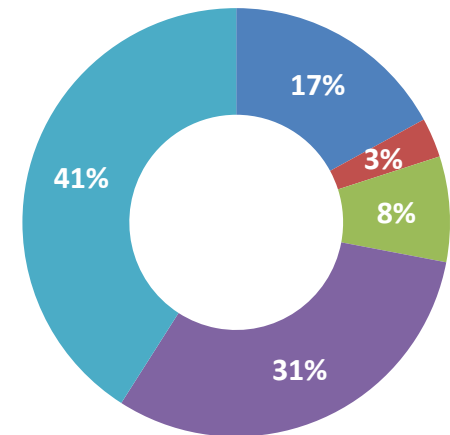
(a mixture of 1 P and 2 P)



## E&P CAPEX 2012

687 G\$

(statistical limits arbitrary)



- Majors
- Total
- OPEC NOC
- Other NOC
- Independents

**Private investment covers > 60% of all CAPEX**

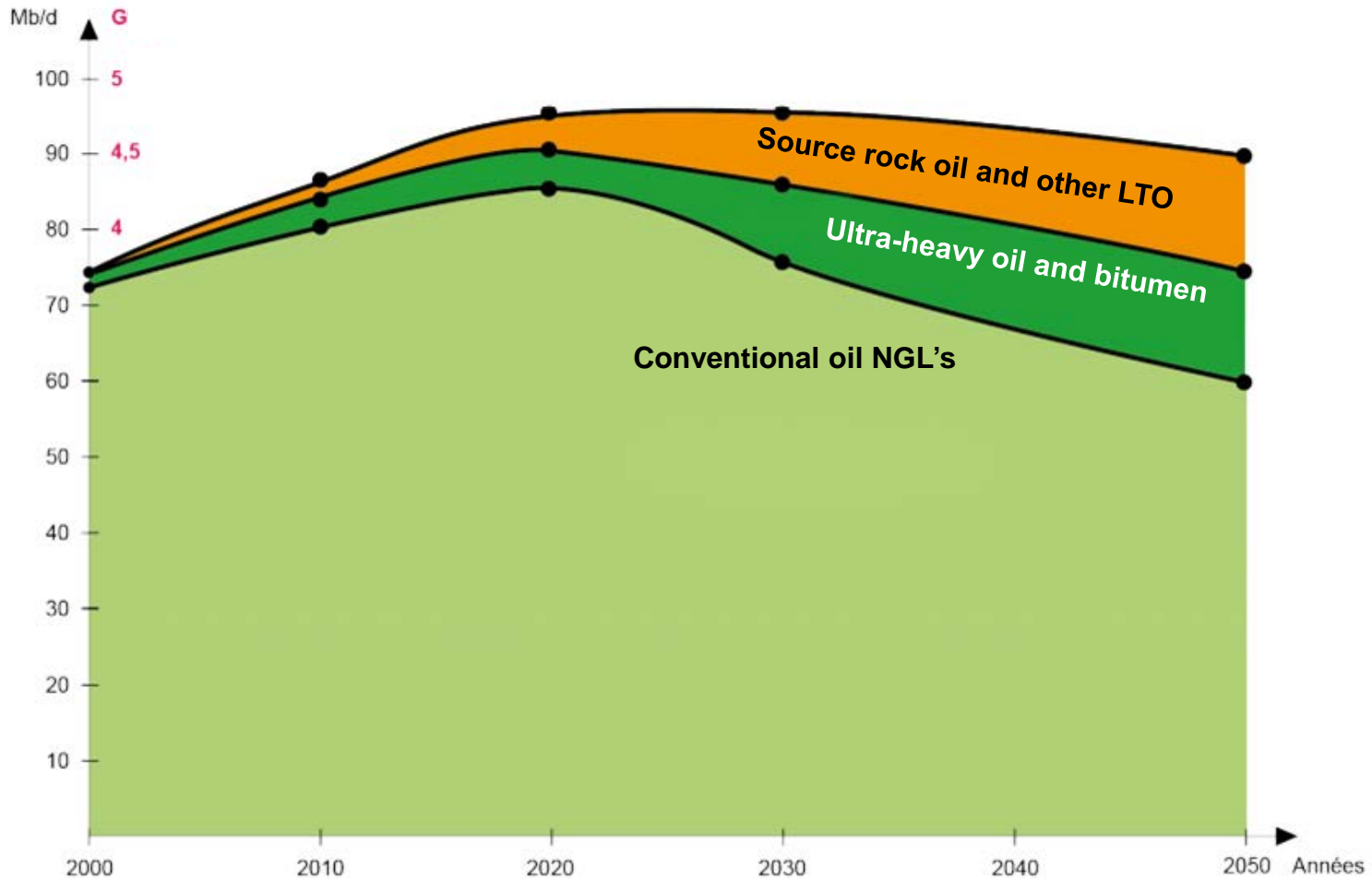
**Role of OPEC paramount in bringing production to market**

Sources: IEA, WM, Total, Barclays Capital, PFC, IHS, rapports et présentations annuelles

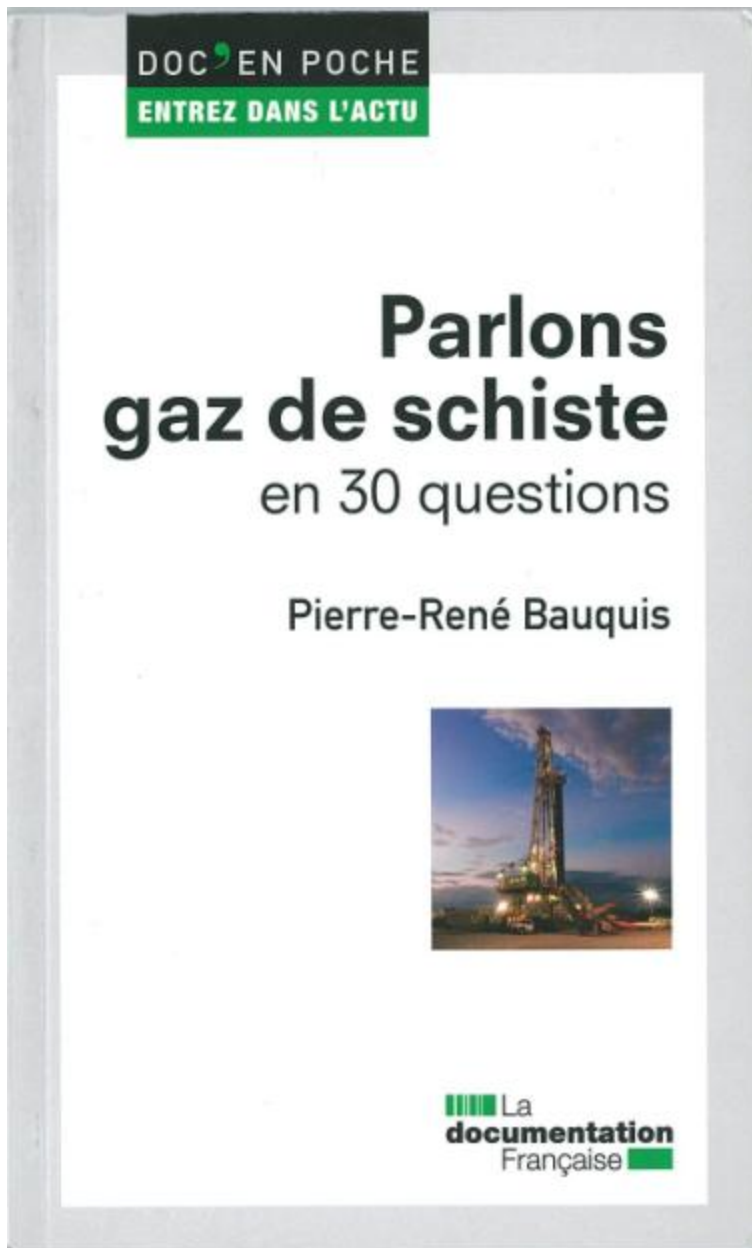
# ATENTATIVE VIEW ABOUT FUTURE WORLD OIL PRODUCTION IN 2030 (VIEW OF P. R. BAUQUIS)

	2015 (est)	2030 « guess »	Basis for 2030 « guess »
<b><i>The first league</i></b>	Prod OPEC = 30 +6 NGL =36		OPEC 40 + 5 NGL = 45
USA	12,5	10	(5 conv <sup>t</sup> + 5 LTO)
Saudi Arabia	9,5	10	(10 conv <sup>t</sup> )
Russia	11,0	10	(8 conv <sup>t</sup> + 2 LTO)
Sub Total 1 <sup>st</sup> league	33,0	30	2030 = 30 Mb/d (23 conv <sup>t</sup> + 7 LTO)
<b><i>The second league</i></b>			
Canada	4,5	6-7	(3 conv <sup>t</sup> + 3/5 H.H)
China	4,1	4-5	(4 conv <sup>t</sup> + 1 LTO)
Venezuela	2,5	3-6	(2 conv <sup>t</sup> +1/4 H.H)
Irak	3,3	6-12	(100% conv <sup>t</sup> )
Iran	3,0	3-6	(100% conv <sup>t</sup> )
UAE	2,8	4-5	(100% conv <sup>t</sup> )
Kuwait	2,8	3-4	(100% conv <sup>t</sup> )
Sub total 2 <sup>nd</sup> league	23	30-45	
Others (except biofuels 2,6 and process gains 2,5)	34	25-40	
World total	90	100 Mb/d	100 Mb/d

**A PERSONNAL VIEW ABOUT FUTURE WORLD OIL PRODUCTION. HOW MUCH WILL THE US CONTRIBUTE IN WORLD SHALE OIL/LTO PRODUCTION BY 2050 ?**  
**PEAK OIL FORECAST PRACTICALLY UNCHANGED AT AROUND OR BELOW 100 MB/D STARTING 2020-2025**



Source: PR BAUQUIS Octobre 2013



- Pour savoir l'essentiel sur les « gaz de schistes » un petit ouvrage d'initiation pour 5,90 euros publié par la Documentation Française.
- **Offrez-le à tous vos amis, et à tous les écologistes de votre connaissance.**
- L'auteur (P.R. BAUQUIS) est totalement indépendant et les droits d'auteur vont à de bonnes œuvres.