Hydrocarbon Infrastructure

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GLOBAL ENERGY MANAGEMENT INSTITUTE

March 11, 2015

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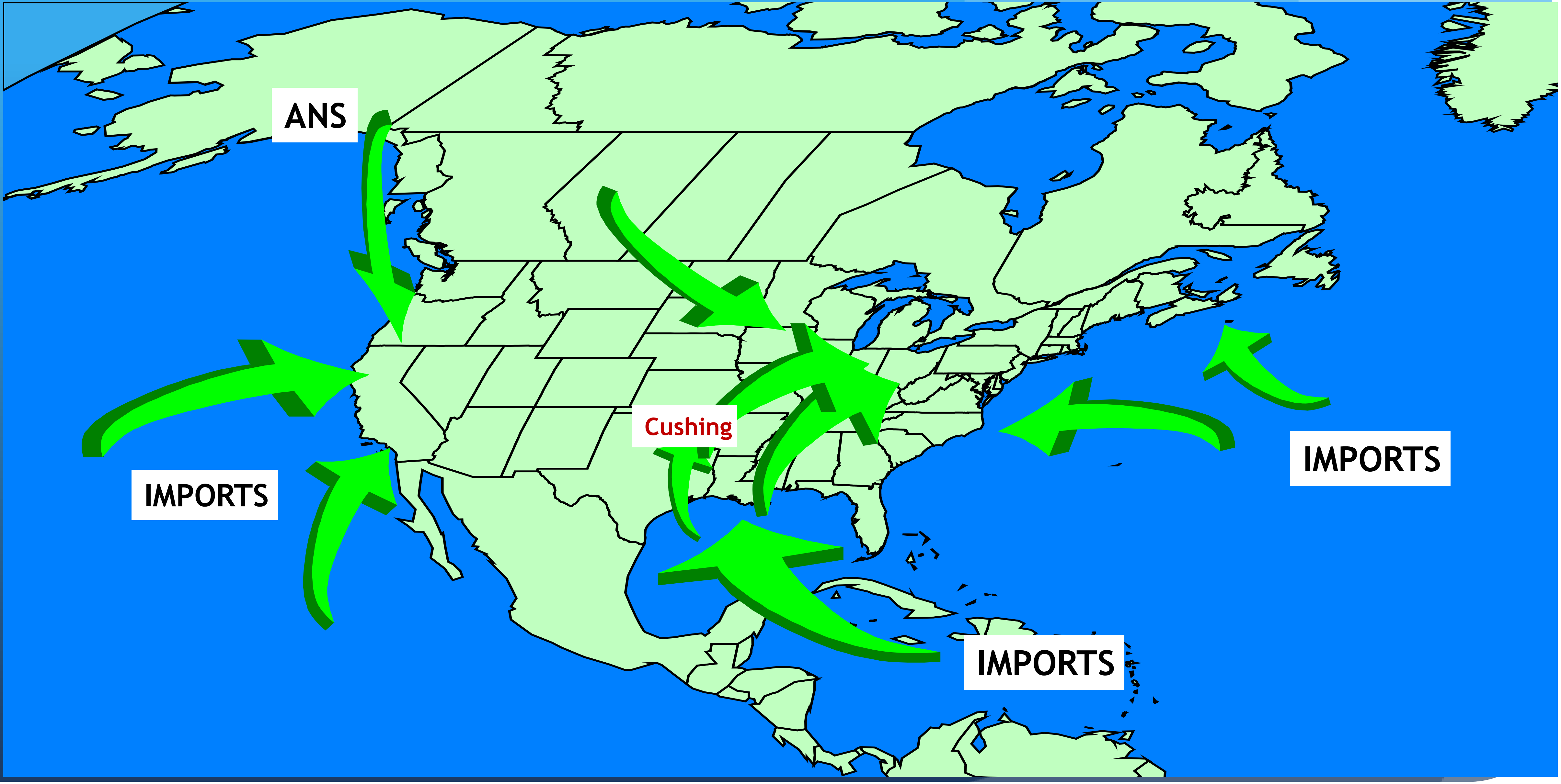
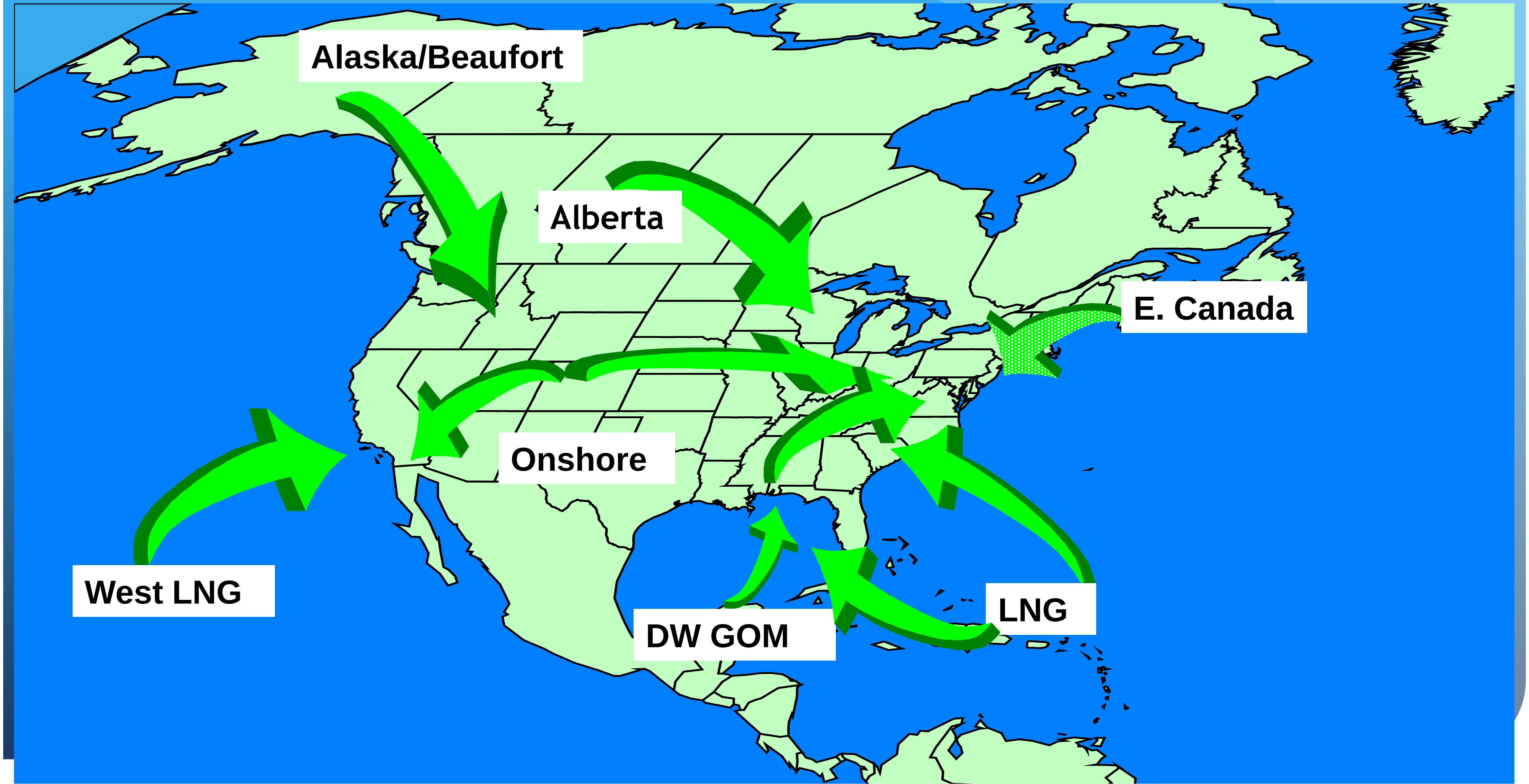
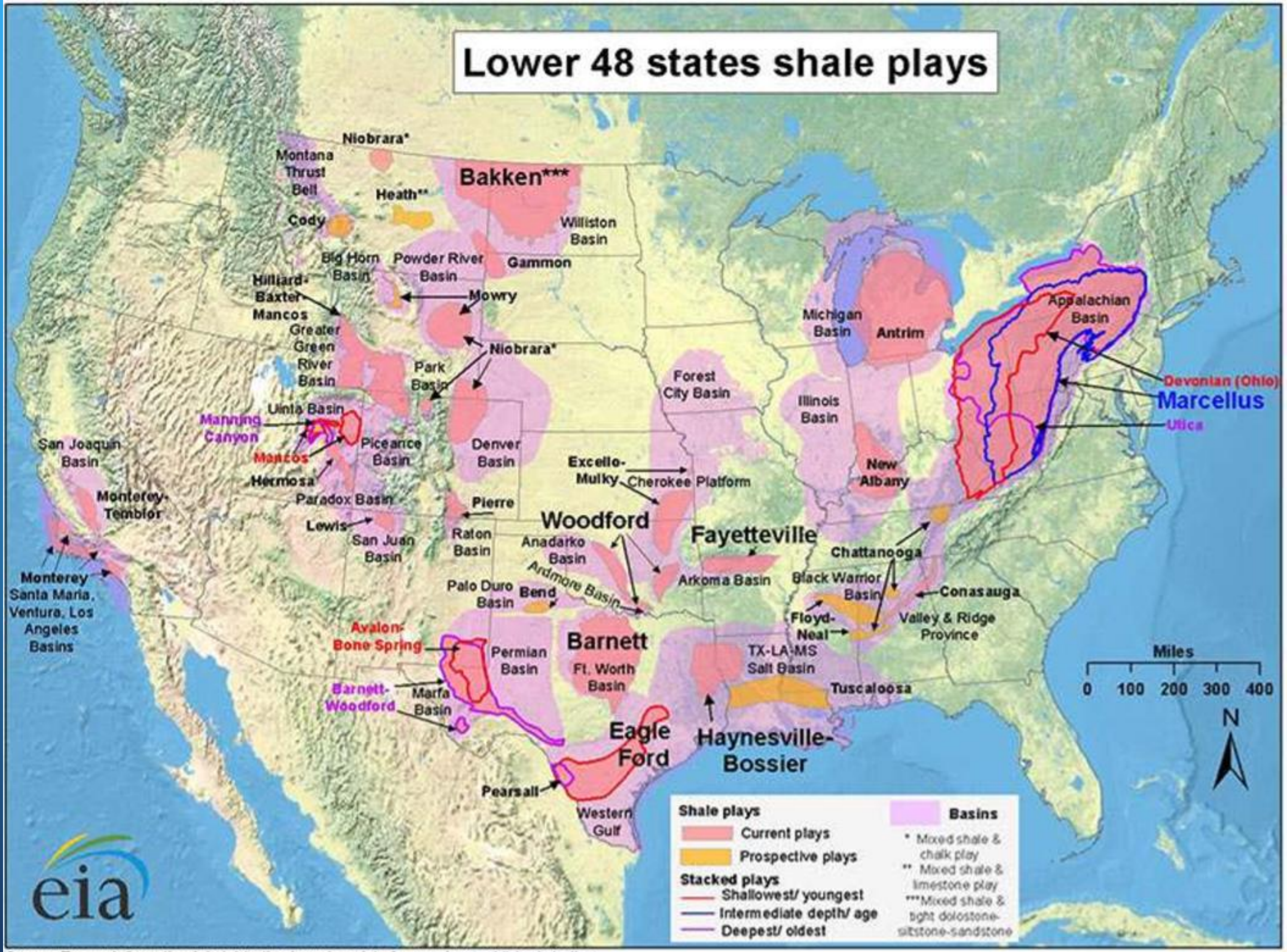
NA Crude Supply Solutions circa 2005



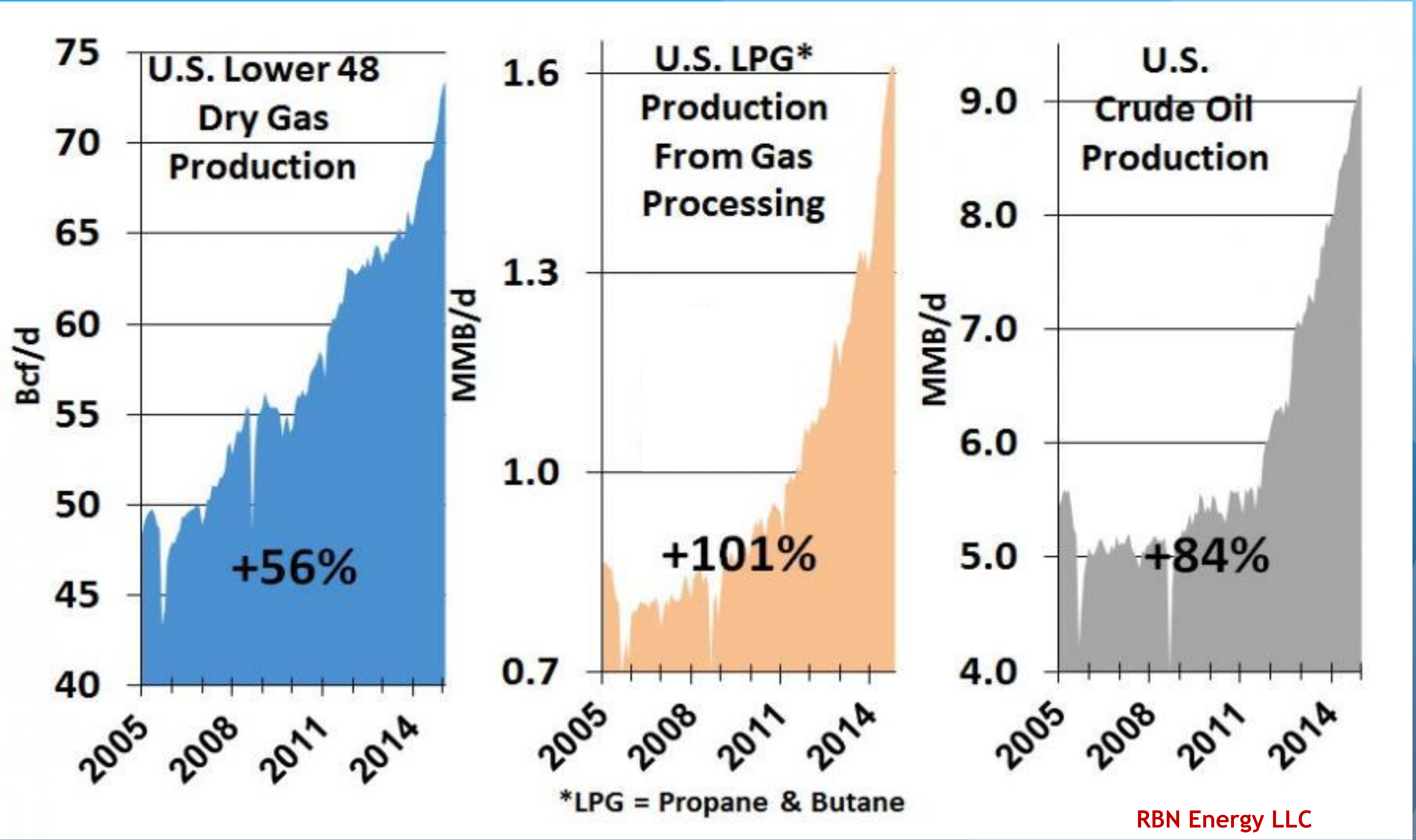
NA Nat Gas Supply Solutions circa 2005

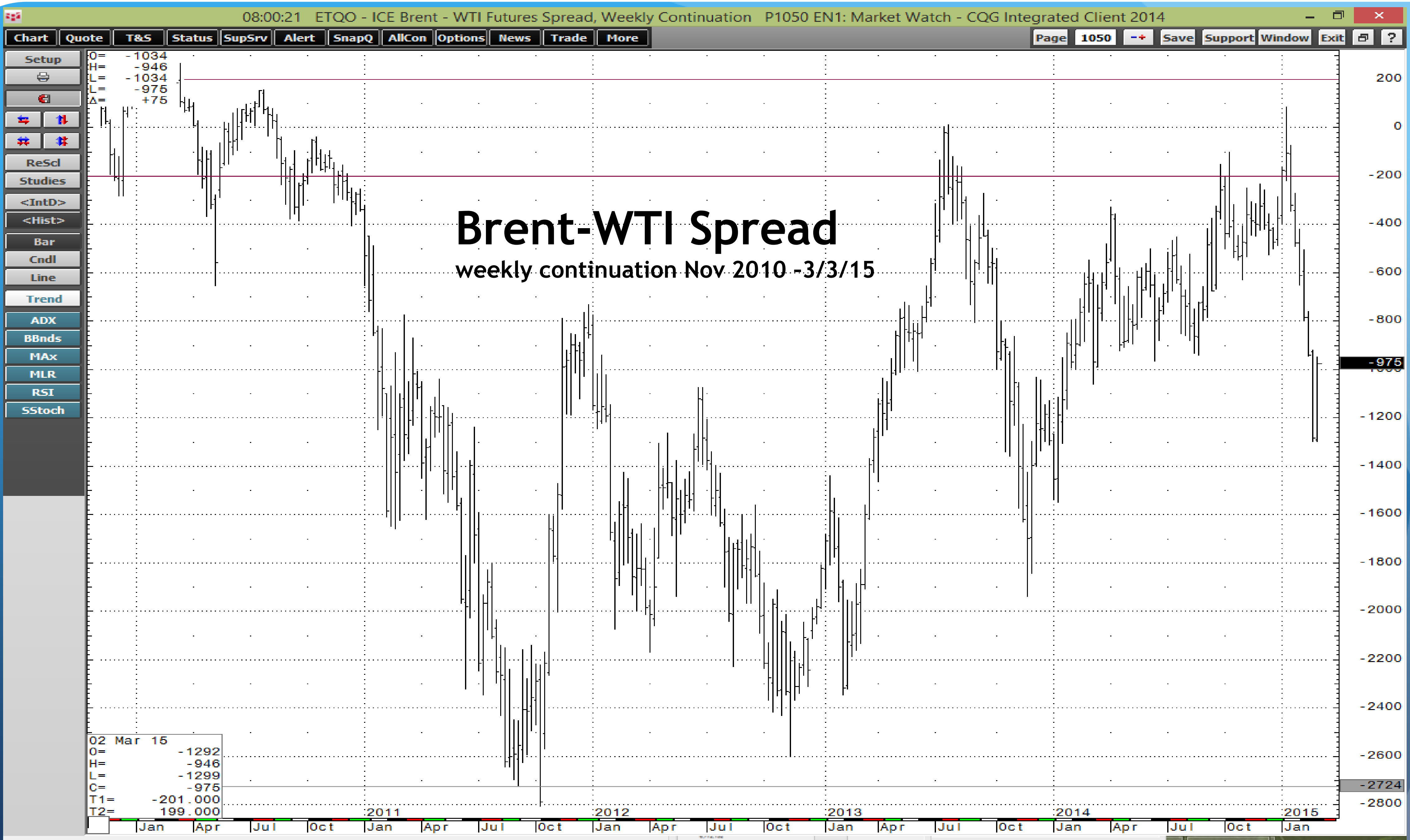


The Game Changer: Shale



Source: Energy Information Administration based on data from various published studies.
Updated: May 9, 2011


U.S. Lower 48
Dry Gas
Production
Bcf/d
75
70
65
60
55
50
45
40
+56%
2005
2008
2011
2014
U.S. LPG*
Production
From Gas
Processing
MMB/d
1.6
1.3
1.0
0.7
+101%
2005
2008
2011
2014
*LPG = Propane & Butane
U.S.
Crude Oil
Production
MMB/d
9.0
8.0
7.0
6.0
5.0
4.0
+84%
2005
2008
2011
2014
RBN Energy LLC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Studies
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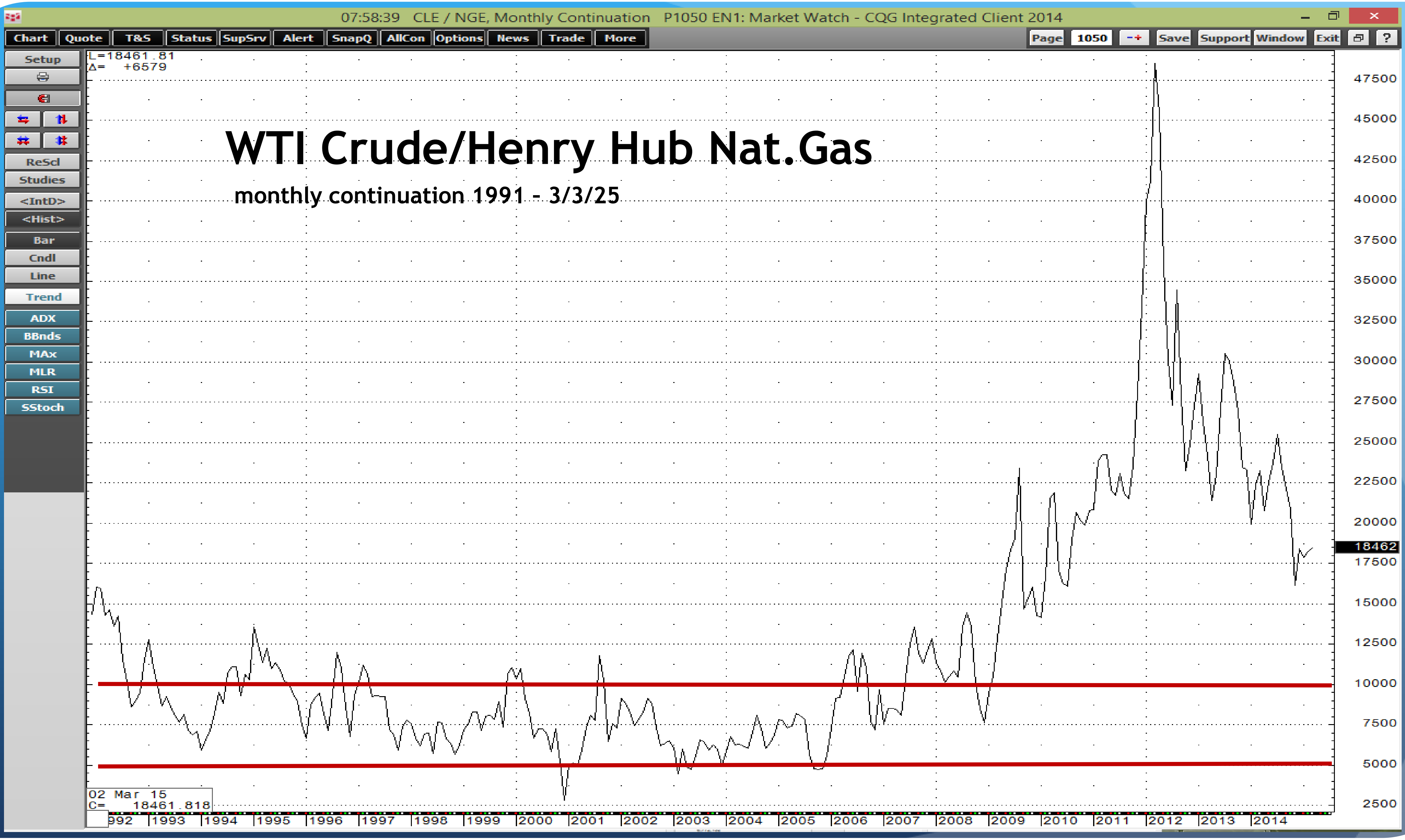
Bar
Cndl
Line
Trend
ADX
BBnds
MAx
MLR
RSI
SStoch
O= -1034
H= -946
L= -1034
L= -975
Δ= +75
Brent-WTI Spread
weekly continuation Nov 2010 -3/3/15
02 Mar 15
O= -1292
H= -946
L= -1299
C= -975
T1= -201.000
T2= 199.000
200
0
-200
-400
-600
-800
-975
-1200
-1400
-1600
-1800
-2000
-2200
-2400
-2600
-2724
-2800
2011
2012
2013
2014
2015
Jan Apr Jul Oct Jan Apr Jul Oct Jan Apr Jul Oct Jan Apr Jul Oct Jan Apr Jul Oct Jan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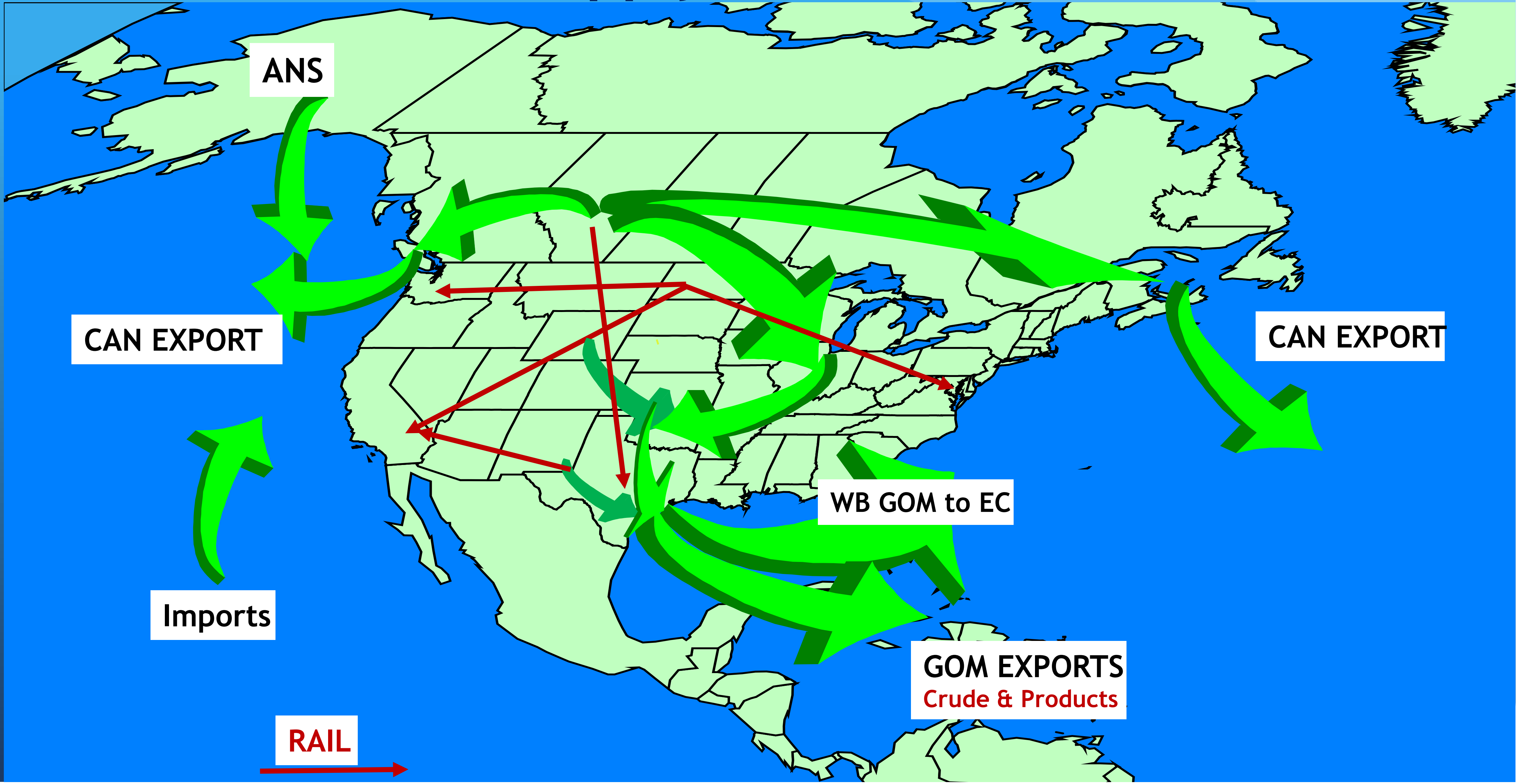
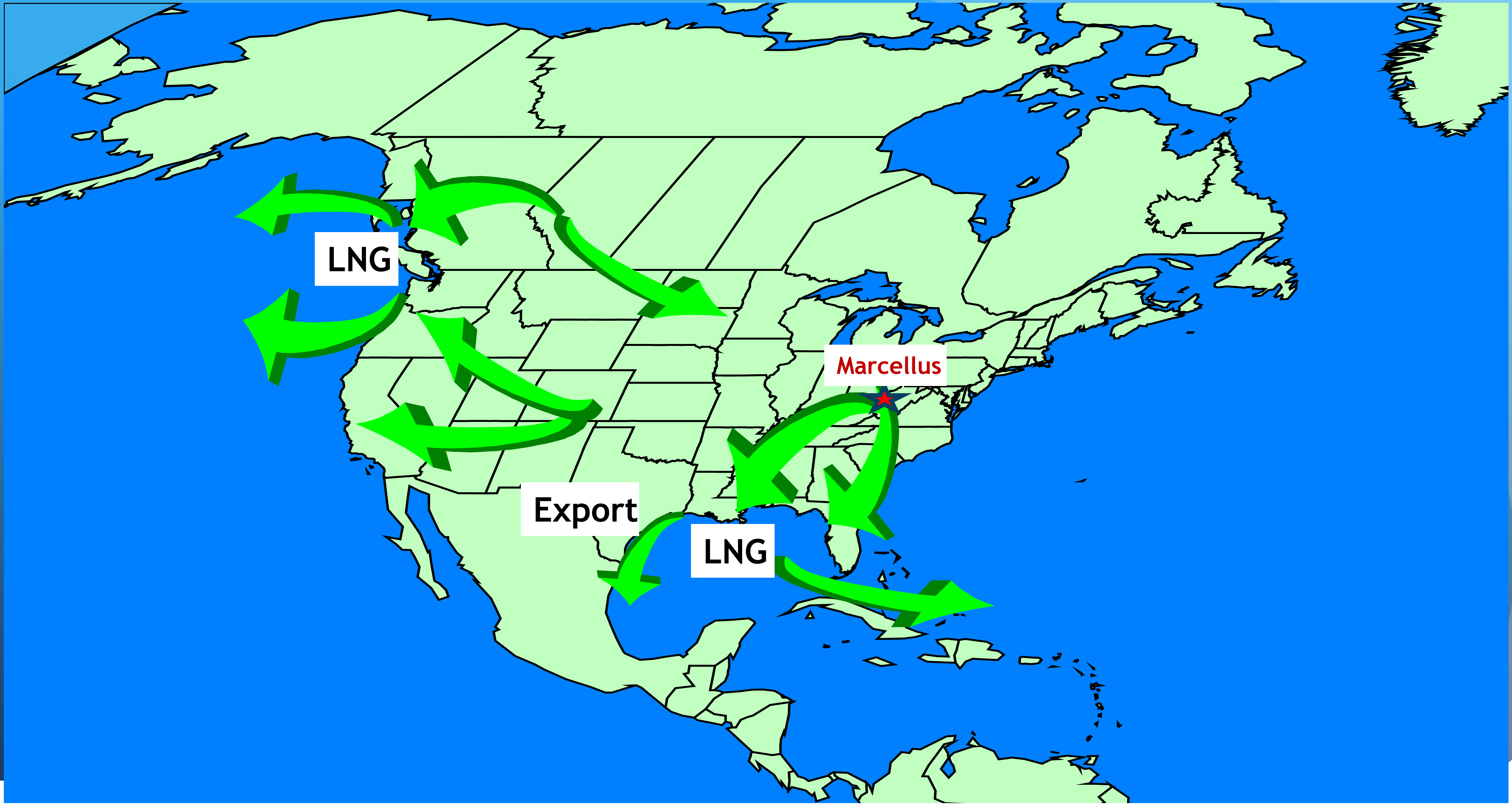
Bar
Cndl
Line
Trend
ADX
BBnds
MAx
MLR
RSI
SStoch
L=18461.81
Δ= +6579
WTI Crude/Henry Hub Nat.Gas
monthly continuation 1991 - 3/3/25
47500
45000
42500
40000
37500
35000
32500
30000
27500
25000
22500
20000
18462
17500
15000
12500
10000
7500
5000
2500
02 Mar 15
C= 18461.818
992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014

NA Crude Supply Solutions circa 2015



NA Nat Gas Supply Solutions circa 2015



Hydrocarbon Infrastructure

- Transportation to Domestic Market
- Transformation from Natural State
- Export Facilities

Transport to Market

highest to lowest cost per unit

- Truck
- Rail
- Inland Barge
- Pipeline
- Ocean Freight

Transformation from Natural State

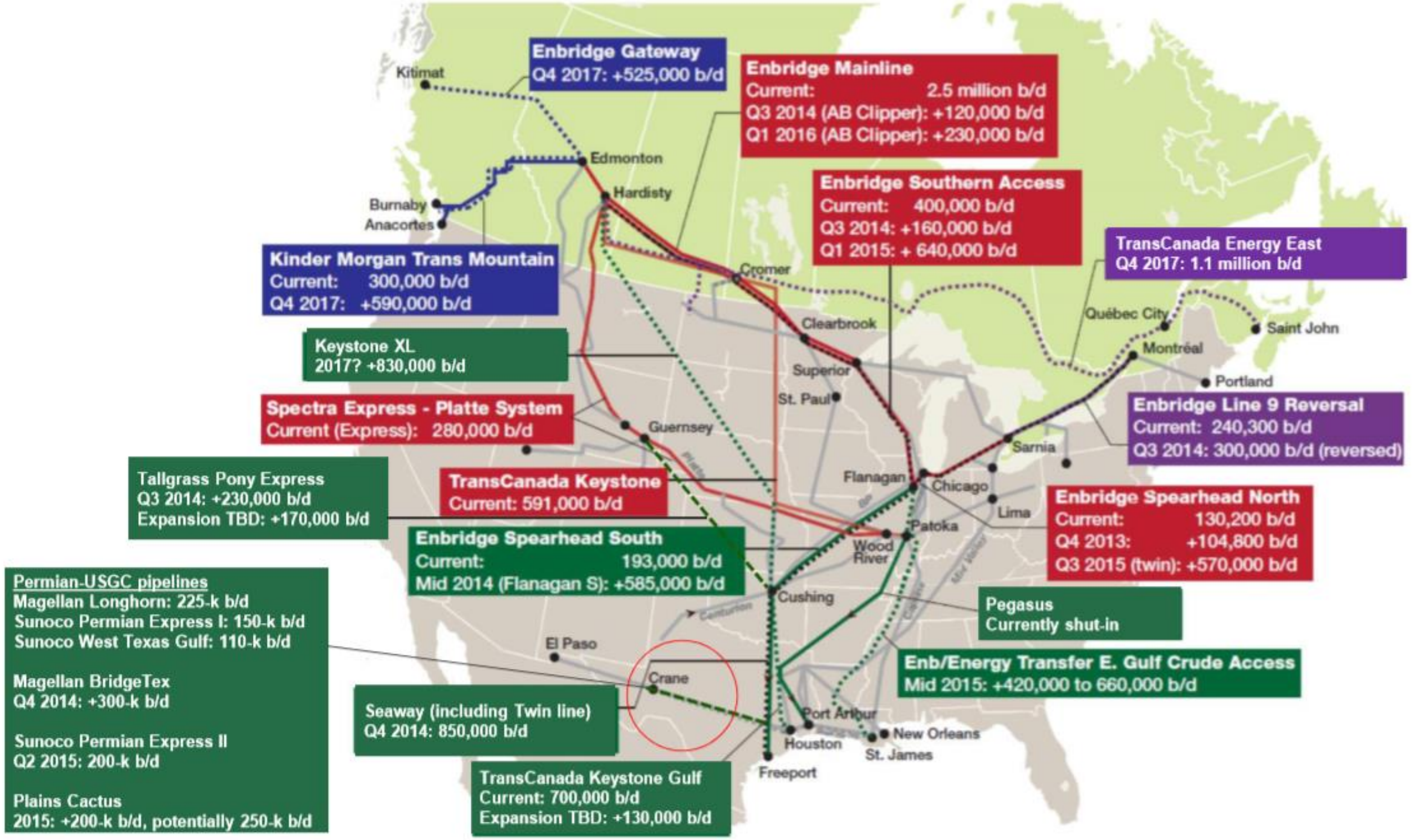
- Gas Processing Plants (NGLs)
- NGLs Splitters
- Distillation of Condensate/Crude pre Refinery
- Refining to Intermediate Products
- Refining to Finished Products
- Gas to Liquids (LNG, Chemical, Fuel)

Impediments to Infrastructure Development

- Environmental
- Public Perception
- Regulatory
- Economic
- Business Models

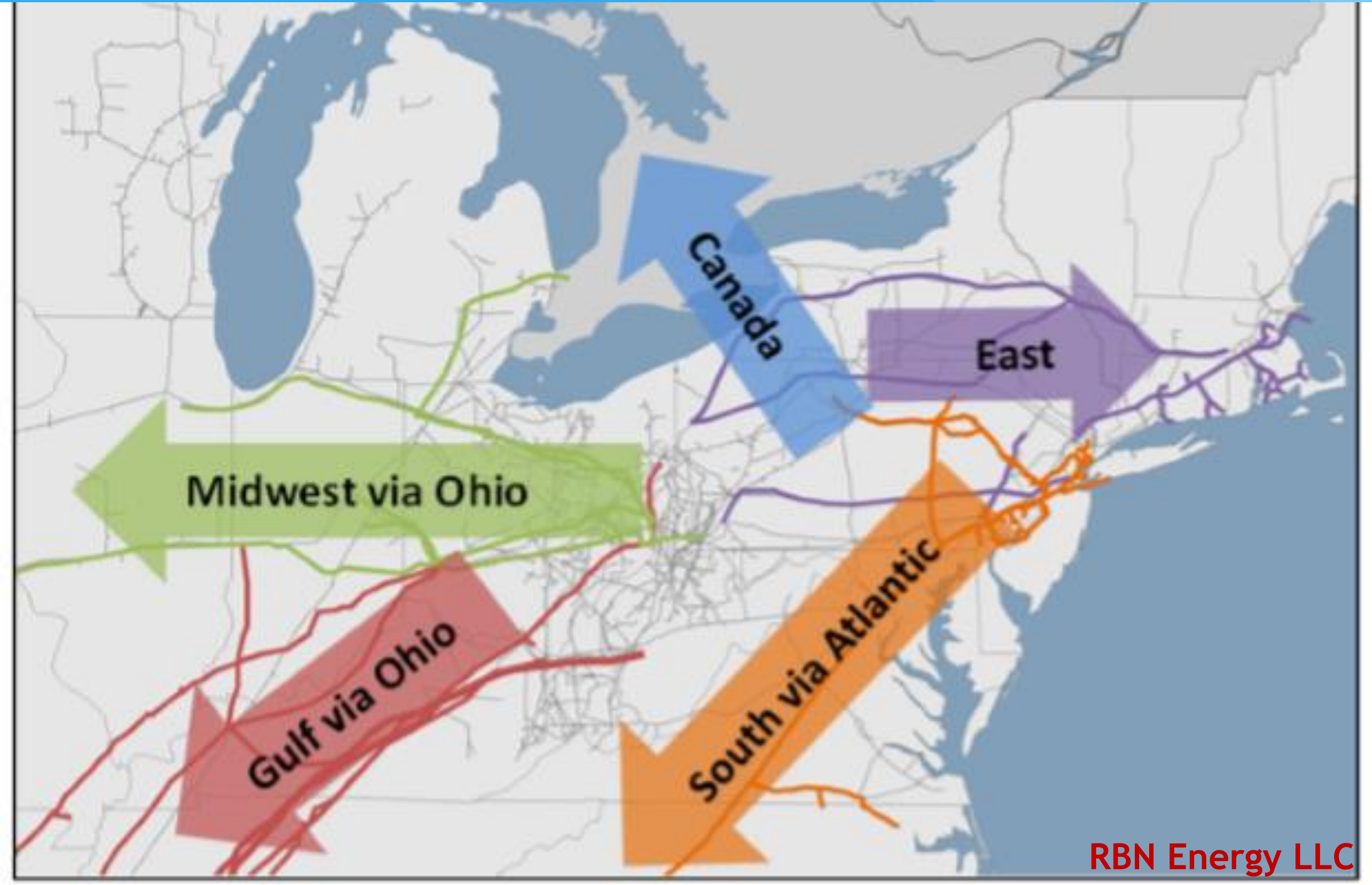
Pipeline build-out brings more inland crude to the Gulf Coast

…and also eastern Canada via Line 9. The Flanagan South and Seaway Twin pipelines started in December 2014. The Alberta Clipper expansion (part of the Enbridge Mainline) is being held-up by US politics.



Citi

Marcellus/Utica Pipeline Market Areas



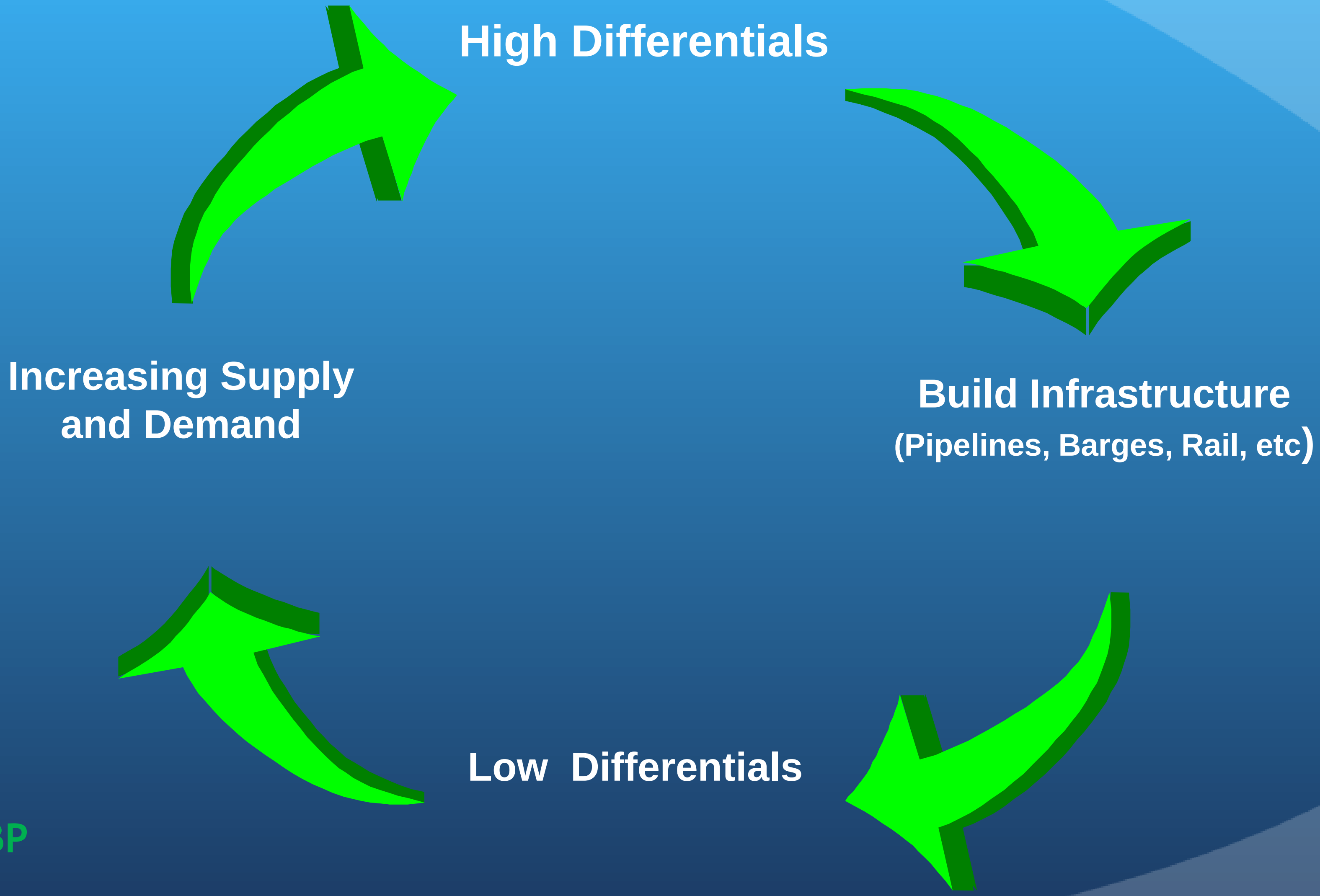
Pipelines to Market

South via Atlantic Total	7.725 bcf/d
Canada Total	1.178 bcf/d
East Total	5.802 bcf/d
Midwest via Ohio Total	5.255 bcf/d
Gulf via Ohio Total	8.226 bcf/d

Grand Total 28.186 bcf/d

Corridor	Date	Company	Project	MMcf/d
South via Atlantic	2015	Transco	Leidy SE	525
	2017	Transco	Atlantic Sunrise	1,700
	2018	DTI	Atlantic Coast	1,500
	2018	EQT	Mountain Valley	1,500
	2018	Transco	Western Marcellus Pipeline	1,750
	2018	Transco	Diamond East	750
South via Atlantic Total				**7,725**
Canada	2014	TGP	Rose Lake	230
	2015	NFG	Northern Access 2015	140
	2015	TGP	Niagara Exp	158
	2016	Iroquois	SoNo	300
	2016	NFG	Northern Access 2016	350
Canada Total				**1,178**
East	2014	TETCO	TEAM 2014	600
	2014	Williams	NE Comp Connector	100
	2015	TCO	East Side Exp	310
	2016	Algonquin	AIM	342
	2016	Williams	Constitution	650
	2017	AGT & MNE	Atlantic Bridge	400
	2018	TETCO	A2M	1,000
	2018	TGP	NE Energy Direct	1,400
	2018	Algonquin	Access Northeast	1,000
East Total				**5,802**
Midwest via Ohio	2014	REX	Backhaul	200
	2014	ANR	Lebanon	350
	2015	TETCO	U2GC	425
	2016	DTI	Lebanon West II	130
	2016	REX	Backhaul	1,200
	2017	ETP	Rover *	2,750
	2017	TETCO	Adair Southwest	200
Midwest via Ohio Total				**5,255**
Gulf via Ohio	2014	CGT	West Side Expansion	540
	2014	TETCO	TEAM South	300
	2014	TGP	Utica Backhaul Transportation	500
	2014	ANR	ANR East/SE ML Reversal, Ph. 1	1,250
	2015	TETCO	OPEN Project	550
	2015	TGP	Broad Run Flexibility Project	590
	2015	ANR	ANR East/SE ML Reversal, Ph. 2	750
	2016	CGT	Leach Xpress	1,500
	2016	TETCO	Gulf Markets Ph. 1	250
	2016	TGT	Northern Supply Access	626
	2017	TETCO	Access South	320
	2017	TETCO	Gulf Markets Ph 2	400
	2017	TGP	SW Louisiana Supply Project	450
	2017	TGP	Broad Run Expansion Project	200
Gulf via Ohio Total				**8,226**
Grand Total				**28,186**

Market Cycles



Kevin Bass, BP
2001