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Shale Gas: What Is It, How Will It Impact Supply, Prices and Customers, and The Regulatory Issues It Raises:

Interstate Pipeline Transportation Issues

Presented by: **Melissa Whitten**
La Capra Associates, Inc.

Presented to: **National Association of State Utility Consumer Advocates**
2011 Mid-Year Meeting
San Antonio, Texas June 28, 2011

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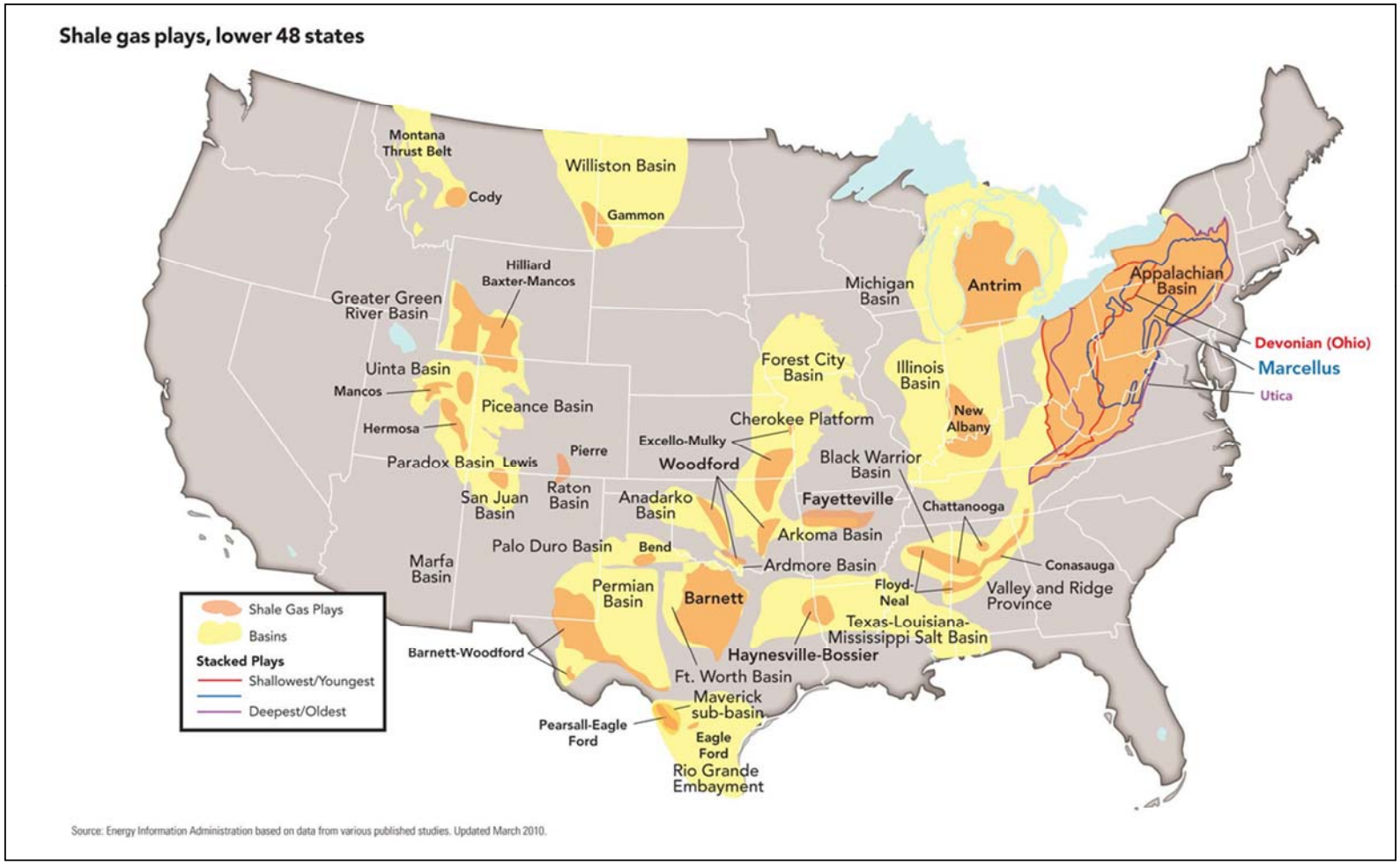
What is Shale Gas: Pervasive



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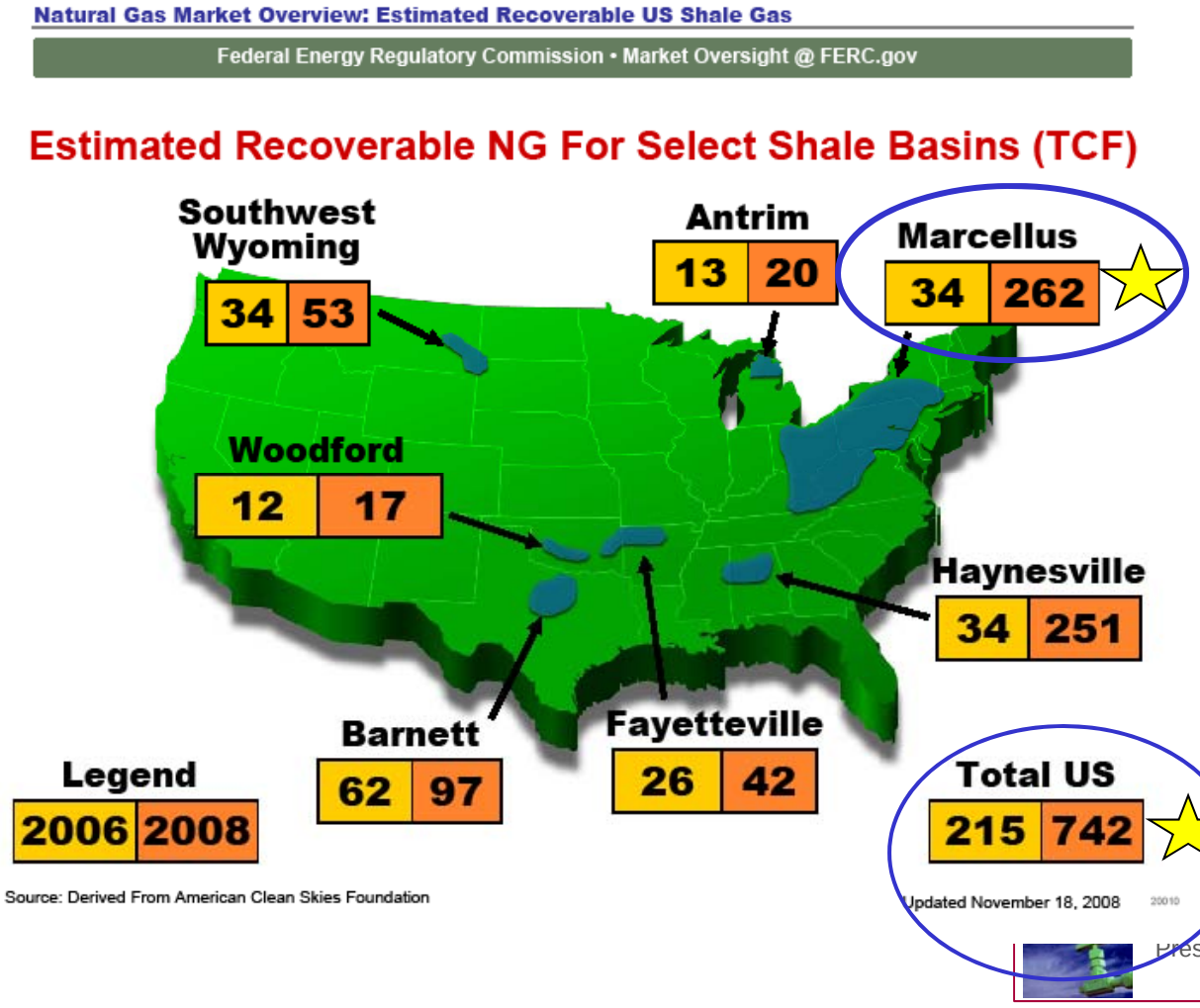
Technology Breakthrough: Higher Recoverable Reserve Estimates



What is a TCF?

1 trillion cubic feet

or

1 billion Mcf

or

~ 1 billion mmBtu

and

Enough natural gas to:

- Heat 15 million homes for 1 year
- Generate 100 billion kilowatt-hours of electricity
- Fuel 12 million natural gas-fueled vehicles for one year

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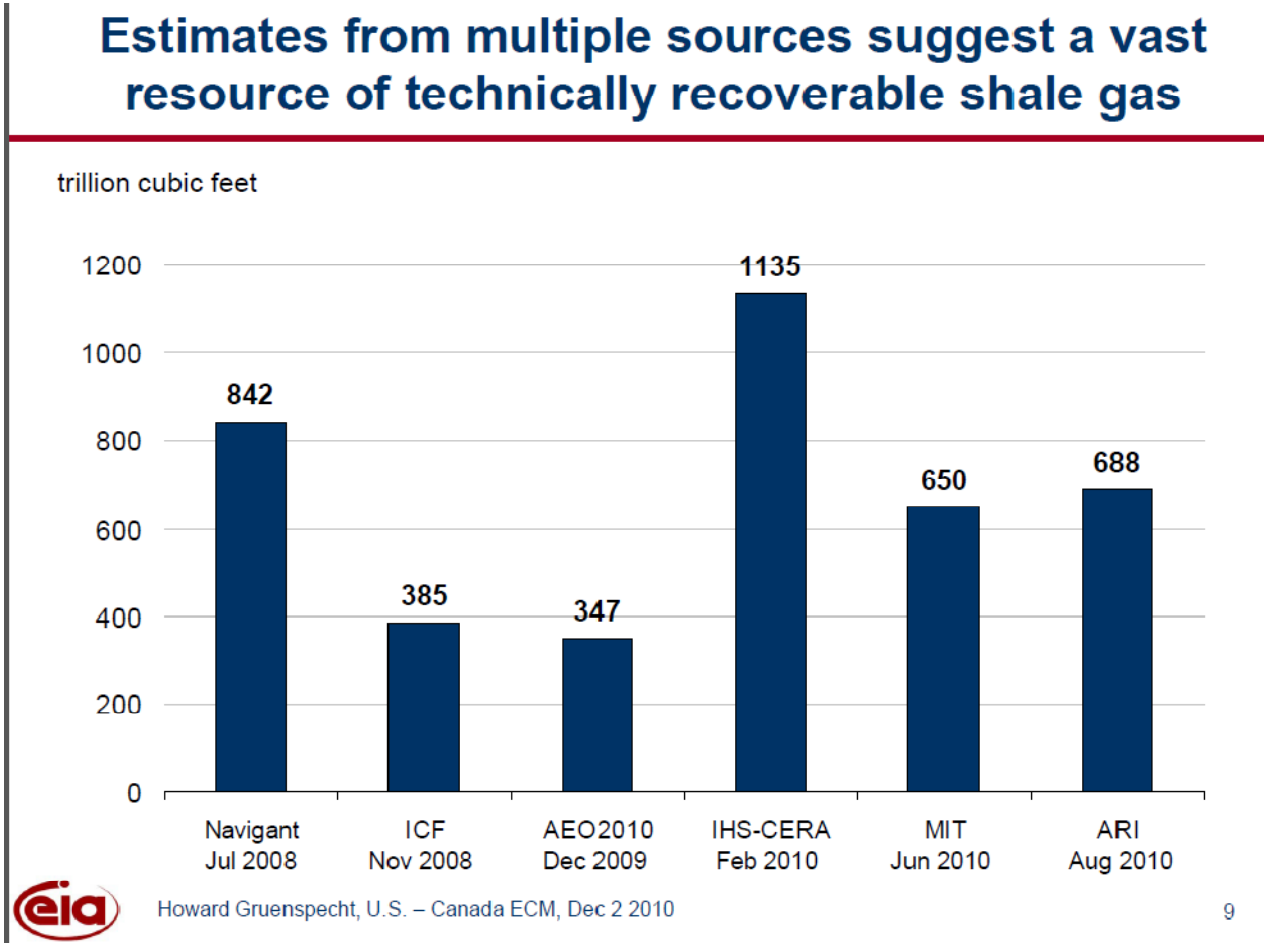
Recoverable Reserves equivalent to 10 to 100 yrs consumption



http://www.eia.gov/neic/speeches/howard12102010.pdf

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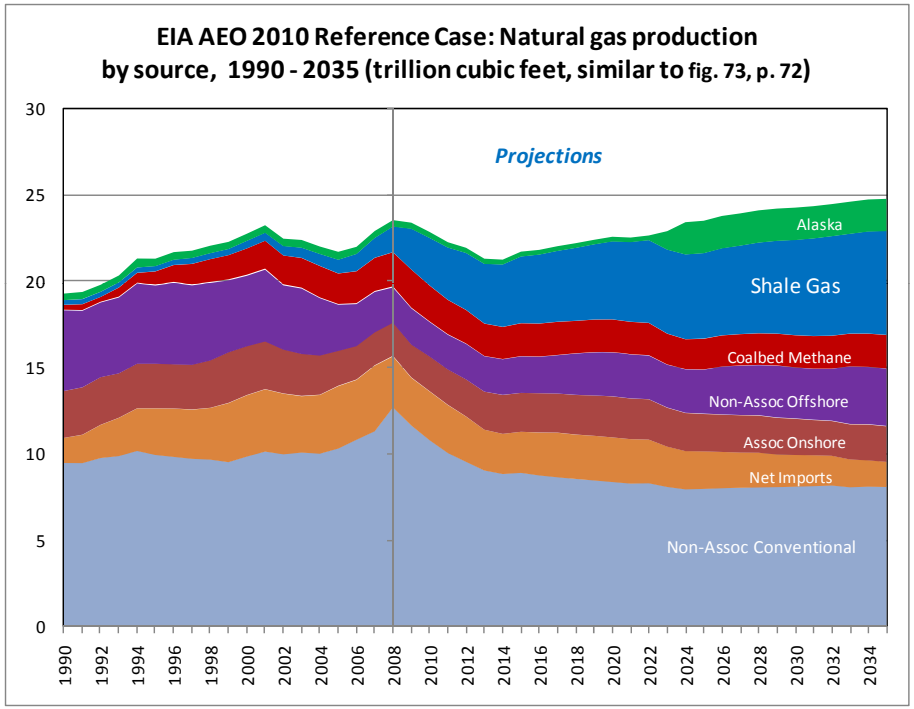
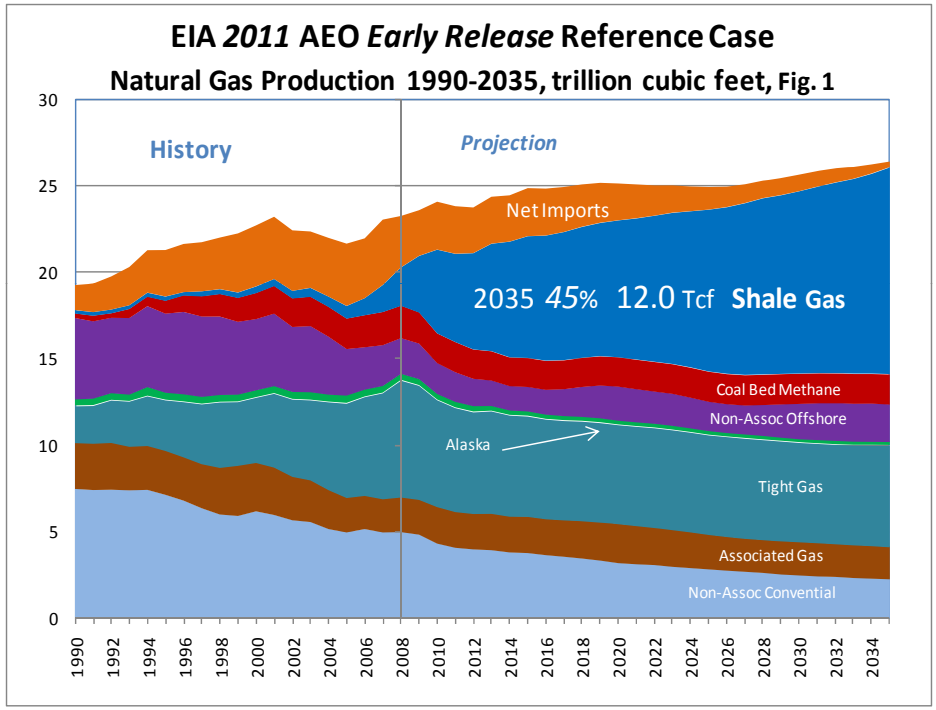
The Rise of Shale Gas: EIA doubles forecast of production by 2035

from 6 Tcf to 12 Tcf, accounts for almost half of total production





2010 AEO reference case

2011 AEO reference case

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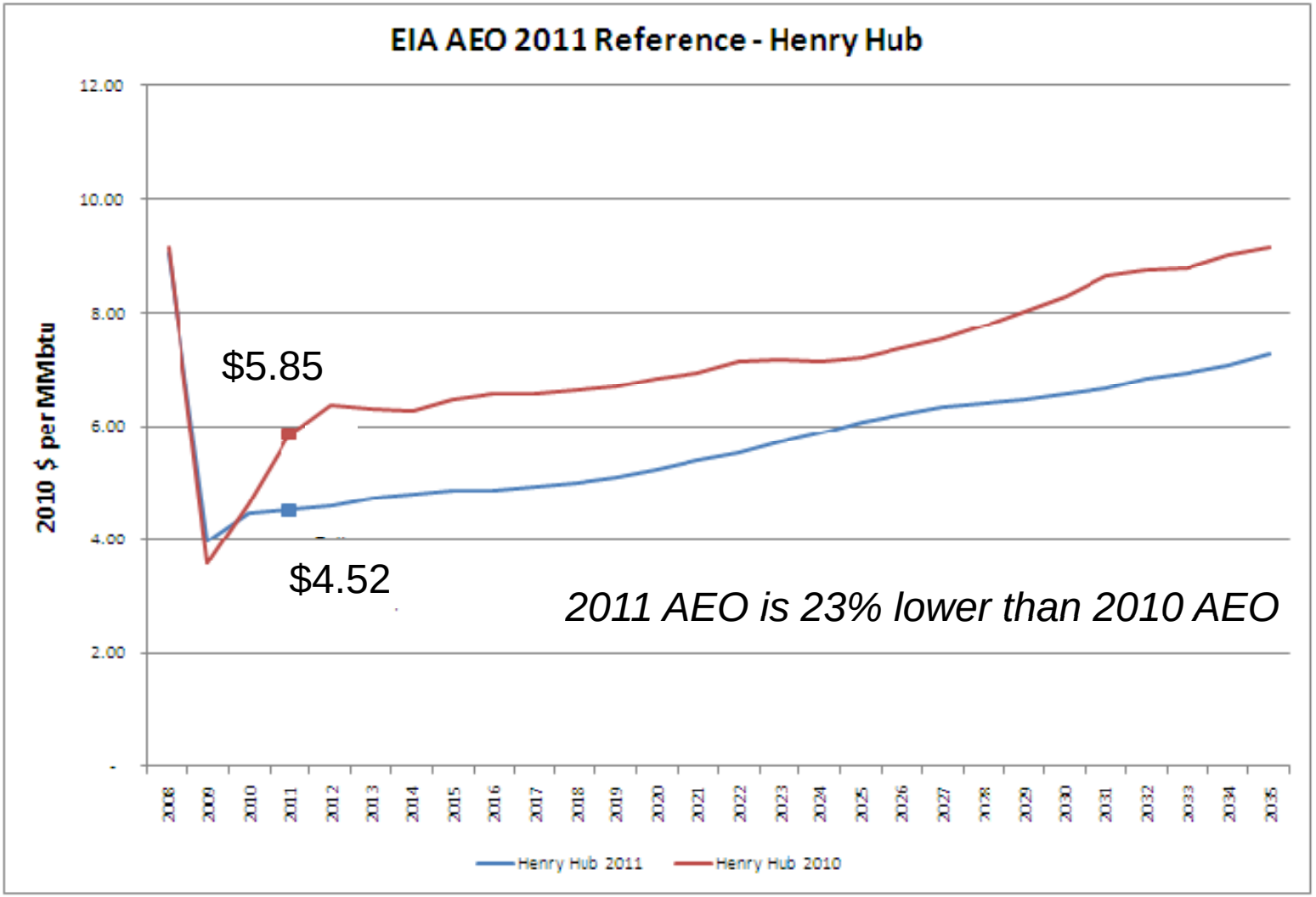
Shale Gas Price: EIA Forecast – Henry Hub



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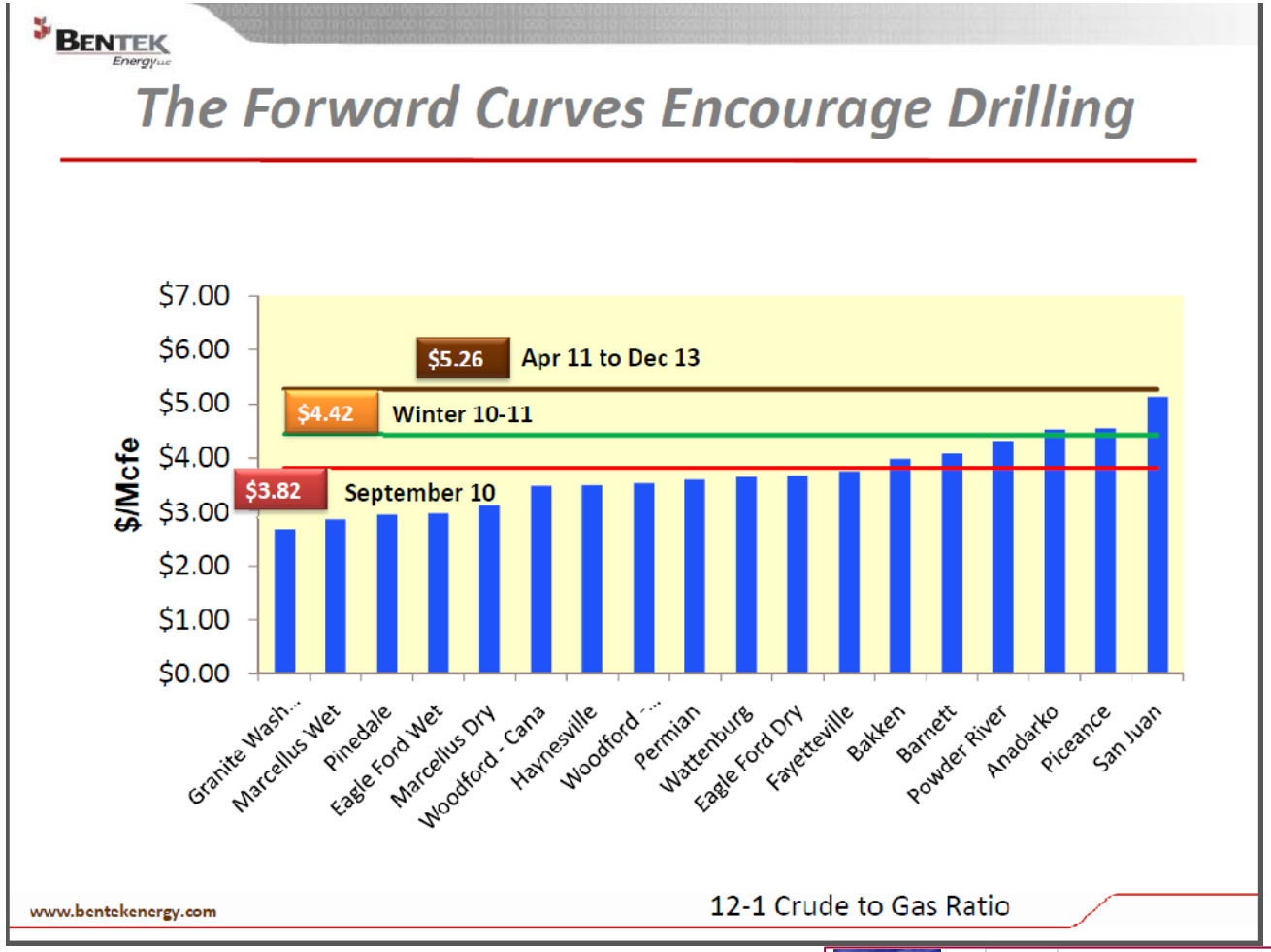
Why Does Supply Increase Despite Low Market Price ?
1. Competitive Full Cycle Cost of Production



Kern River Gas Transmission Company Customer Meeting, October 19, 2010

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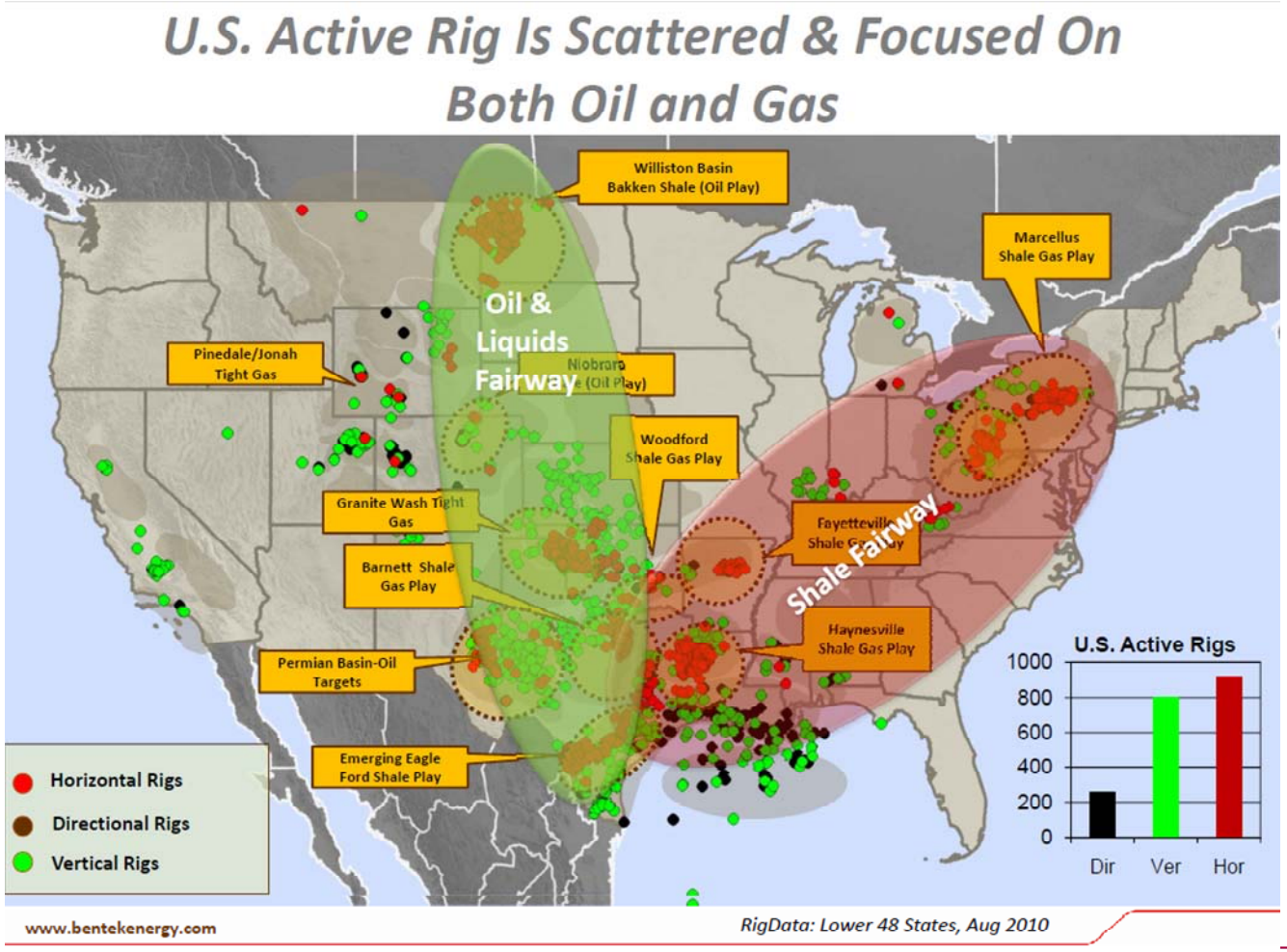
Why Does Supply Increase Despite Low Market Price ?
2. Presence of Rich Gas (Liquids) in Shale Formations



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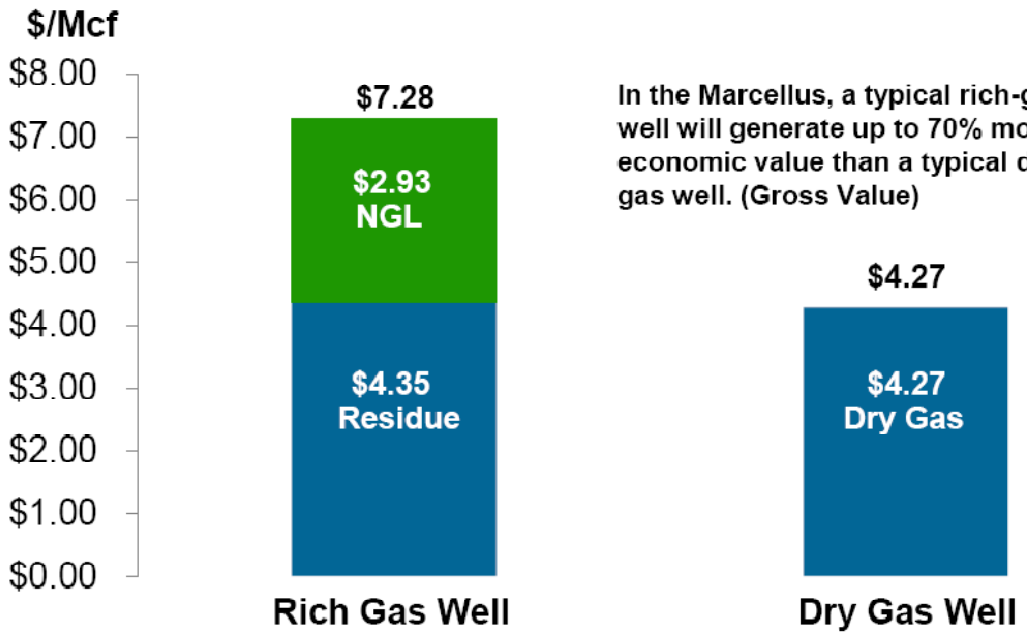
NGL from Shale Offers Multi-Product Revenue Stream

High - Value, Rich - Gas in the Marcellus

Value of 1 Mcf Produced – Rich Gas vs. Dry Gas



In the Marcellus, a typical rich-gas well will generate up to 70% more in economic value than a typical dry-gas well. (Gross Value)

Dry gas assumes 1,030 Btu/cf. Rich gas assumes 1,300 Btu/cf. Assumes TCO gas and NGL prices on April 14, 2010. "NGL Value" deducts typical processing, fractionation and transportation fees.

eeting
, 2011

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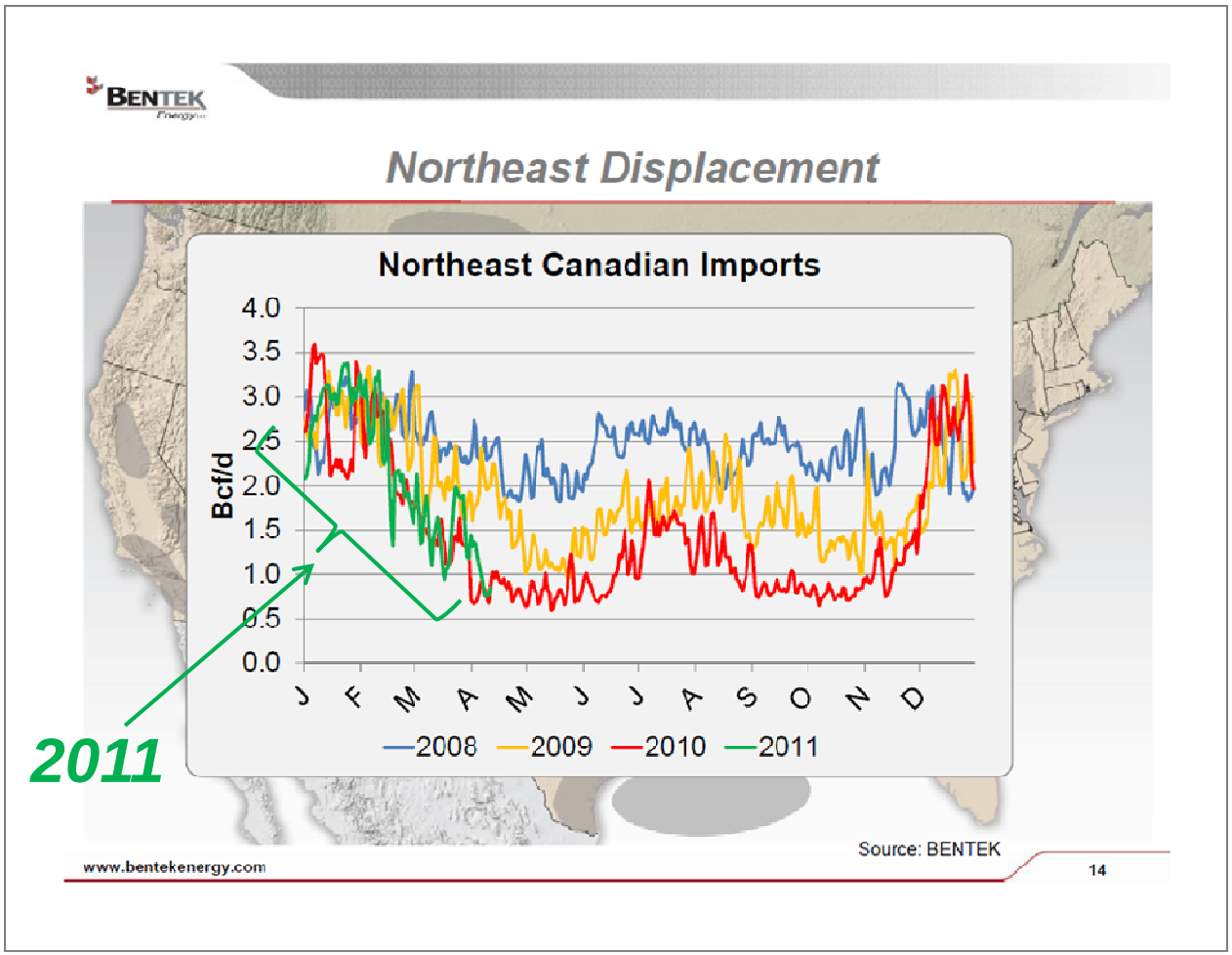
Western Canadian Conventional Production / Imports Declining



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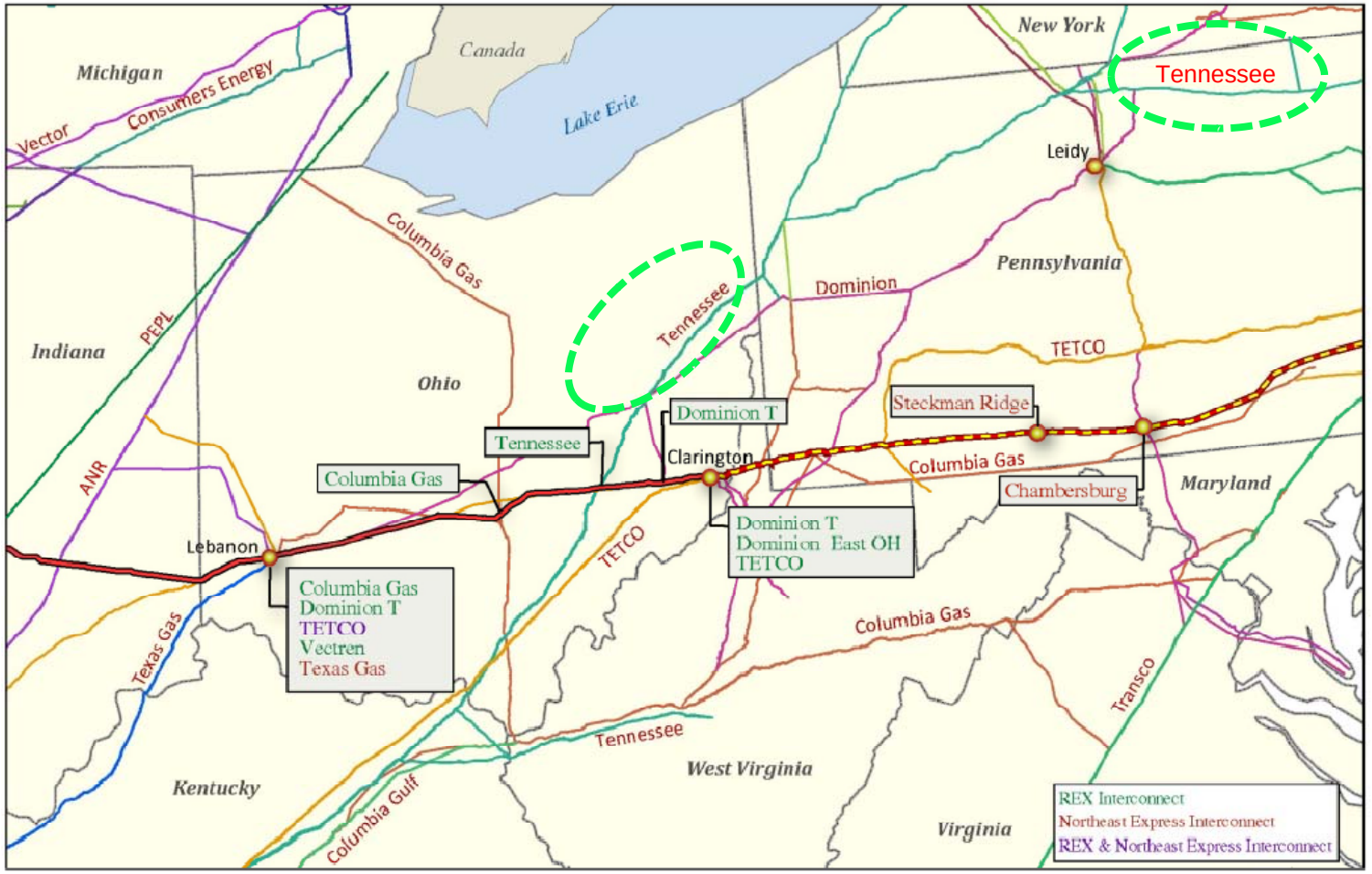
Before Marcellus: Rockies Express ("REX") *excess Rockies Production*



Columbia Gas

Columbia Gulf

Dominion

TETCO

Transco

REX--NEX

Source: IOGA Annual Meeting, May 2008, www.rexpipeline.com

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REX Competitive Rate Economics based on $10 gas in 2008

Sponsor	Route	Volume (Bcf/d)	Transport Rate ($/Dth/d)	FL&U Percent	Total Transport Cost (with $10/mcf cost of gas)
KinderMorgan/ Sempra P&S *REX(NEX)*	Clarington to Princeton Clarington to Linden Clarington to Hoboken	1.1 (1)	$0.64 $0.67 $0.87	1.09% 1.26% 1.26%	$0.75 $0.80 $1.00
TETCO	Clarington to Lambertville (via Northern Bridge and Time 3)	0.3-0.5	$0.79	3.20%	$ 1.11
Transco	Clarington to Station 195 Clarington to Princeton Clarington to Hoboken	0.70	$0.61 $0.81 $1.16	0.50% 1.28% 1.28%	$0.66 $0.94 $1.29
National Fuel/ Millennium	Clarington to Ramapo (into Transco in Northern NJ)	0.55-0.75	$1.25 $1.45	2.4% 2.9%	$1.44 $1.68
NiSource	Leidy to Ramapo via Millennium (into Transco in Northern NJ)	0.50	$0.98 $1.18	1.4% 1.9%	$1.09 $1.33
Tennessee	Clarington to Pleasant Valley NY w/ Build on IGTS to access NY	1.10	$0.79 $1.34	1.26% 3.76%	$0.89 $1.64

(1): volumes ramp up over 3 to 5 year period w/max capacity 1.8 Bcfd

Source: IOGA Annual Meeting, May 2008, www.rexpipeline.com

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What are the Risks to the Forecast ?

- Risk = Opportunity + Challenge
- Opportunities:
  - **Readily available supply for previously constrained markets**
  - **enhances diversity & reliability to meet peak and load growth**
  - **possible lower price volatility – long term**
  - **environmental advantage of gas vs coal or oil**
- Challenges:
  - **Scope**
  - **Scale**
  - **Timing**
  - **Environment**

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Challenges in detail:

- Scope
  - Too expensive for “demand pull”
  - “producer push” required for 1st phase
  - No one party has capacity to vertically integrate back to the wellhead
  - “Smaller” independent producers have taken the lead
- Scale
  - Investment $, MLPs, JVs, VPPs maintain access to capital markets
  - Coordinate gathering, processing liquids extraction; Downstream bottlenecks
- Timing
  - Technical learning curve
  - Pipeline transmission permit & construction (~ $20 mil/mile)
- Environment
  - State level responsibility for regulation
  - New sources of revenue, jobs vs local cost of living & infrastructure

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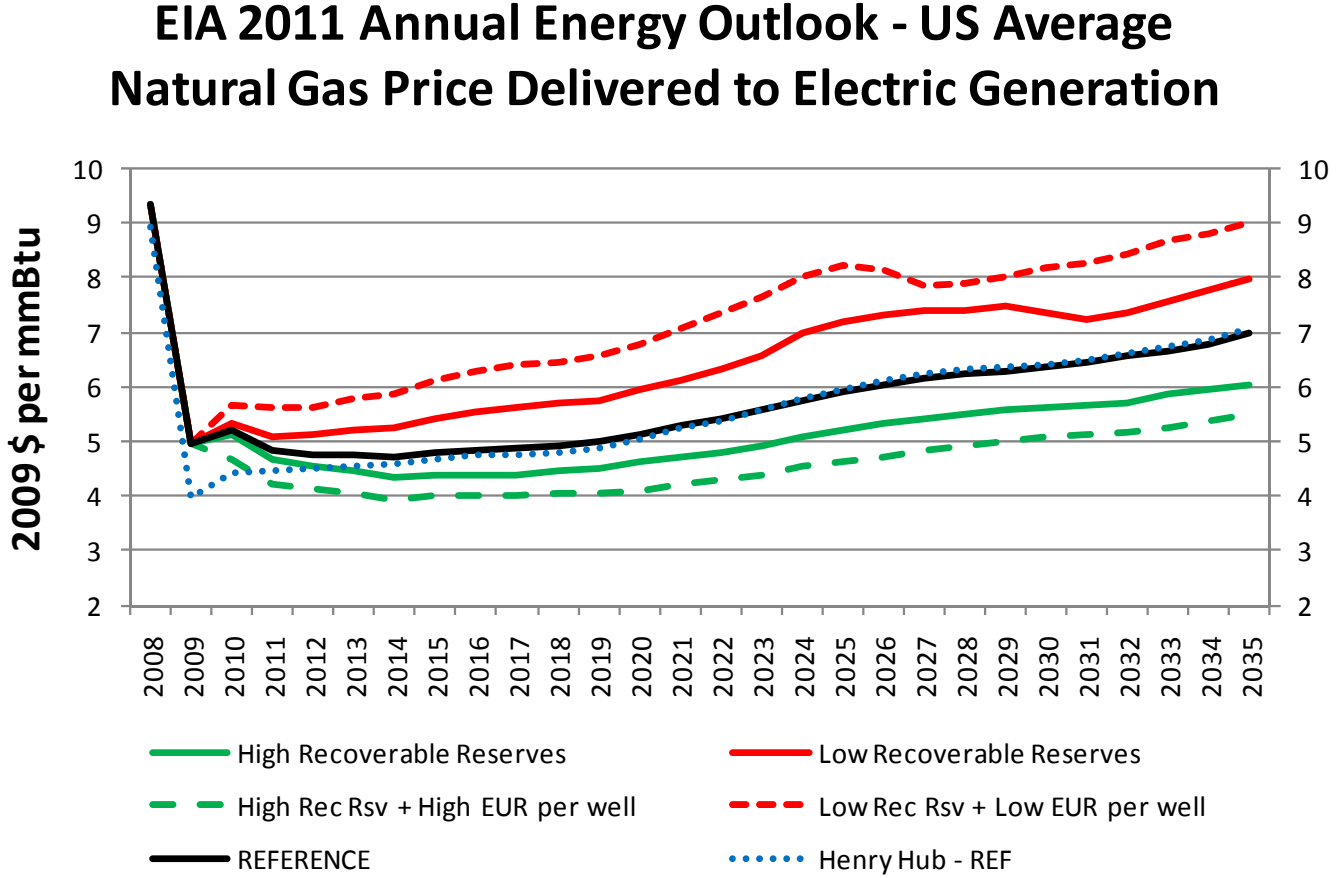
Shale Gas Price: EIA Forecast Including Production Side Cases



Recoverable Reserves includes Total Unproved Technically Recoverable Shale Gas Resources
Shale gas production grows to account for almost 50% of total production by 2035
Price Ranges between $5 and $9 per mmBtu by 2035 in Real Terms

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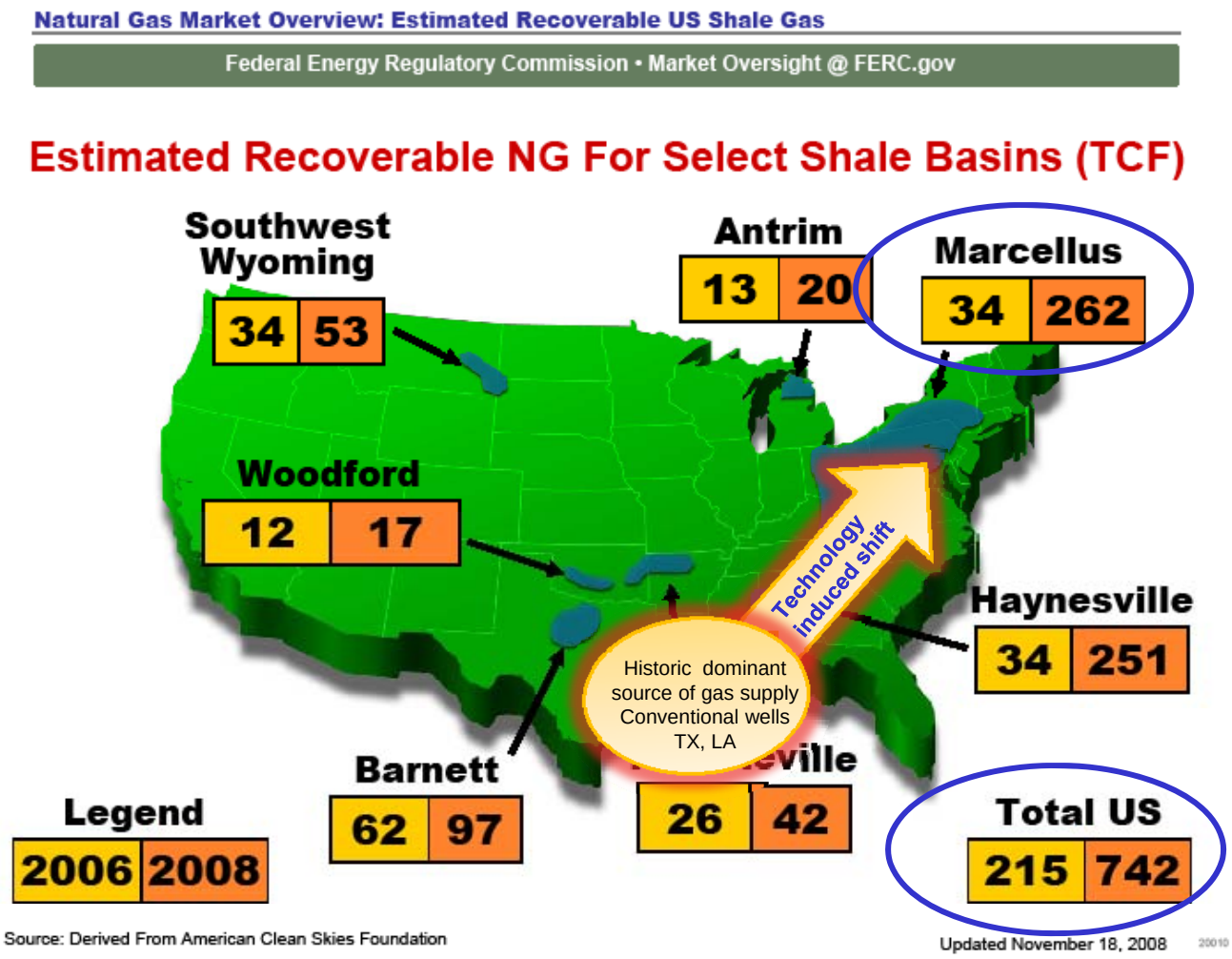
Technology, Reserves & Pipeline Flows: Northeast Supply Hub Forms



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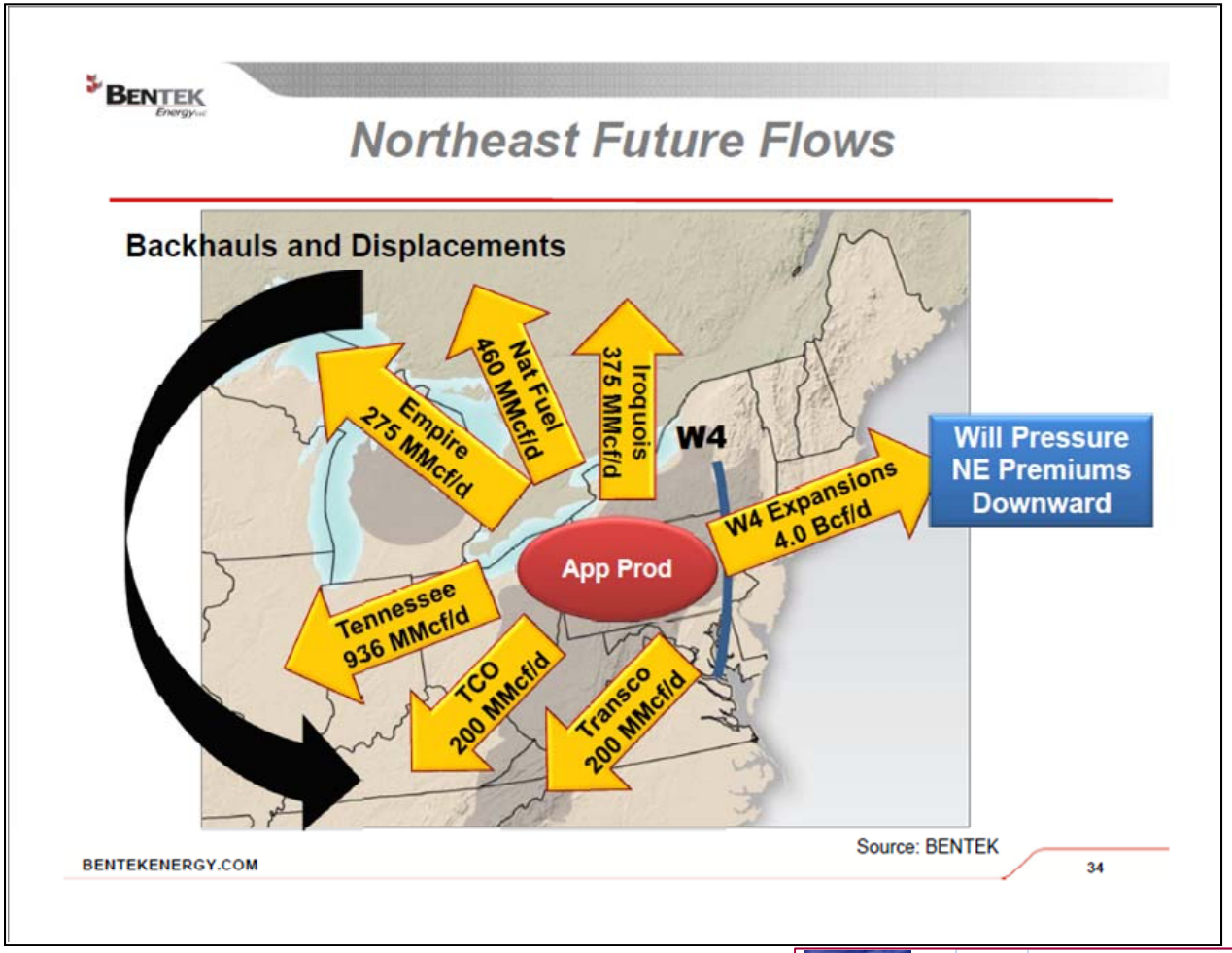
Case Study: Market Impact on Tennessee Gas Pipeline



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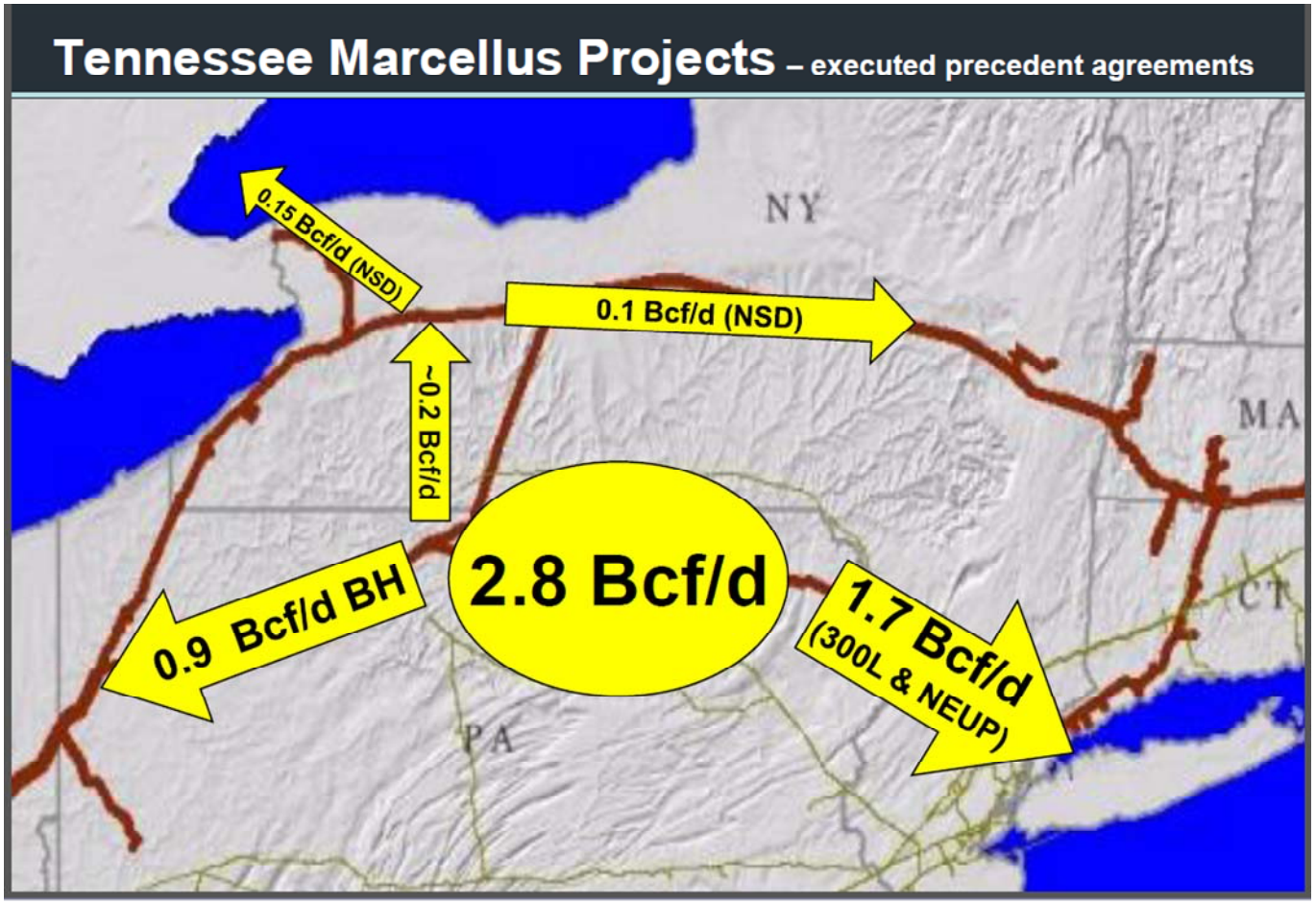
Problem: How to move incremental 2.8 Bcf/d from the middle of "long-haul design" system ?
Solution: Strategic Incrementally priced expansions & *"back hauls"*



Source: NECA Fuels Conference, September 2010

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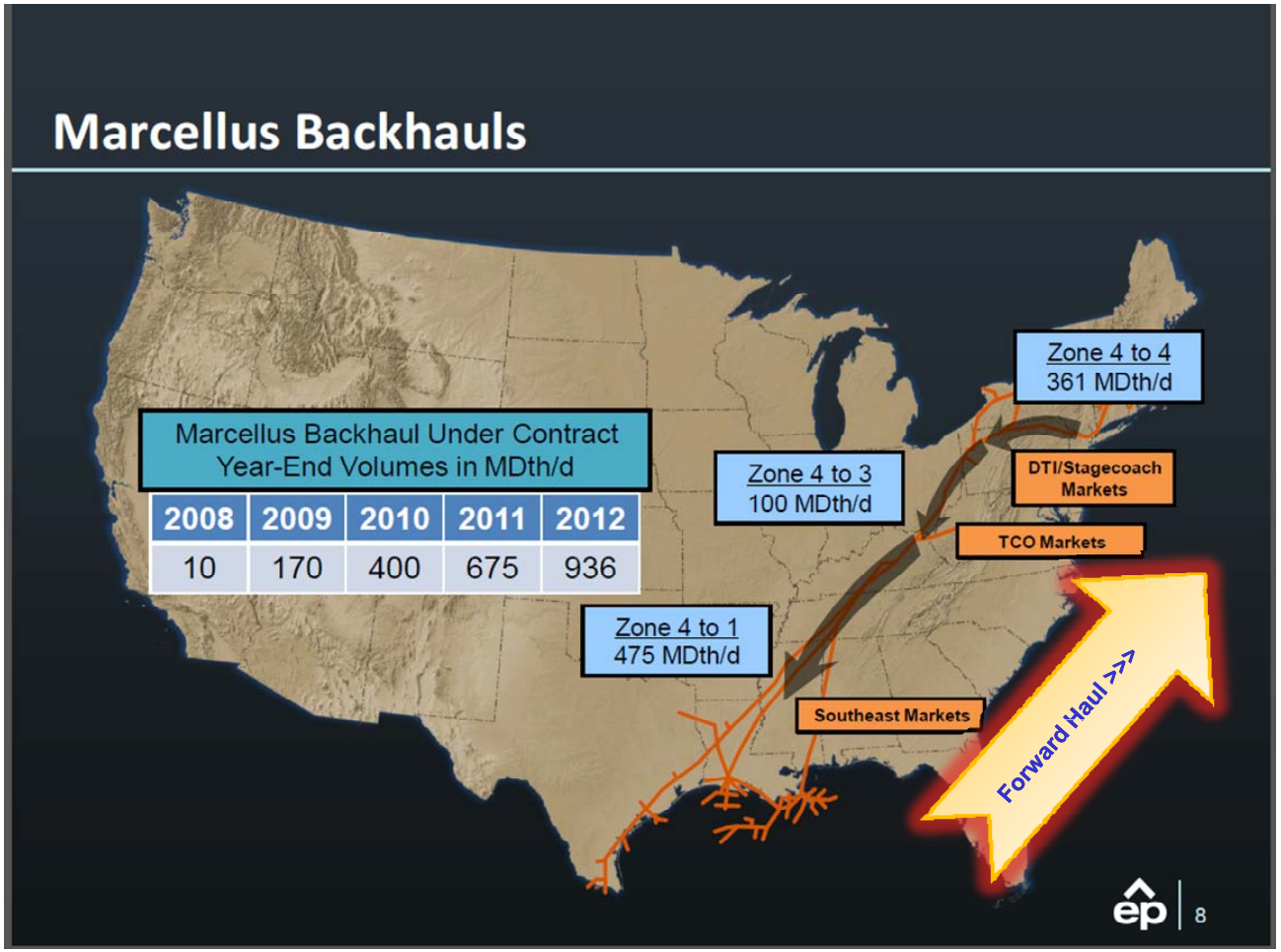
Back Haul agreements to maintain value of capacity, but physical limit:



Source: NECA Fuels Conference, September 2010

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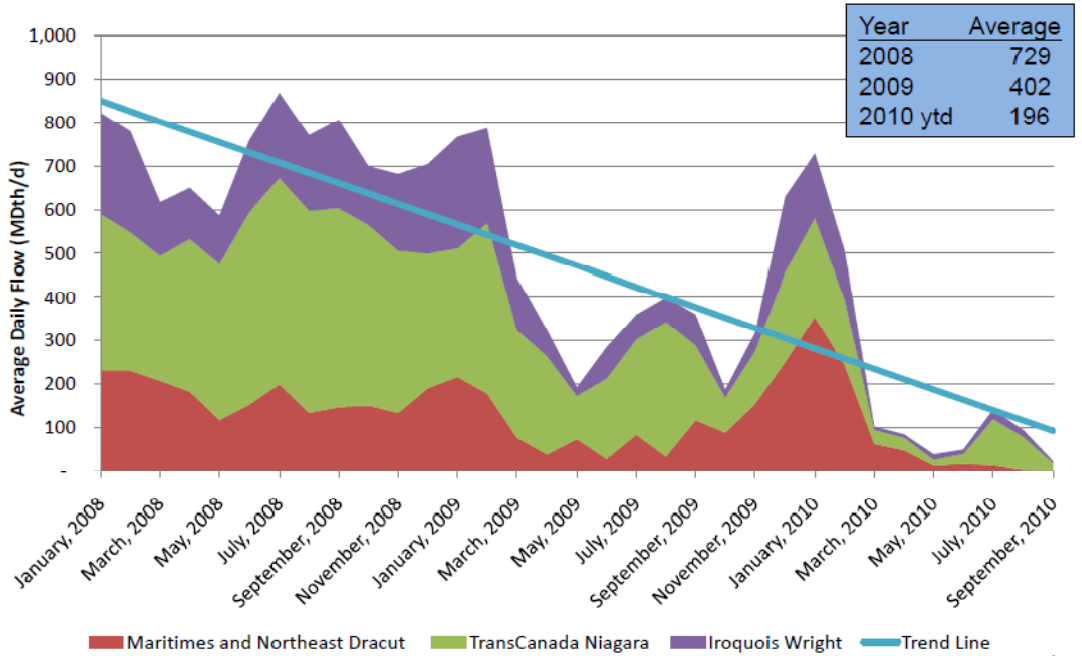
Net Imports : TGP Canadian Receipts at Iroquois/Transcanada:

Chapman Testimony – Exhibit No. TGP-149

Docket No. RP11-____
Exhibit No. TGP-149
Page 1 of 1

TGP Canadian Receipts

January 2008-September 2010 Scheduled Volumes



Note: Maritimes et al.

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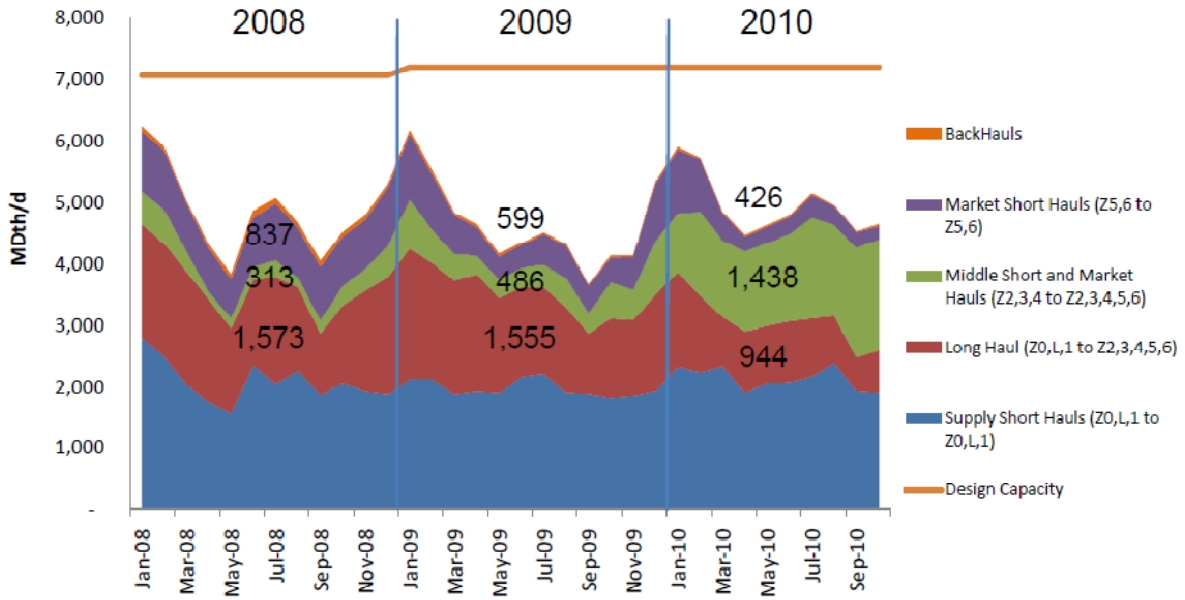
RESULT: Underutilized Design Capacity = Cost under recovery

Docket No. RP11-____
Exhibit No. TGP-142
Page 1 of 1

TGP Billable Throughput versus Design Capacity (Jan 2008-Oct 2010)



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Tennessee Gas Pipeline (TGP) General Rate Case

- FERC Docket No. RP11-1566: filed 11/30/2010 (Previous: 1994/1996)
- Strategy:
  - Align rates with *"current conditions"*
  - Roll in market area expansions
  - Correct cost under-recovery
  - Negative salvage and accelerated depreciation
  - Reasonable ROI to maintain access to capital markets (Fitch Rating BBB-)
  - Cost of service excludes revenue from discounted negotiated rate service
  - Back haul rates EFV design

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RESULT: TGP Proposed Revenue Requirement increases 24%

$ billions	Existing RP95-112	Proposed RP11-1566	% change
Rate Base	1.5	2.6	78%
Cost of Service (*)	0.7	1.06	51%
Total Revenue Requirement:	0.8	1.05	24%
Maximum Rate Billing Determinants	**MMDth/day**		
Reservation	4.2	3.9	-5.9%
Usage:		4.7	
Including Discounted Capacity:	7.9	7.2	-8.9%

(*) w/o increased deprec & neg salvage costs = $0.956 bil or approx 35% increase

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TGP Also Proposed Higher Cost of Equity:

Capital Structure	Existing			*Proposed*		
	RP95-112	% of Total	wgtd avg	*RP11-1566*	*% of Total*	*wgtd avg*
Debt (+)	*not part of settlement*	48%	3.3%	7.81%	45%	3.55%
Equity (*)	12.71%	52%	6.6%	13.50%	55%	7.36%
Wgtd Average:		100%	9.9%		100%	10.91%

(*) RP95-112 cost of equity per witness C. Oblitas, capital structure not part of settlement

(+) not part of RP95-112 settlement, estimated from pre-tax rate of return 15.3%

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RESULT: Rate Shock, Complex Settlement Negotiations

Tennessee Gas Pipeline Company
FERC Gas Tariff
Sixth Revised Volume No. 1

Second Revised Sheet No. 14
Superseding
First Revised Sheet No. 14

RATES PER DEKATHERM

FIRM TRANSPORTATION RATES
RATE SCHEDULE FOR FT-A

Base Reservation Rates

RECEIPT ZONE \ DELIVERY ZONE	0	L	1	2	3	4	5	6
0	$7.9894 ~~$3.10~~		$15.4673 ~~$6.45~~	$20.4167 ~~$9.06~~	$20.7581 ~~$10.53~~	$26.0517 ~~$12.22~~	$27.5992 ~~$14.09~~	$34.2310 ~~$16.59~~
L		$7.2193 ~~$2.71~~						
1	$11.6165 ~~$6.66~~		$11.0299 ~~$4.92~~	$14.3056 ~~$7.62~~	$19.7957 ~~$9.08~~	$22.3343 ~~$10.77~~	$25.0764 ~~$12.64~~	$30.4605 ~~$15.15~~
2	$20.4167 ~~$9.06~~		$14.2411 ~~$7.62~~	$7.9407 ~~$2.86~~	$7.4961 ~~$4.32~~	$10.3845 ~~$6.32~~	$13.9557 ~~$7.89~~	$17.5872 ~~$10.39~~
3	$20.7581 ~~$10.53~~		$11.5032 ~~$9.08~~	$7.9923 ~~$4.32~~	$6.0819 ~~$2.05~~	$9.7564 ~~$6.08~~	$16.9402 ~~$7.64~~	$19.2652 ~~$10.14~~
4	$26.0517 ~~$12.53~~		$23.8387 ~~$11.08~~	$9.9356 ~~$6.32~~	$14.4347 ~~$6.08~~	$8.4756 ~~$2.71~~	$9.0952 ~~$3.38~~	$12.4456 ~~$5.89~~
5	$30.8462 ~~$14.09~~		$22.0101 ~~$12.64~~	$10.3128 ~~$7.89~~	$12.2418 ~~$7.64~~	$9.3189 ~~$3.38~~	$8.7954 ~~$2.85~~	$11.0128 ~~$4.93~~
6	$35.4587 ~~$16.59~~		$25.0651 ~~$15.15~~	$17.5872 ~~$10.39~~	$19.2652 ~~$10.14~~	$15.6926 ~~$5.89~~	$8.5862 ~~$4.93~~	$7.5263 ~~$3.16~~

Short Haul Zone 4 to 6

Marcellus to Boston citygate

SFV ⇨ EFV

Proposed increase + SFV:

$12.44 vs $5.89 / Dth-mth

Rate impact : > 100%

Depends upon load factor

Variable rates lower

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Re-Contracting Risk Not Unique to TGP

Potential for Regionalization of Firm Transportation

Pipeline	System Capacity	Potential Expiration in Next 3 Years
Columbia Gas	3.0 Bcf/day	1.6 Bcf/day
Dominion	5.7 Bcf/day	3.0 Bcf/day
Tennessee Gas	6.7 Bcf/day	3.9 Bcf/day
Texas Eastern	6.2 Bcf/day	1.2 Bcf/day
TransContinental Gas	7.7 Bcf/day	2.0 Bcf/day
	29.3 Bcf/day	11.7 Bcf/day

40% of transportation contracts subject to renewal in next 3 years

Trend is to drop the southern segments

Source: Rex tag Interstate Natural Gas Infrastructure

RANGE RESOURCES

Hart Energy Marcellus Midstream Conference I April 20, 2010 I 4

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REX-NEX extended map: Competition for Premium Northeast Markets

Algonquin

Iroquois Gas

Tennessee

TETCO

Transco

REX--NEX

Source: IOGA Annual Meeting, May 2008, www.rexpipeline.com

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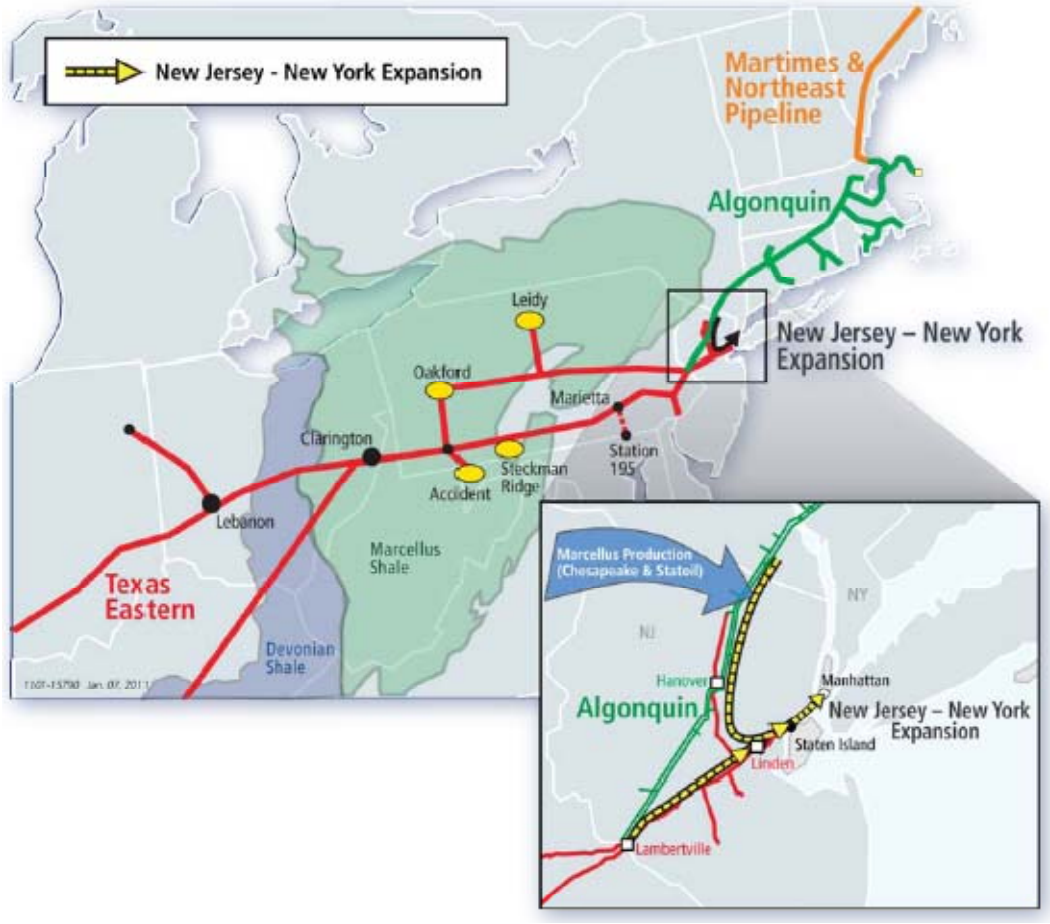
Texas Eastern Transmission (TETCO): NY-NJ Expansion



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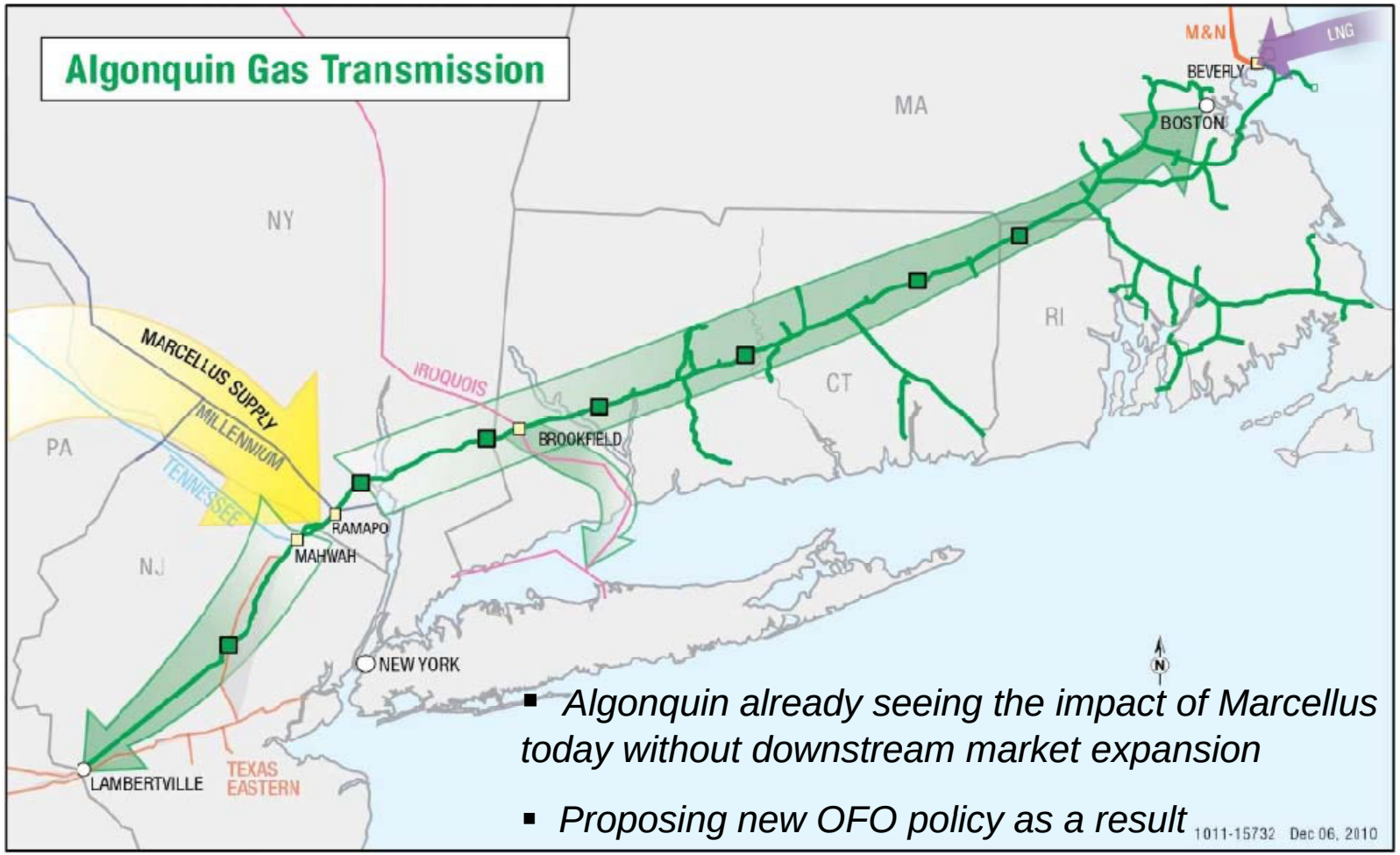
Spectra / Algonquin Incremental Market (AIM) project :



- *Algonquin already seeing the impact of Marcellus today without downstream market expansion*
- *Proposing new OFO policy as a result*

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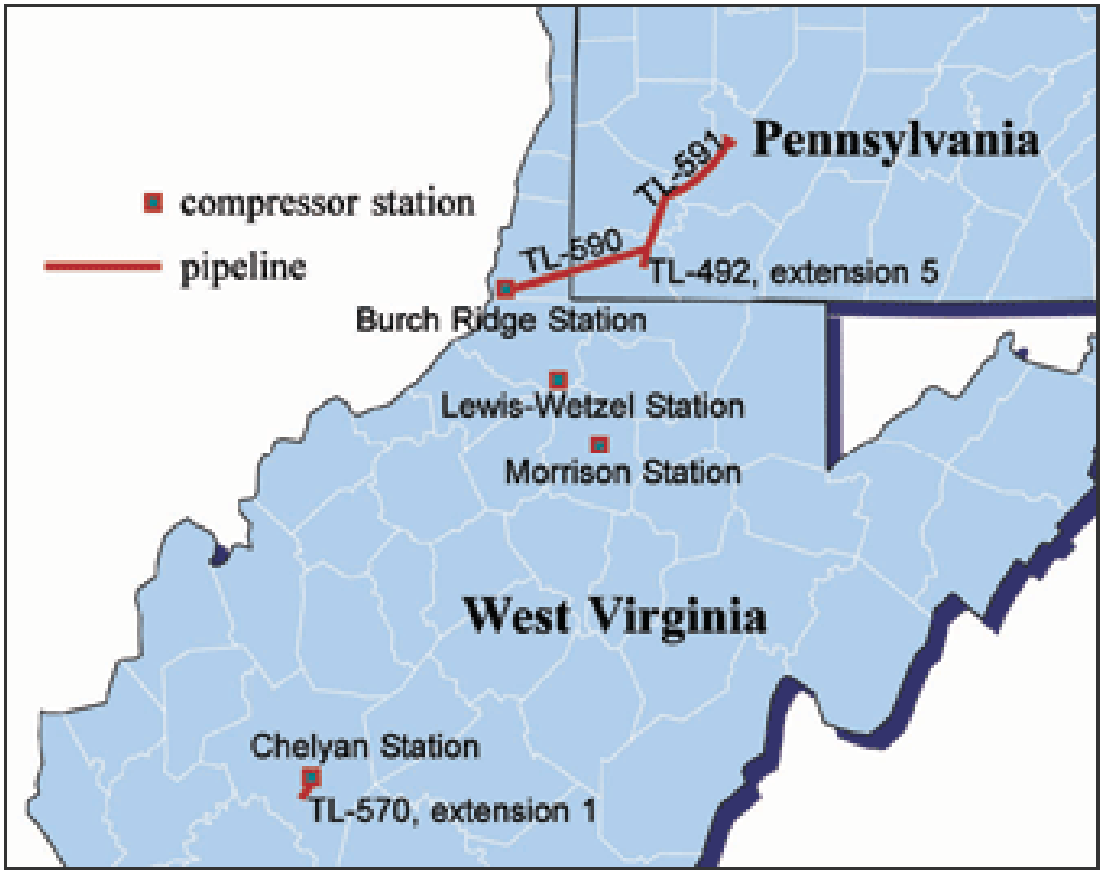
Dominion Transmission: Appalachian Gateway Project



- Interconnects with TETCO at Oakford , PA

- Major short-haul receipt point for NE LDCs

- In Service: Sep 2012
  FERC CP10-448

http://www.dom.com/business/gas-transmission/appalachian-gateway/index.jsp

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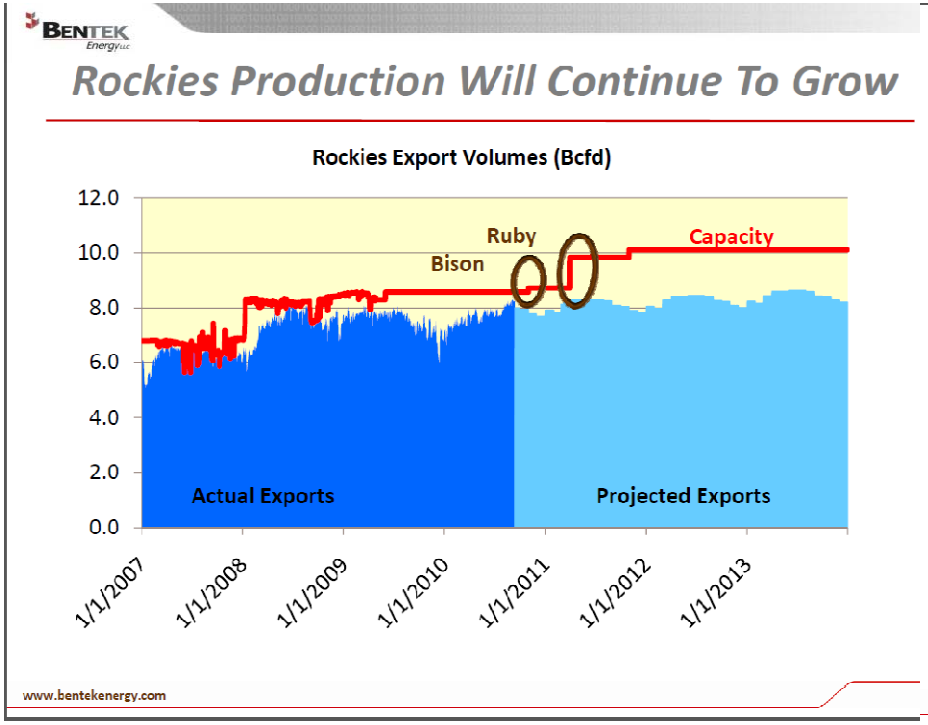
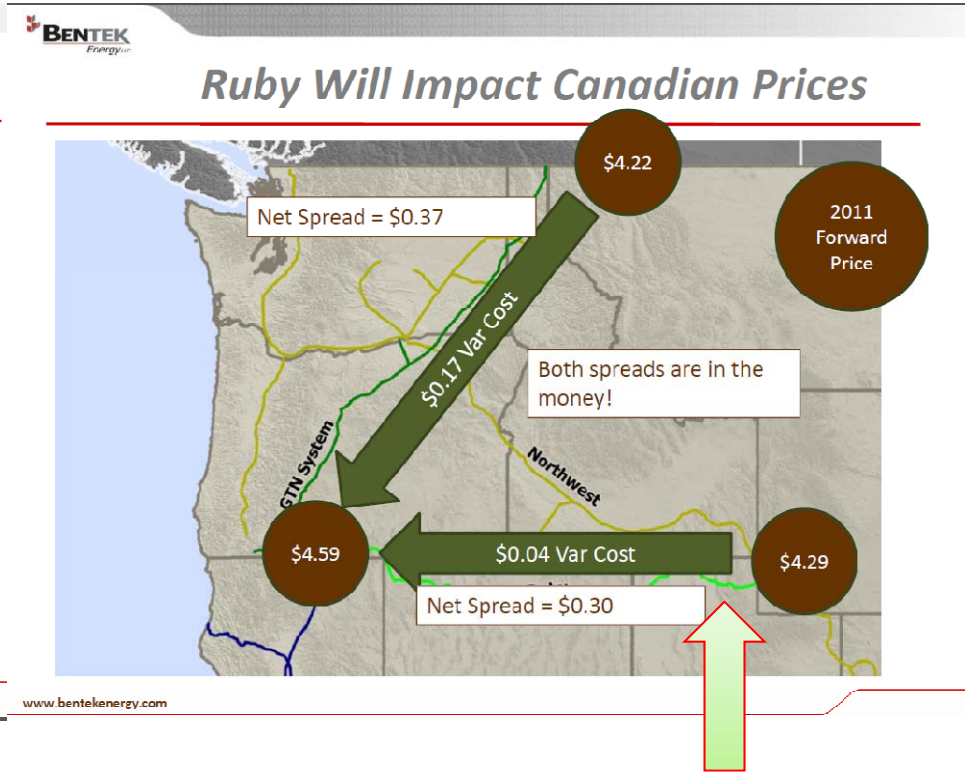
Rockies Production Growth Impacts More than REX-East





RUBY PIPELINE

Kern River Gas Transmission Company Customer Meeting, October 19, 2010

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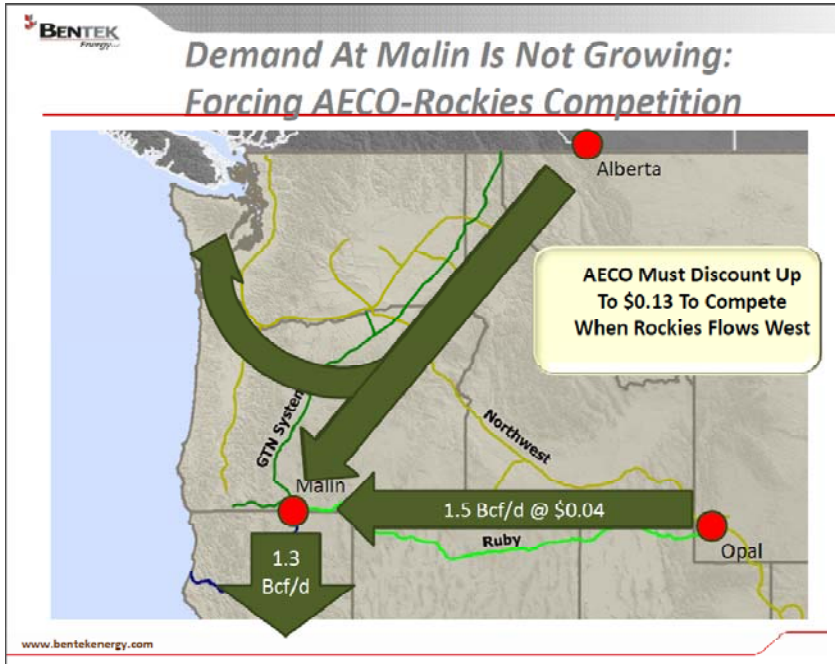
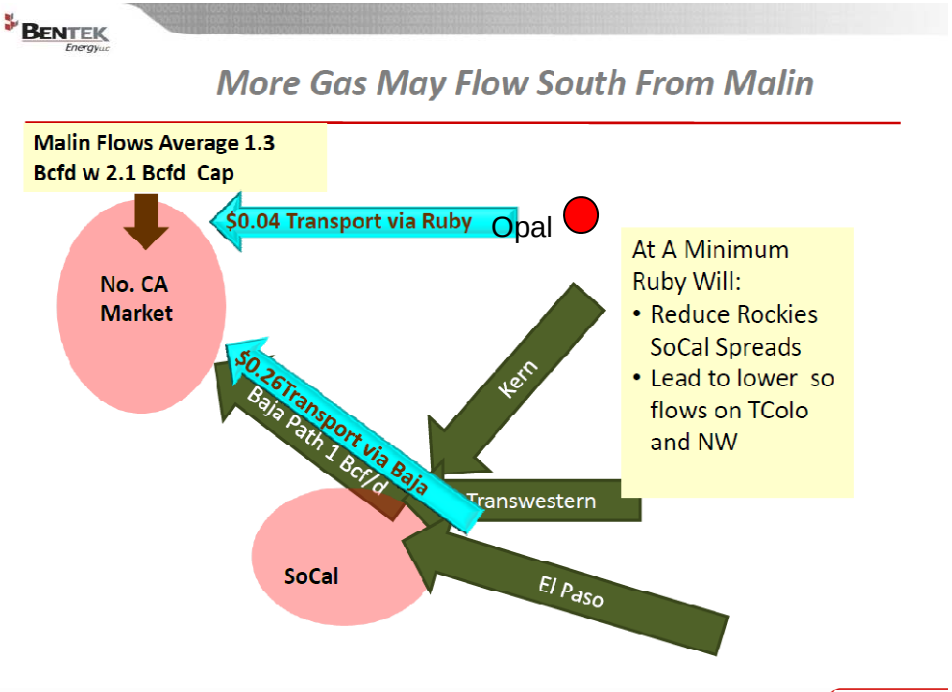
Rockies Production Growth: Redirects Western Market Flows



- *May reduce gas flow from Opal on Kern / Questar,*
- *More liquidity at SoCal border from other pipelines*
- *Provides incentive for backhauls on Kern?*



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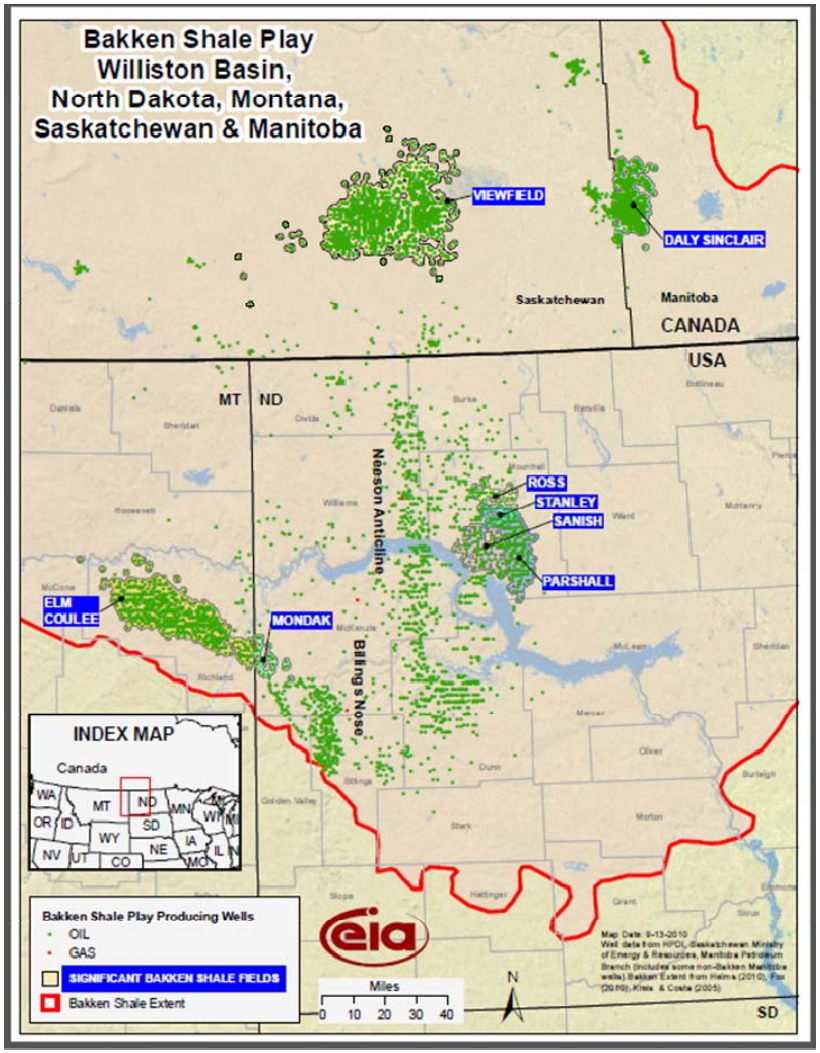
Bakken Shale Region: Both Oil & Gas Shale Play



- Substantial Infrastructure Issue:
- Oil shale production considered economic when Crude Oil > $60 per bbl
- Today Insufficient pipeline take-away capacity
- Shipping excess production by:
  - Rail
  - Truck
- Impact on roads becoming a huge issue for local governments

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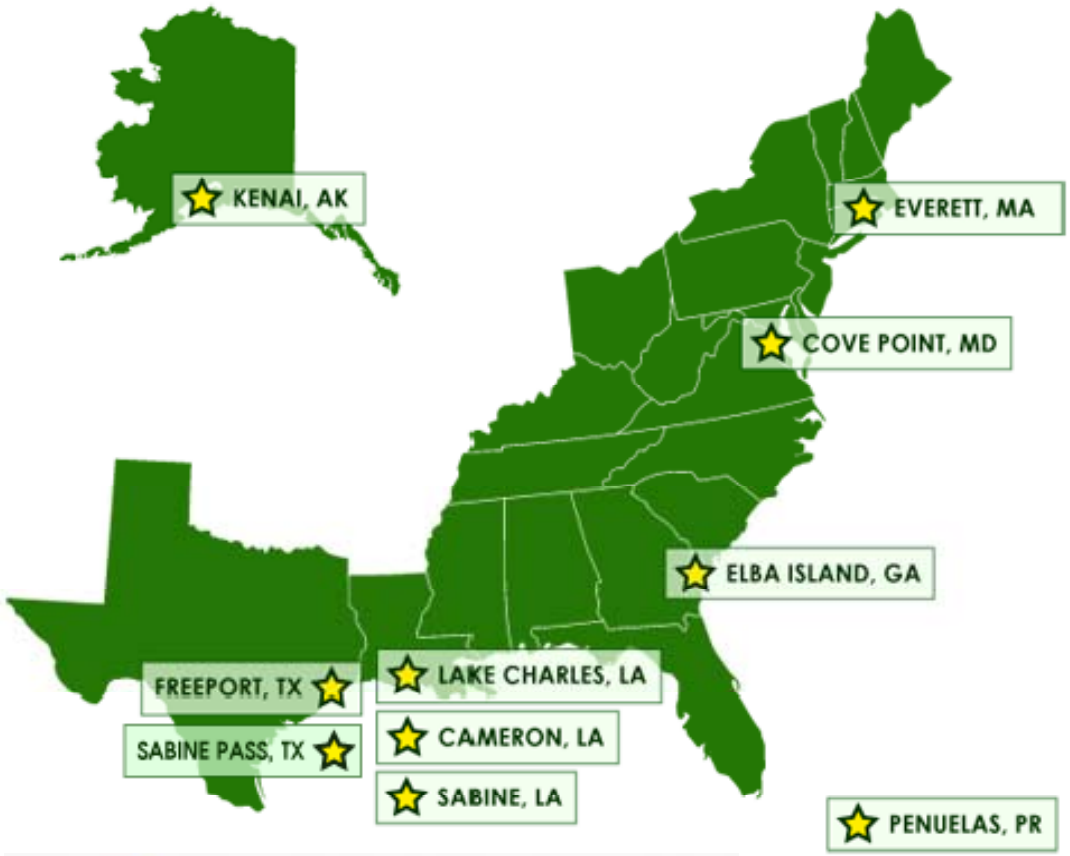
NEXT LEVEL OF SHALE IMPACT: LNG EXPORTS ??



FERC
FEDERAL ENERGY REGULATORY COMMISSION

❑ 2011 DOE Approval to export / Proposed to FERC (2012):

- Sabine, LA: (Cheniere)
  import: 2.6 Bcf/d
  export: 803 bcf per year
  (prelim agrmt w/ Chesapeake)
- Freeport, TX: (Macquarie)
  import: 1.4 Bcf/d
  export: 511 bcf per year

❑Under consideration:

- Cove Point, MD (Dominion)
- Lake Charles(Southern / BG)
- Jordan Cove (Oregon)

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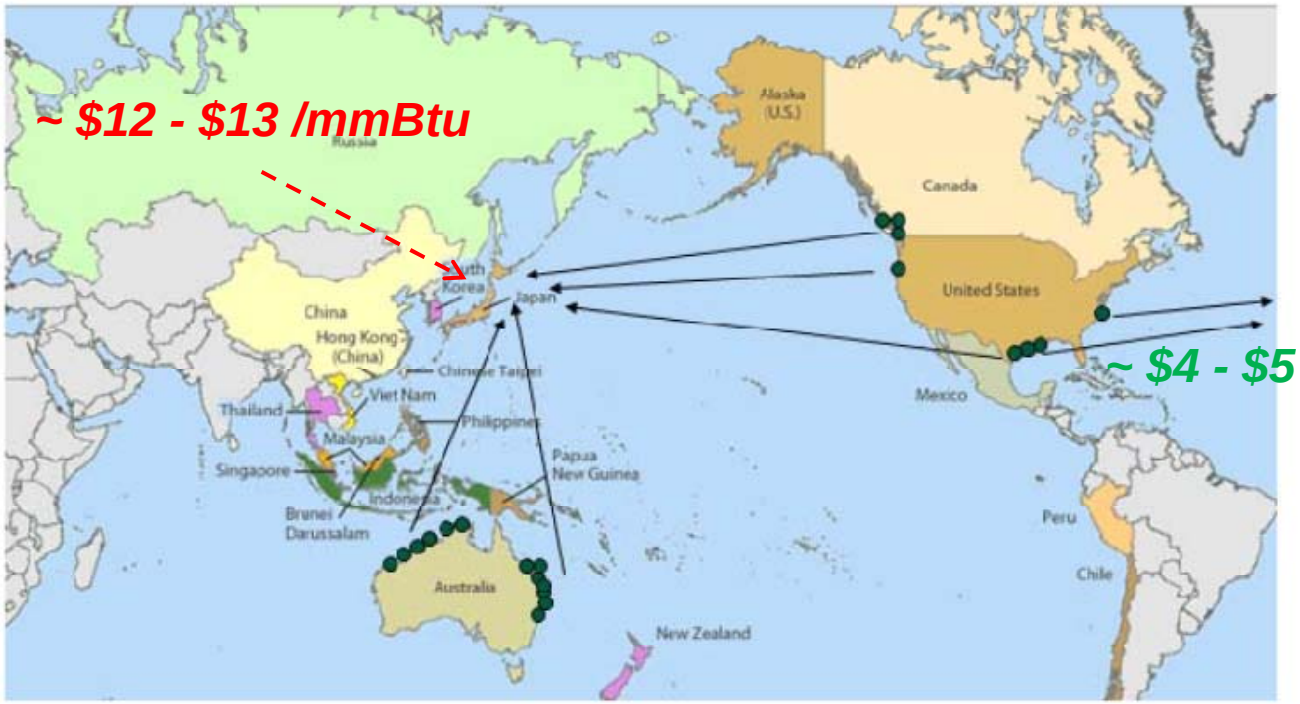
NEXT LEVEL OF SHALE IMPACT: Target Market Price Differential

Exports: The real deal?



- Who wins? Brownfield vs. greenfield; supply costs; transport; who's investing/buying?

platts

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NEXT LEVEL OF SHALE IMPACT: US GOM Competitive?

Exports: The real deal?

	DELIVERY TO ASIA		
	WESTERN CANADA	US GULF COAST	AUSTRALIA
Shipping	$0.65	$2	$0.80-$0.90
Gas	$5.40	$6	???
Liquefaction	???	$1.75	???
Fuel surcharge	???	$0.50	???
TOTAL	**~ $9**	**$10.25**	**$12 netback**

Source: Cheniere Energy, Barclays Capital, NYMEX, Platts M2M

platts

LNG Export Potential

- $billions w/ a "B" to add liquefaction trains
- 2014 / 2016 estimate for first export of domestic production (not re-export)
- 8 announced
  3 in Canada, 5 in US
  totaling 5.4 Bcf/d
- given world market conditions Platts estimates 1 to 2 Bcf/d

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STATUS OF SHALE GAS DATA: "Secret" or Public ?

- Besides Trade & Broadsheet Press
- Besides advocacy groups (both sides) & corporate web sites
- PA DEP Well Production Data
  http://www.dep.state.pa.us/dep/deputate/minres/oilgas/new_forms/marcellus/marcellus.htm
- FracFocus.org
- FracTracker.org
- Penn State (Geology and Agriculture)
- EPA Draft Hydraulic Fracturing Study Plan

http://water.epa.gov/type/groundwater/uic/class2/hydraulicfracturing/upload/HFStudyPlanDraft_SAB_020711.pdf

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QUESTIONS ?

Thanks!

Contact Information:

Melissa Whitten

La Capra Associates

One Washington Mall, 9th Floor
Boston, MA 02108

Tel: 617-778-5515

acochis@lacapra.com
mwhitten@lacapra.com