



BERNSTEIN

November 2015

Climate Change and Oil & Gas Industry

How Do We Bridge To A Low-Carbon Future?

Oswald Clint, Ph.D., ACA • Senior Analyst • +44-207-170-5089 • oswald.clint@bernstein.com

Teng Ben, CFA • Associate • +44-207-170-0589 • teng.ben@bernstein.com

Ruth Garratt • Associate • +44-207-170-0564 • ruth.garratt@bernstein.com

See Disclosure Appendix of this report for important Disclosures and Analyst Certifications

Agenda

- + **Climate Change Policies – The Single Greatest Threat To The Oil & Gas Industry**
 - + Is This 2°C Limit Really Achievable?
 - + Oil & Gas Emissions Lifecycle
- + **Gas – Low Carbon Bridge to the Future or Road to Ruin?**
 - + Why Other Energy Sources Are Not Competitive Enough?
 - + The Shift To Natural Gas
- + **Implications For The Oil & Gas Industry**
 - + Myths And Realities of Stranded Carbon
 - + Countries/Companies At Risk
 - + Majors' Response To Climate Change
- + **Conclusion**
- + **Appendix**

Agenda

- + **Climate Change Policies – The Single Greatest Threat To The Oil & Gas Industry**
 - + Is This 2°C Limit Really Achievable?
 - + Oil & Gas Emissions Lifecycle

- + Gas – Low Carbon Bridge to the Future or Road to Ruin?
 - + Why Other Energy Sources Are Not Competitive Enough?
 - + The Shift To Natural Gas

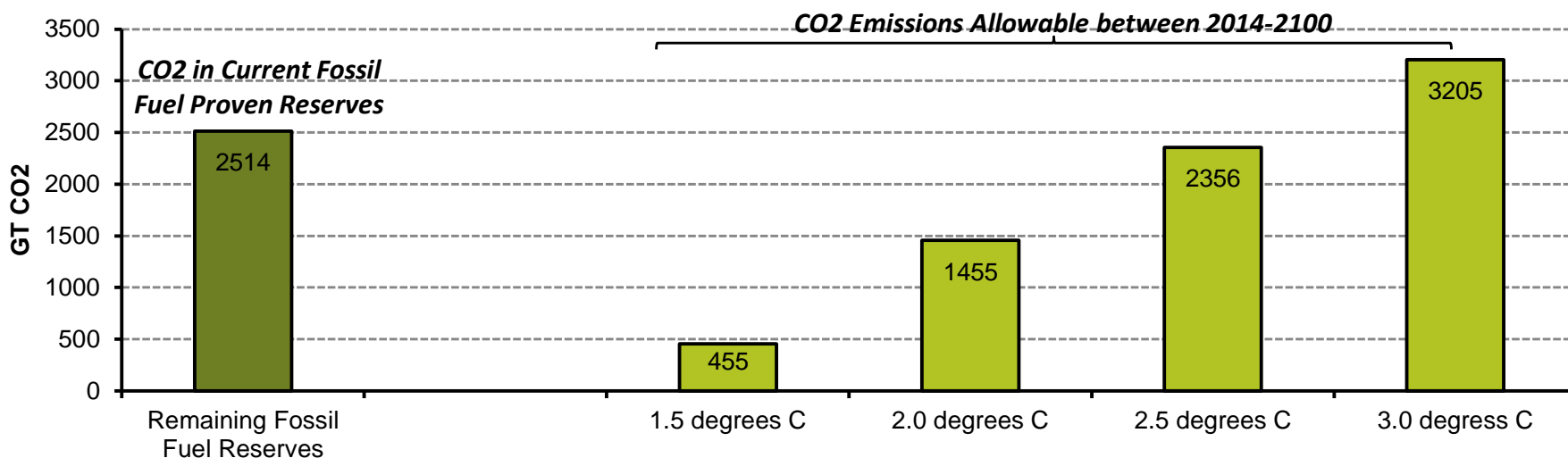
- + Implications For The Oil & Gas Industry
 - + Myths And Realities of Stranded Carbon
 - + Countries/Companies At Risk
 - + Majors' Response To Climate Change

- + Conclusion

- + Appendix

Cumulative Carbon Emissions Allowed Under Various Scenarios

50% Probability of Maximum Temperature Rise Degrees Celcius	Gigatonnes Carbon Dioxide				
	<u>GT CO2</u> Pre-Industry-2014	<u>GT CO2</u> 2014-2049	<u>GT CO2</u> 2050-2100	<u>GT CO2</u> Total 2014-2100	<u>GT CO2</u> Pre-Industry-2100
1.5	1980	430	25	455	2435
2.0	1980	980	475	1455	3435
2.5	1980	1180	1176	2356	4336
3.0	1980	1330	1875	3205	5185



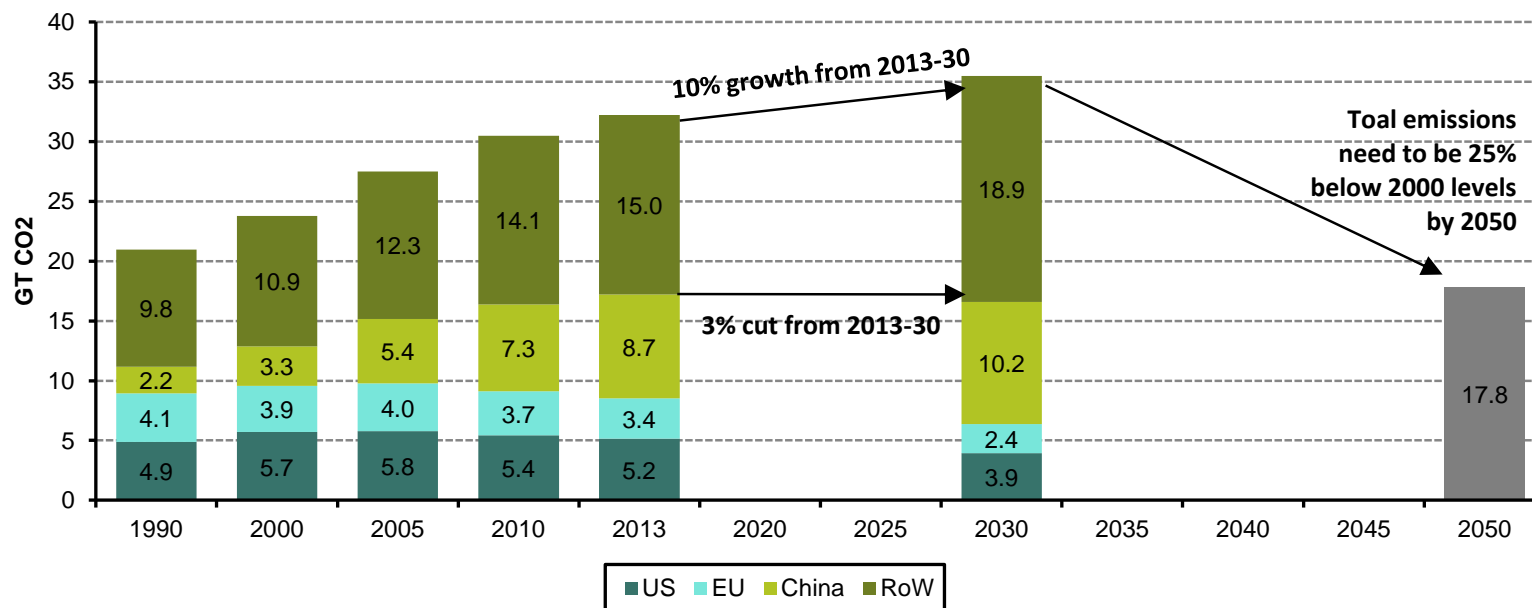
Source: Meinshausen et. Al (Nature), Bernstein Estimates

Is This 2°C Limit Really Achievable? Not Without An Accelerated Shift In The Energy Mix

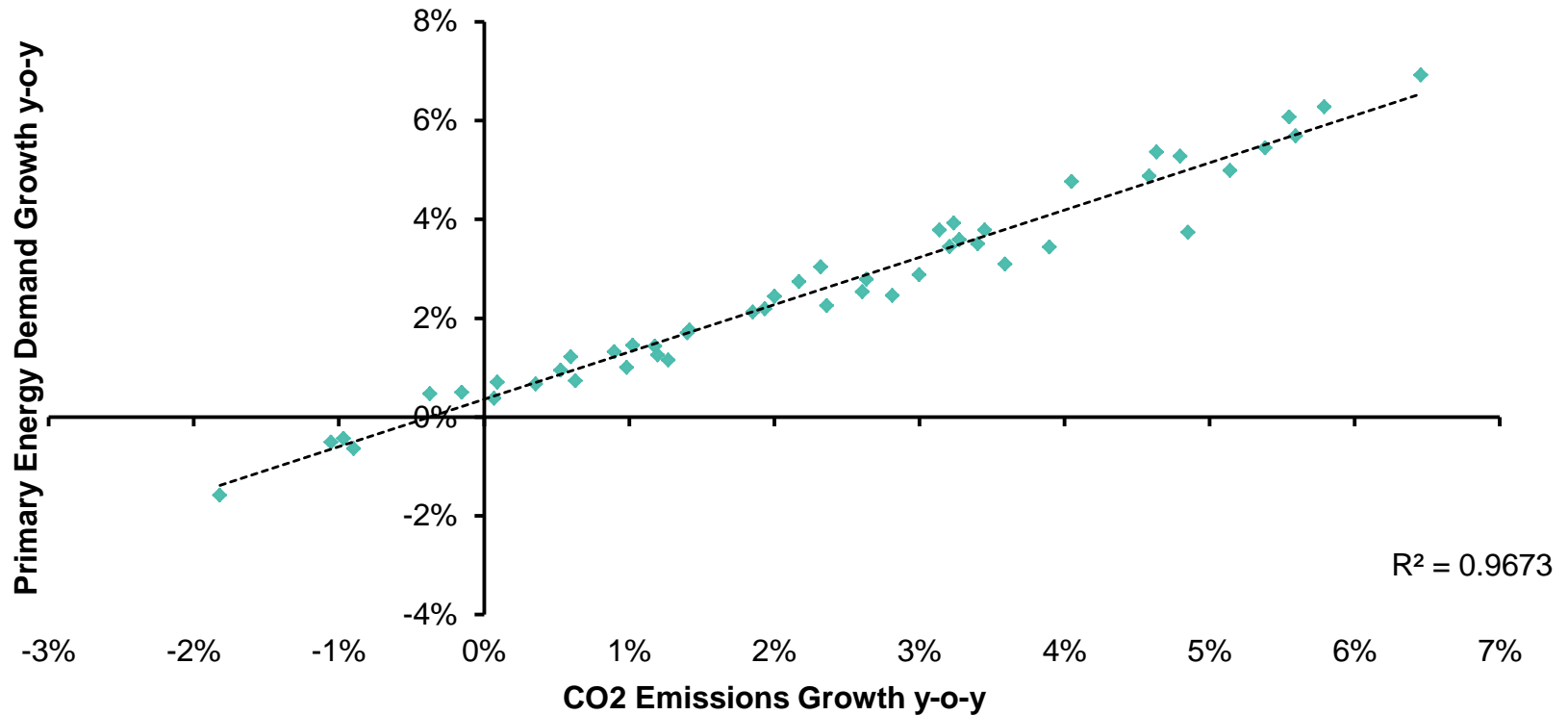
Combined Cuts Announced By the US, China and EU – Only Result in Flat Emissions to 2030

Country	GT CO2 Emissions Per Year						Delta From 13'	Commitment
	1990	2000	2005	2010	2013	2030		
US	4.9	5.7	5.8	5.4	5.2	3.9	-1.2	32% reduction from 2005 levels by 2030
EU	4.1	3.9	4.0	3.7	3.4	2.4	-0.9	40% reduction from 1990 levels by 2030
China	2.2	3.3	5.4	7.3	8.7	10.2	1.5	Carbon emissions to peak in 2030
<i>Sub-Total</i>	11.2	12.9	15.2	16.4	17.2	16.6	-0.6	Aggregated Cut of 0.6GT or 3% from 2013 levels
<i>RoW</i>	9.8	10.9	12.3	14.1	15.0	18.9	3.9	Current Policies WEO 2014 Estimate
World	21.0	23.8	27.5	30.5	32.2	35.5	3.3	Emissions 10% higher by 2030 from 2013

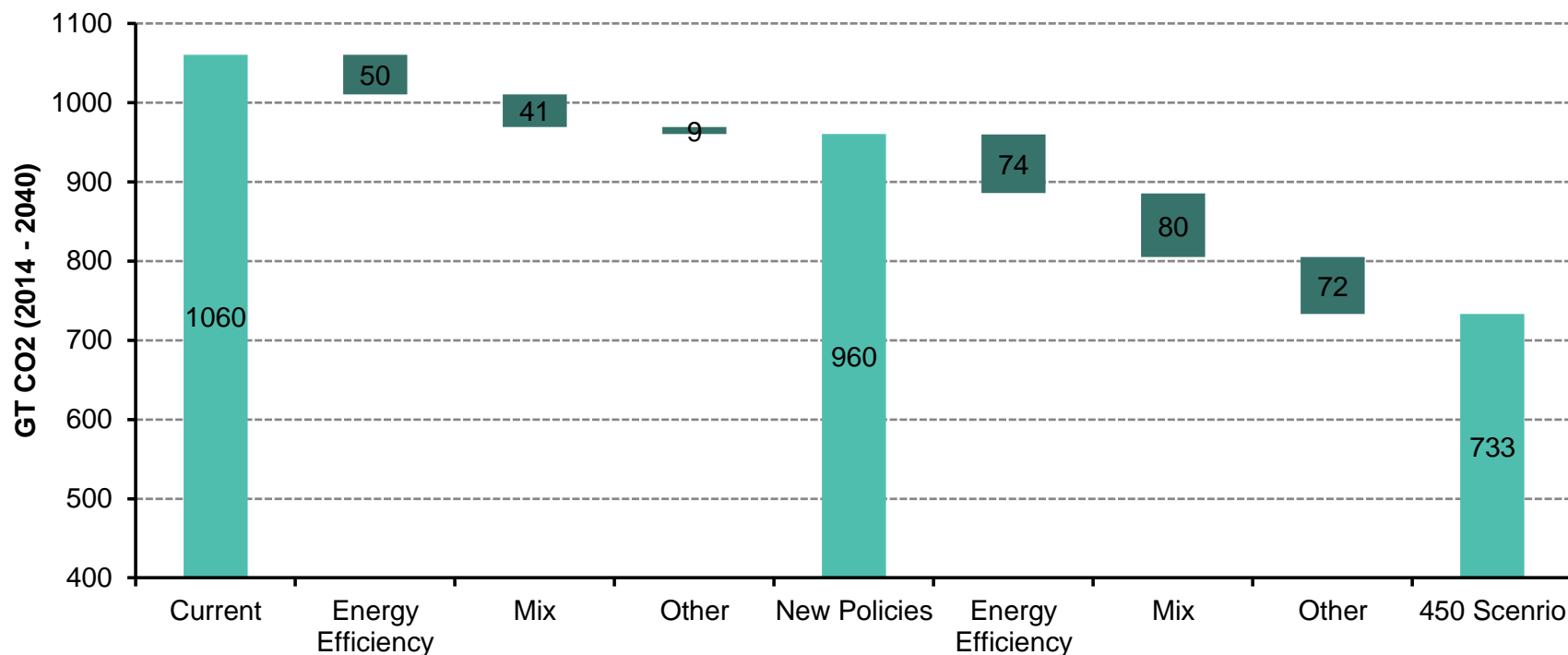
Carbon Emissions Will Continue to Grow to 2030. Then They Need to Be 25% Below 2000 Levels To Achieve The 2°C Limit



Global CO2 Emissions Are Highly Correlated With Primary Energy Demand Growth

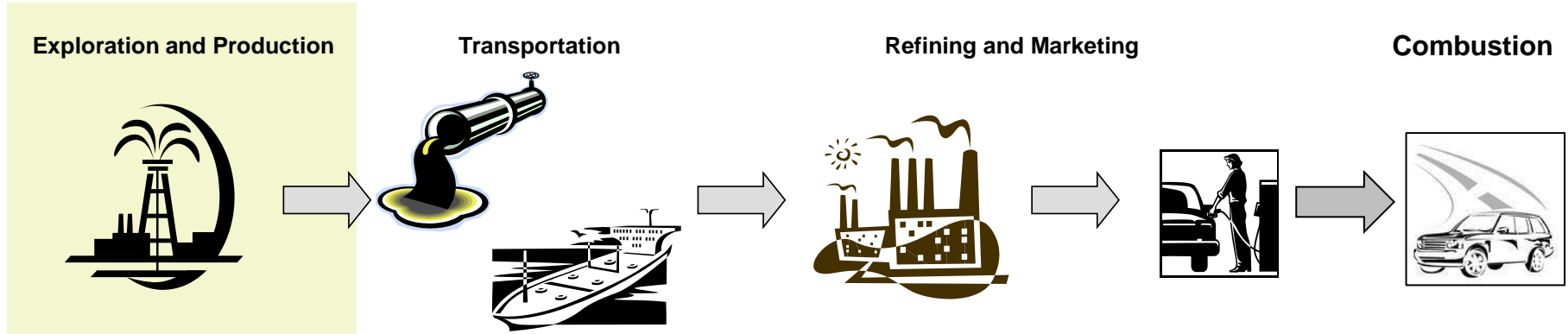


Without Sacrificing Global GDP Growth, 3 Factors Will Drive Lower Carbon Emissions



Note: Other Factors are such as carbon capture and storage
Source: IEA, Bernstein analysis

Oil: Well - To - Wheel Carbon Emission Life Cycle

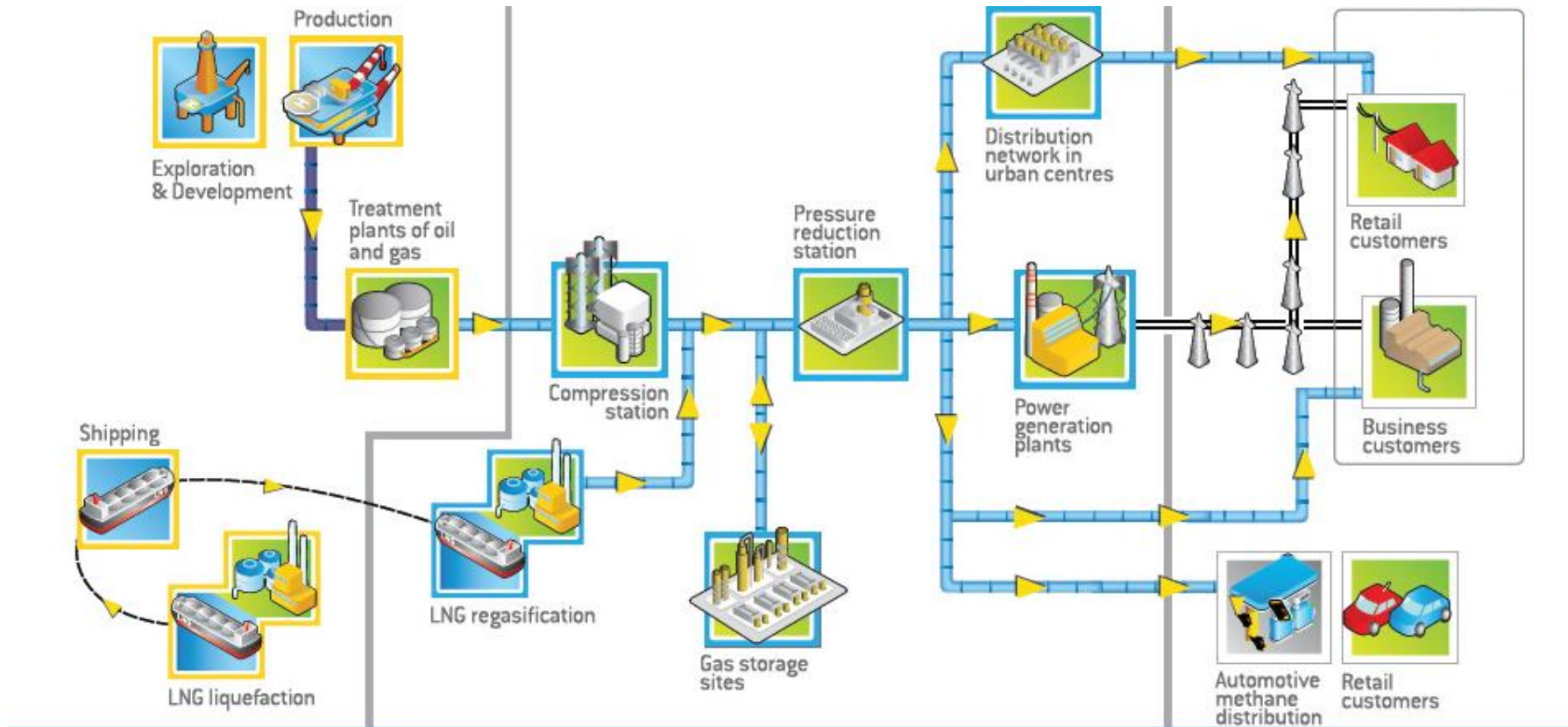


Well – To – Tank (WTT): 20-30% Emission

Well – To – Wheel (WTW): 70-80% Emission

Source: CRS, Wikimedia Commons

Gas: Emission Life Cycle – More Complicated With The Consideration of Methane



Gas Production & Processing

- CO₂ Emission: 29%
- Methane Emission: 65%

Gas Transmission

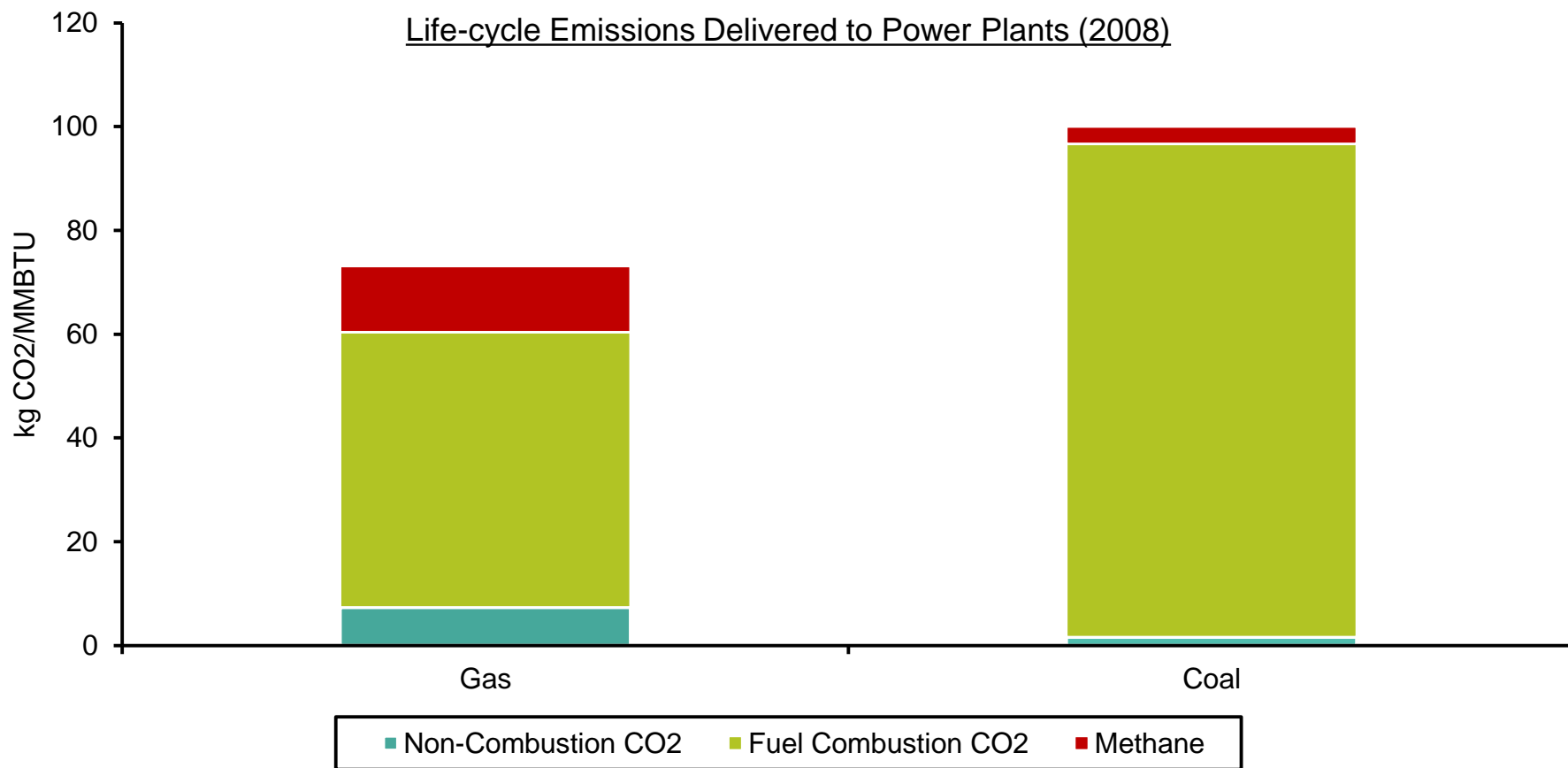
- CO₂ Emission: 46%
- Methane Emission: 54%

Gas Distribution

- Methane Emission: 100%

Source: Company reports, Wikimedia Commons, EPA

Normalised Total Life-cycle GHG Emissions Suggest Gas Is Still Cleaner Than Coal



Source: EPA, Bernstein analysis

Agenda

- + **Climate Change Policies – The Single Greatest Threat to the Oil & Gas Industry**
 - + Is This 2°C Limit Really Achievable?
 - + Oil & Gas Emissions Lifecycle

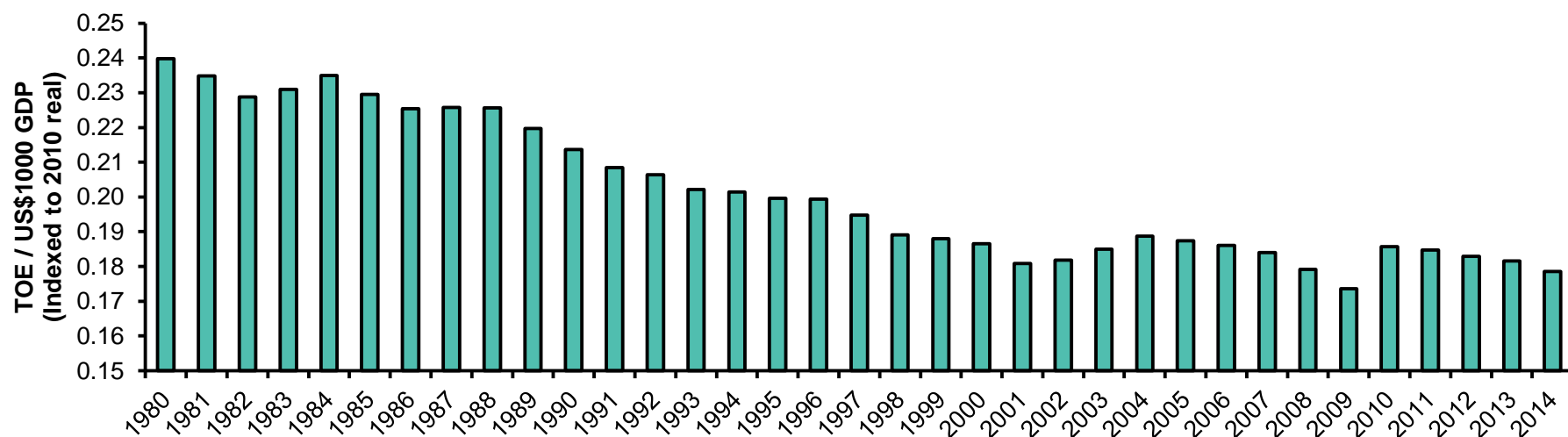
- + **Gas – Low Carbon Bridge to the Future or Road to Ruin?**
 - + Why Other Energy Sources Are Not Competitive Enough?
 - + The Shift To Natural Gas

- + **Implications For The Oil & Gas Industry**
 - + Myths And Realities of Stranded Carbon
 - + Countries/Companies At Risk
 - + Majors' Response To Climate Change

- + **Conclusion**

- + **Appendix**

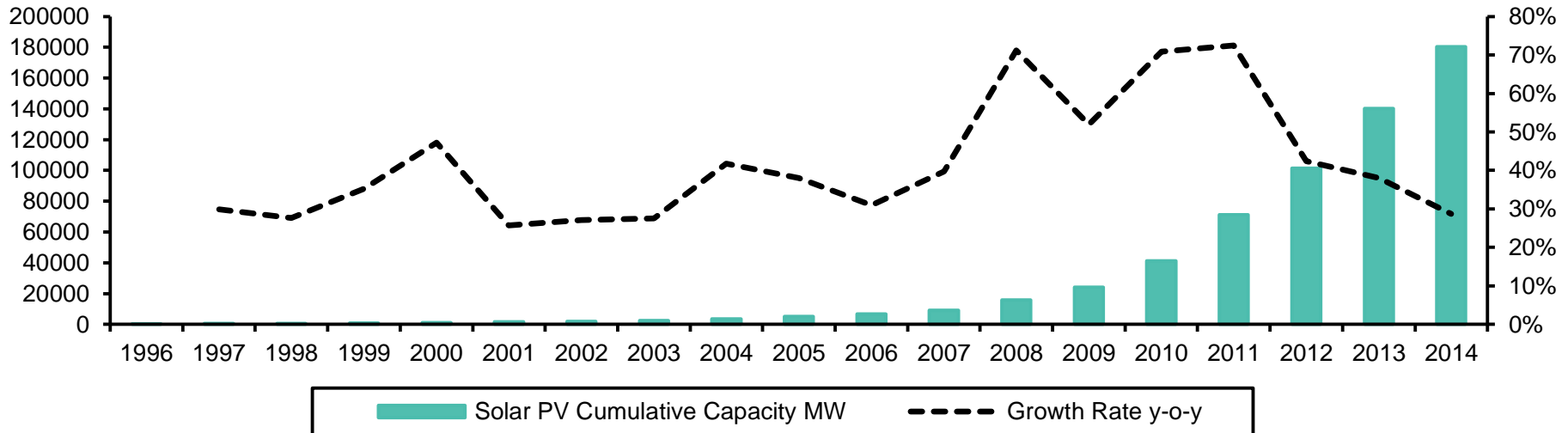
Energy Efficiency: Continues To Improve Albeit More Modestly Than In the 1990s



Source: BP Statistical Review, Bernstein analysis

Other Alternative Energy Sources: Economics Still Are Not There

Solar: Impressive Growth But Slowed As Subsidies Are Removed

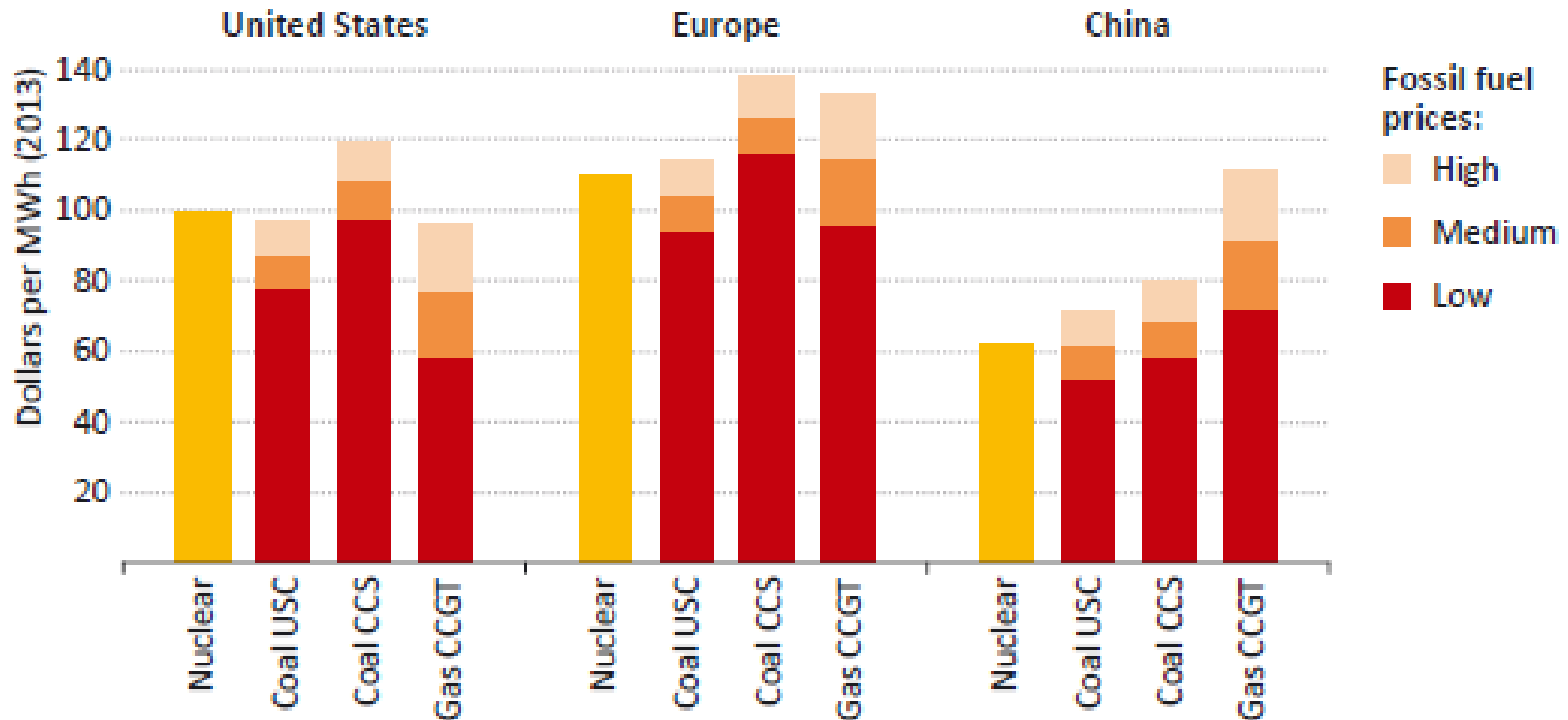


**An Off-grid
Solar System
Costs 10x The
Average Retail
Price of Grid
Electricity in
The US**

		Hybrid System (90% PV) with ITC and MACRS							
		Battery price (\$/kWh)							
		\$ 540	\$ 432	\$ 346	\$ 276	\$ 221	\$ 177	\$ 142	\$ 113
PV system price (\$/W-dc)	\$ 3.81	1.24	1.06	0.91	0.79	0.70	0.63	0.57	0.52
	\$ 3.05	1.19	1.01	0.86	0.75	0.66	0.58	0.52	0.48
	\$ 2.44	1.15	0.97	0.83	0.71	0.62	0.55	0.49	0.44
	\$ 1.95	1.12	0.94	0.80	0.68	0.59	0.52	0.46	0.41
	\$ 1.56	1.10	0.92	0.78	0.66	0.57	0.49	0.43	0.39
	\$ 1.25	1.08	0.90	0.76	0.64	0.55	0.47	0.41	0.37
	\$ 1.00	1.07	0.89	0.74	0.63	0.53	0.46	0.40	0.35
	\$ 0.80	1.06	0.87	0.73	0.61	0.52	0.45	0.39	0.34

Source: BP Statistical Review, Lawrence Berkeley National Laboratory, SEIA, Sandia National Laboratory, Masters, Gilbert M. *Renewable and Efficient Electric Power Systems*. Hoboken: John Wiley & Sons, 2004, Bernstein analysis

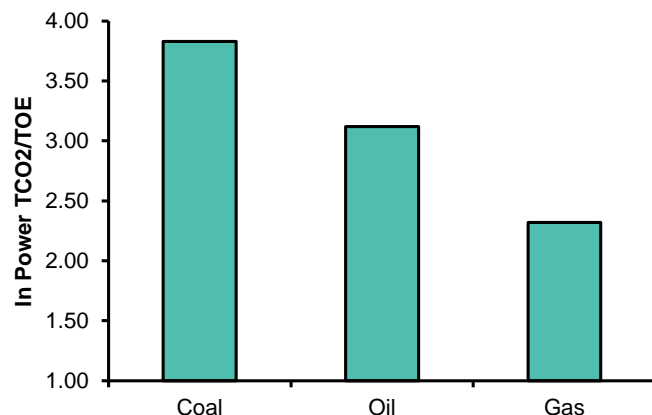
Nuclear: Only More Attractive In China



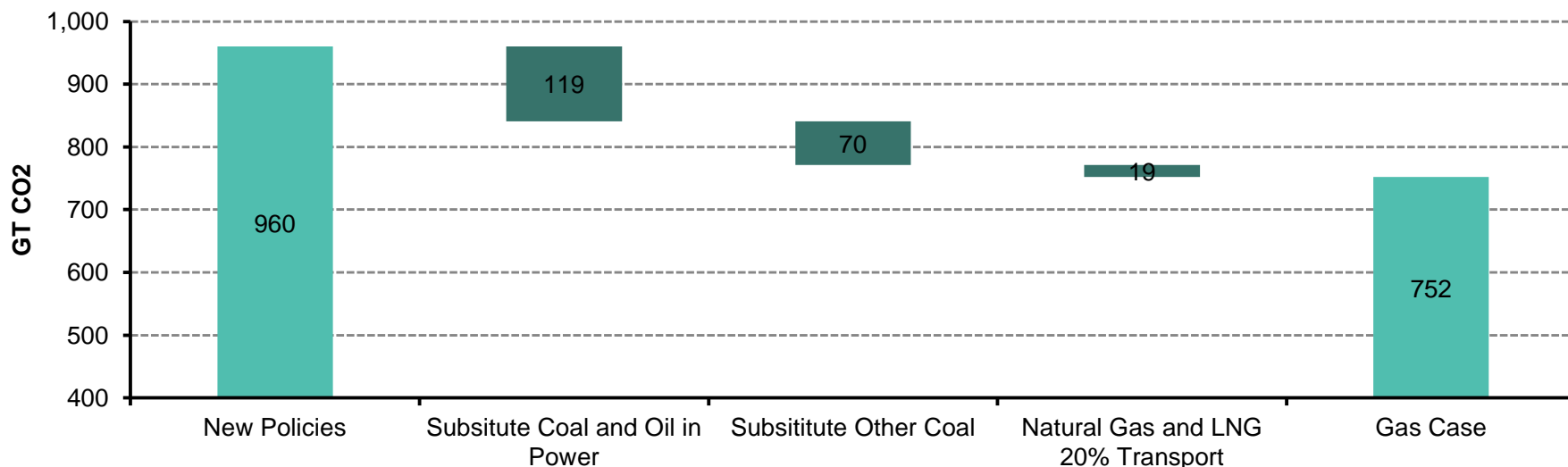
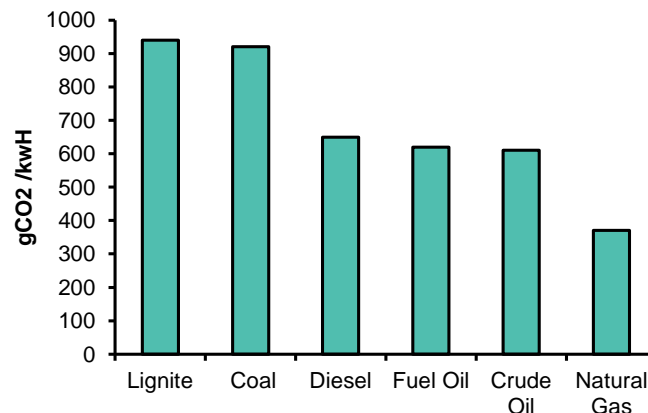
Source: IEA. Note For US Gas Prices Assumed are (High/Med/Low 10/7/4 \$/mmbtu). For Europe Gas Prices Assumed Are (High/Med/Low 15/12/9 \$/mmbtu) and for China Gas Prices Assumed Are (High/Med/Low 14/12/8 US\$/mmbtu). For US Coal Prices Assumed are (High/Med/Low 90/60/30 \$/ton). For Europe Coal Prices Assumed Are (High/Med/Low 140/110/80 \$/ton) and for China Coal Prices Assumed Are (High/Med/Low 120/90/60).

Replacing Coal With Gas In Power And Other, And 20% Of Oil In Transport Would Be One Pathway To Lower CO2 Emissions

Carbon Intensity Of Fossil Fuels From Overall Use



Carbon Intensity Of Coal Is 2x – 3x Of Gas In Electricity Generation



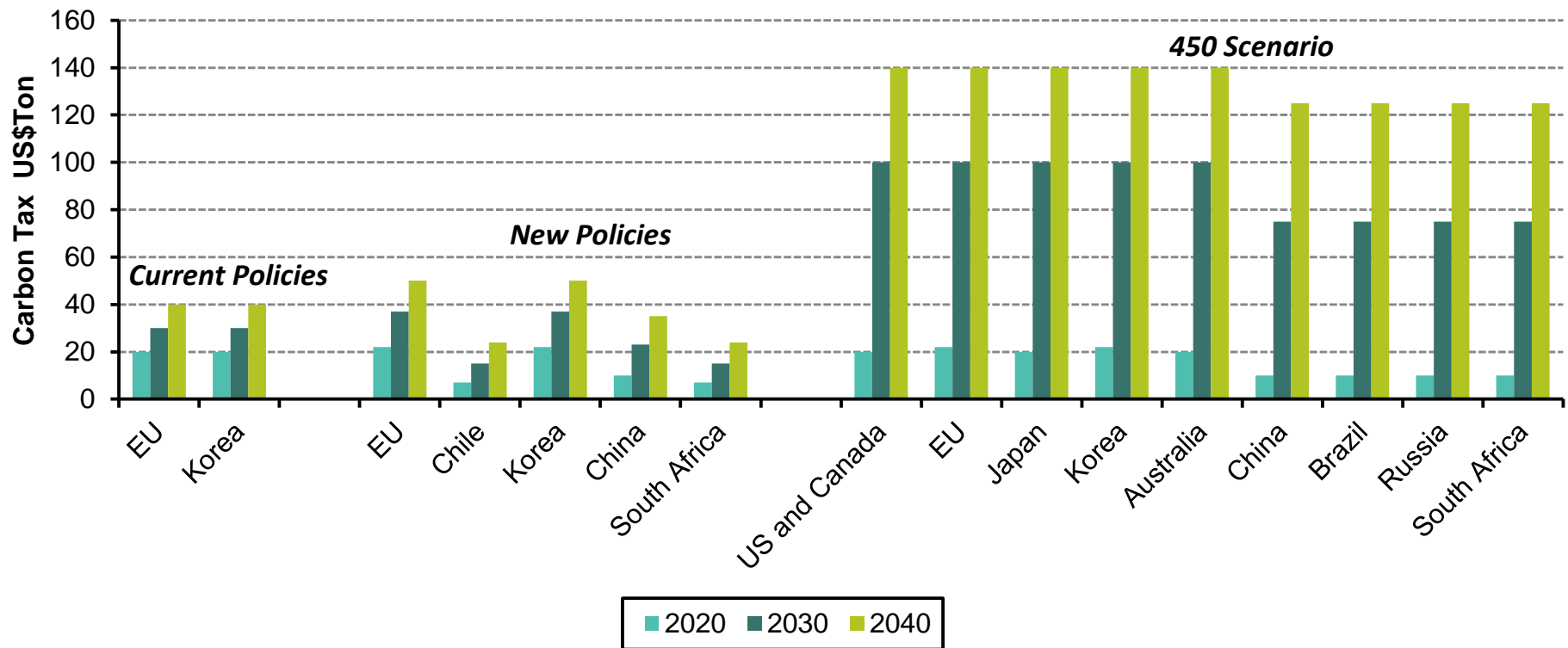
Source: IEA, Bernstein analysis

Implied Carbon Tax For Gas To Be Competitive With Coal

<u>Gas Price</u> \$/mmbtu	<u>Carbon Tax US\$/ton</u>								
	20	40	60	80	100	120	130	140	150
2	3.2	4.3	5.5	6.6	7.8	8.9	9.5	10.1	10.6
3	4.2	5.3	6.5	7.6	8.8	9.9	10.5	11.1	11.6
4	5.2	6.3	7.5	8.6	9.8	10.9	11.5	12.1	12.6
5	6.2	7.3	8.5	9.6	10.8	11.9	12.5	13.1	13.6
6	7.2	8.3	9.5	10.6	11.8	12.9	13.5	14.1	14.6
7	8.2	9.3	10.5	11.6	12.8	13.9	14.5	15.1	15.6
8	9.2	10.3	11.5	12.6	13.8	14.9	15.5	16.1	16.6
9	10.2	11.3	12.5	13.6	14.8	15.9	16.5	17.1	17.6
10	11.2	12.3	13.5	14.6	15.8	16.9	17.5	18.1	18.6
11	12.2	13.3	14.5	15.6	16.8	17.9	18.5	19.1	19.6
12	13.2	14.3	15.5	16.6	17.8	18.9	19.5	20.1	20.6
13	14.2	15.3	16.5	17.6	18.8	19.9	20.5	21.1	21.6
14	15.2	16.3	17.5	18.6	19.8	20.9	21.5	22.1	22.6

Source: Bernstein estimates

Carbon Tax Levels Estimated By The IEA: By 2030 A Carbon Tax Of \$100/Ton Would Be Needed In The 450ppm Scenario



Source: IEA

Agenda

- + **Climate Change Policies – The Single Greatest Threat to the Oil & Gas Industry**
 - + Is This 2°C Limit Really Achievable?
 - + Oil & Gas Emissions Lifecycle

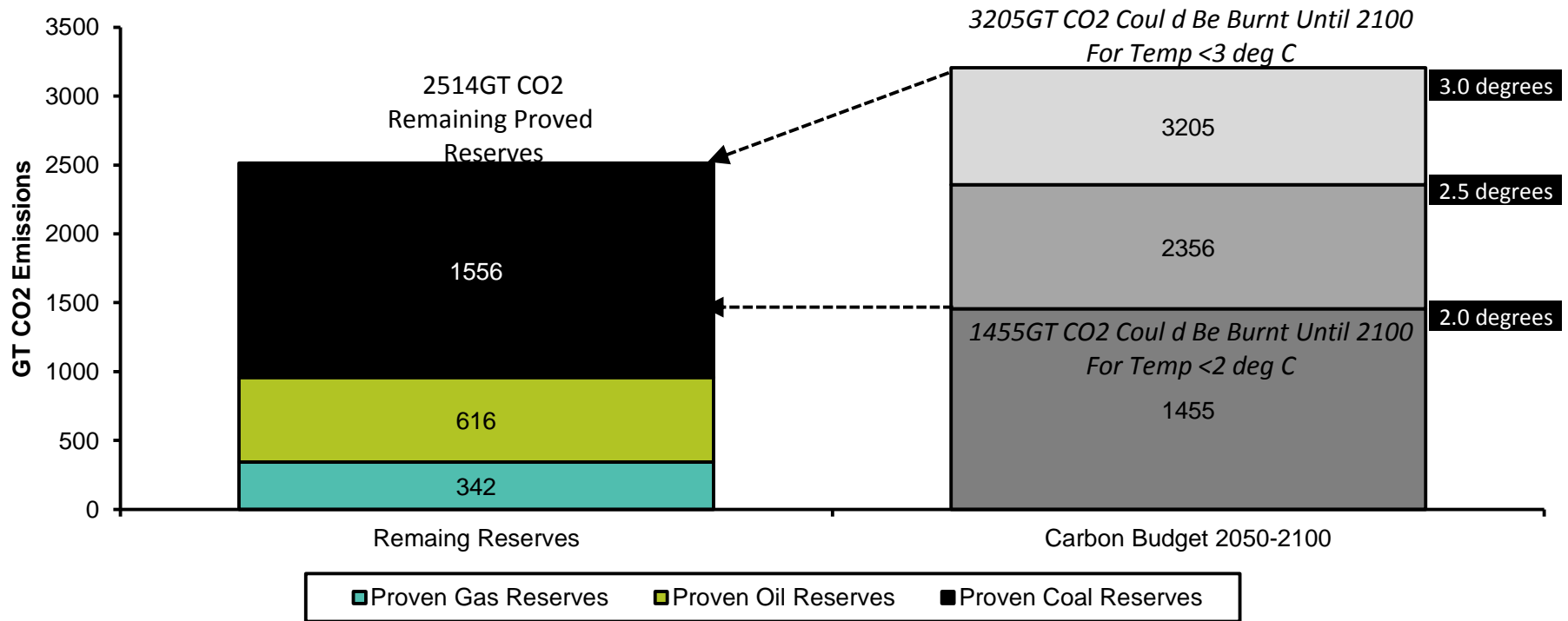
- + **Gas – Low Carbon Bridge to the Future or Road to Ruin?**
 - + Why Other Energy Sources Are Not Competitive Enough?
 - + The Shift To Natural Gas

- + **Implications For The Oil & Gas Industry**
 - + Myths And Realities of Stranded Carbon
 - + Countries/Companies At Risk
 - + Majors' Response To Climate Change

- + **Conclusion**

- + **Appendix**

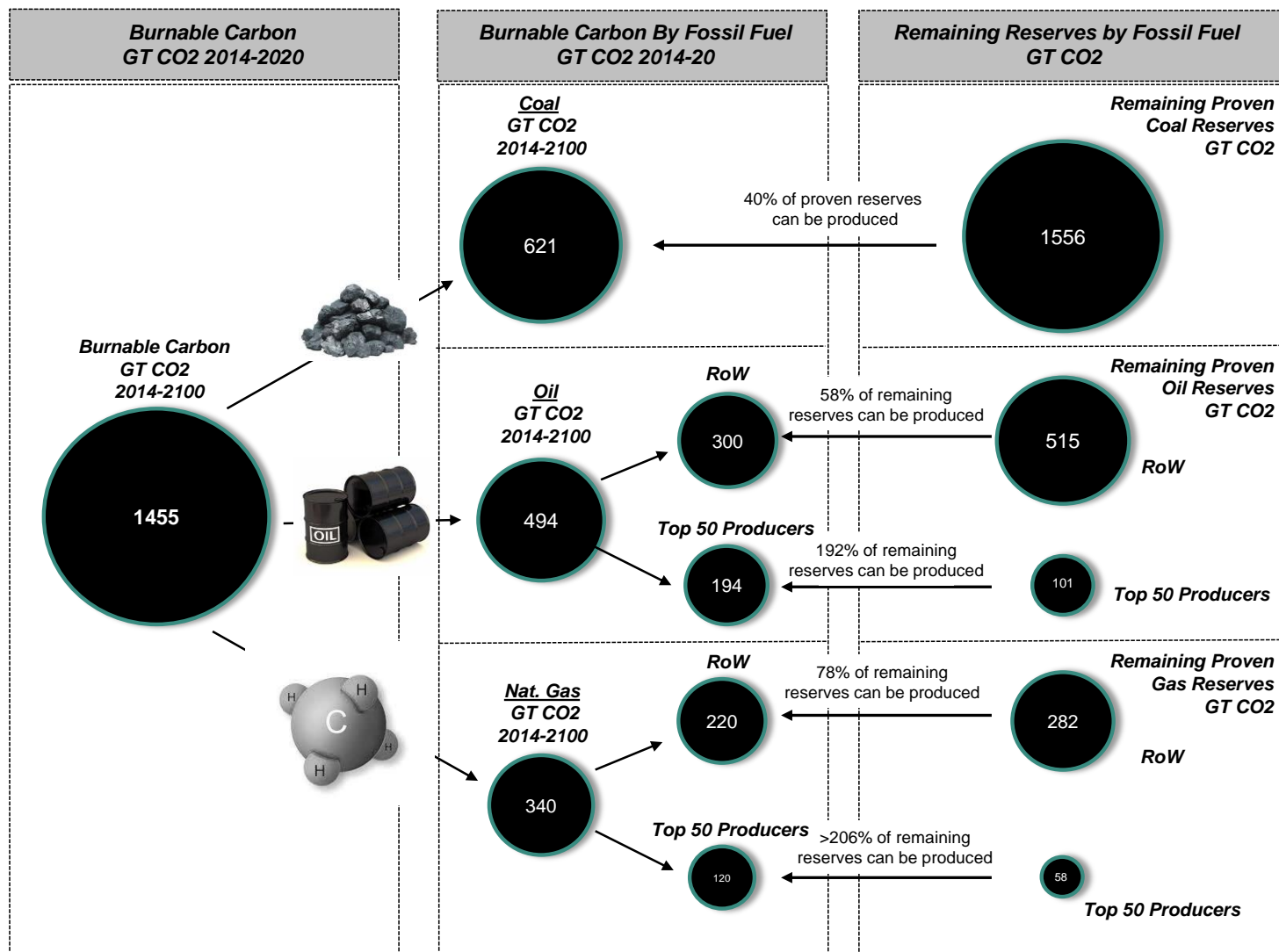
At A 2°C Limit, 40% of Remaining Proven Reserves Are Stranded Between Now And 2100. Coal Will Be Most Impacted



Item	Unit	Oil	Gas	Coal	Total
Remaining Proven Reserves GT CO2 (A)	MTCO2	616	340	1556	2512
Share of Future Emissions %	%	34%	23%	43%	100%
Share of Future Emissions GT (B)	MTCO2	495	339	621	1455
Remaining Reserves Unburnable GT CO2 (A-B)	MTCO2	121	1	935	1057
% Remaining Reserves Unburnable	%	20%	0%	60%	42%

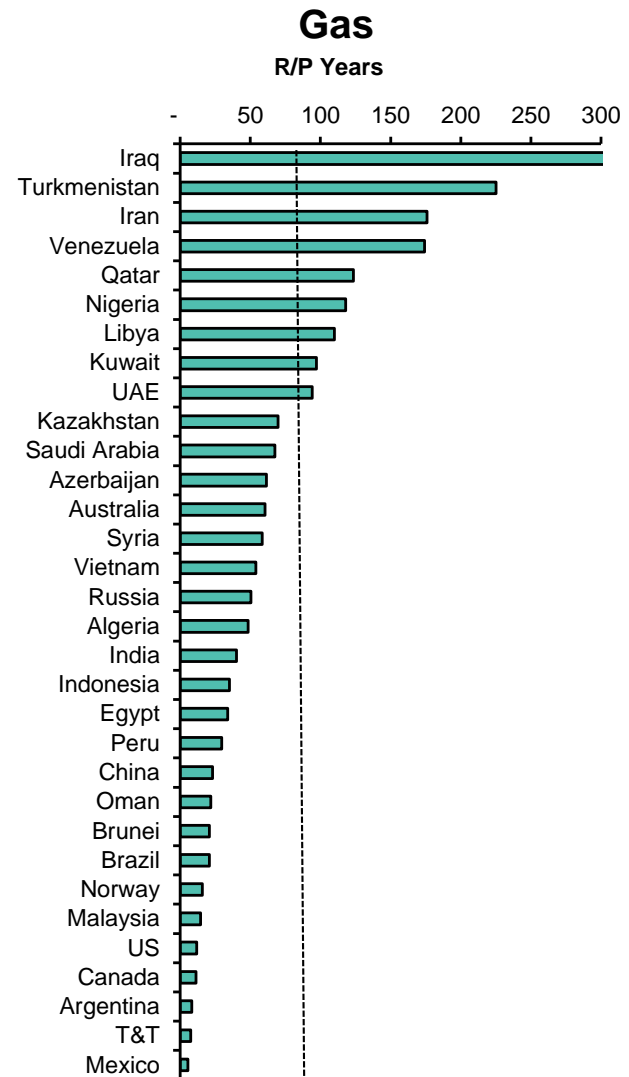
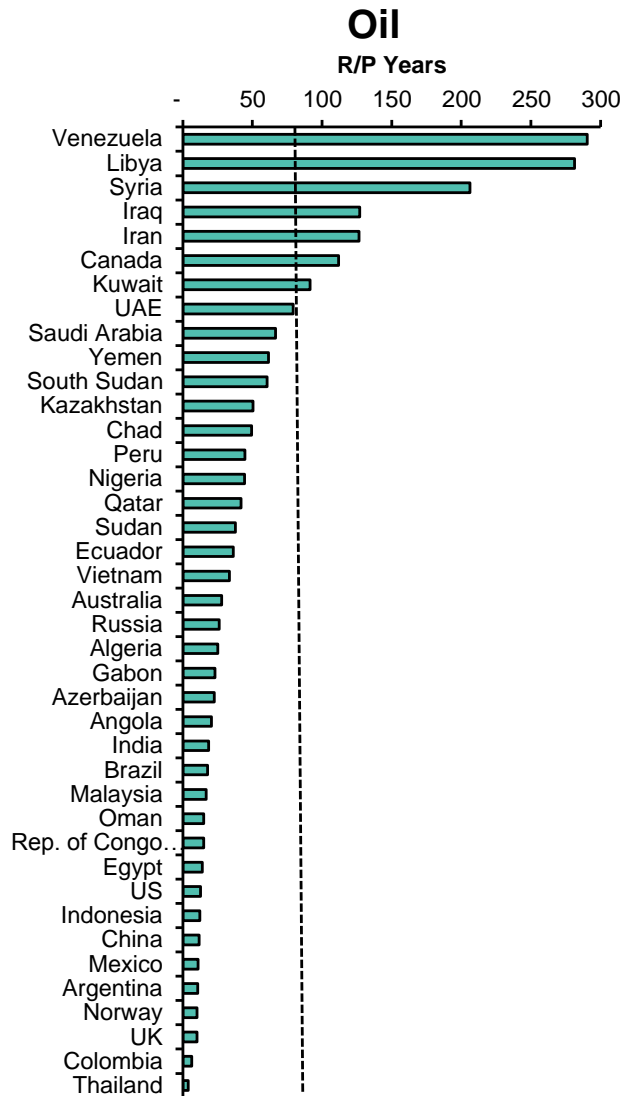
Source: BP Statistical Review, Bernstein analysis

60% Of Proven Coal May be Stranded, But Only 20% For Oil And 0% For Gas

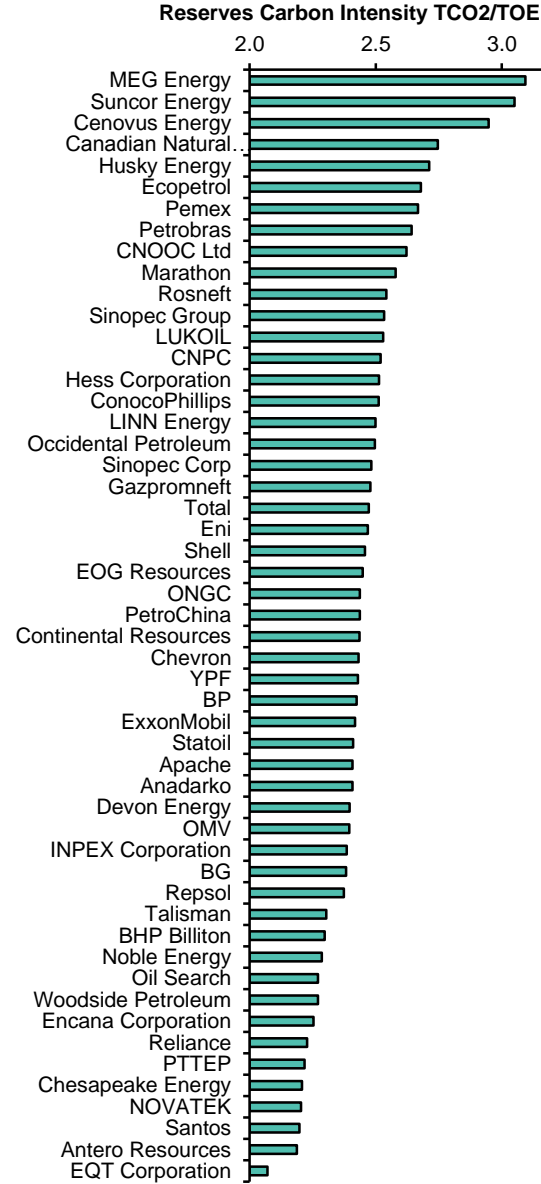
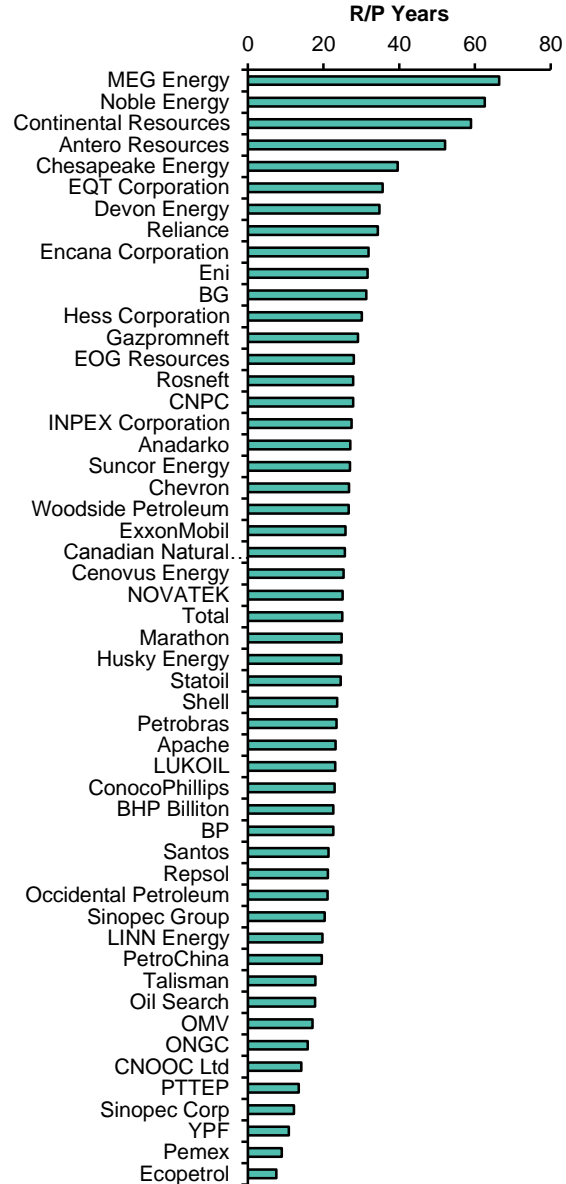


Source: Bernstein Estimates

Countries With The Longest Reserves Life Have The Biggest Risks From Stranded Carbon

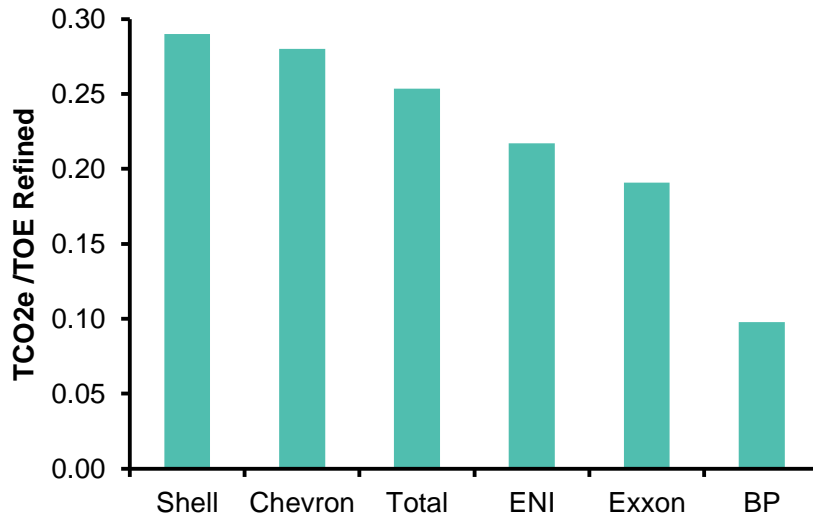


Companies Exposed To The Risk Of Stranded Carbon

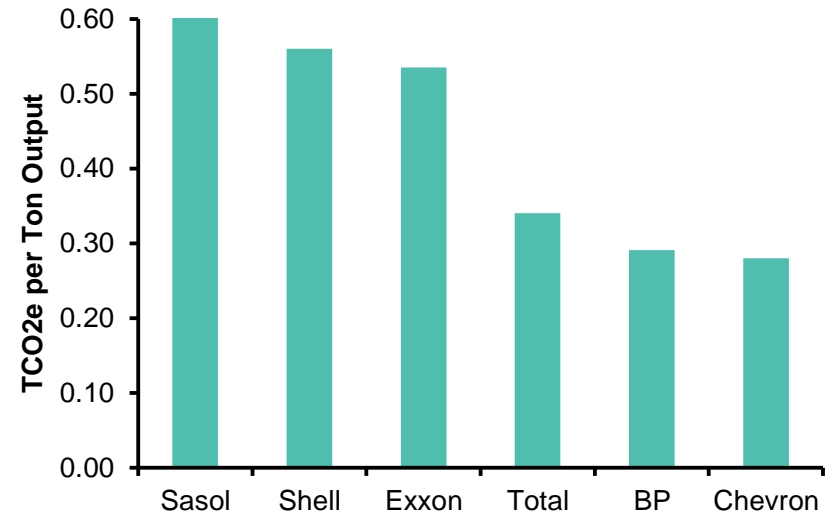


Downstream: Carbon Intensity Of Throughput By Company

Carbon Intensity Of Refining Throughput

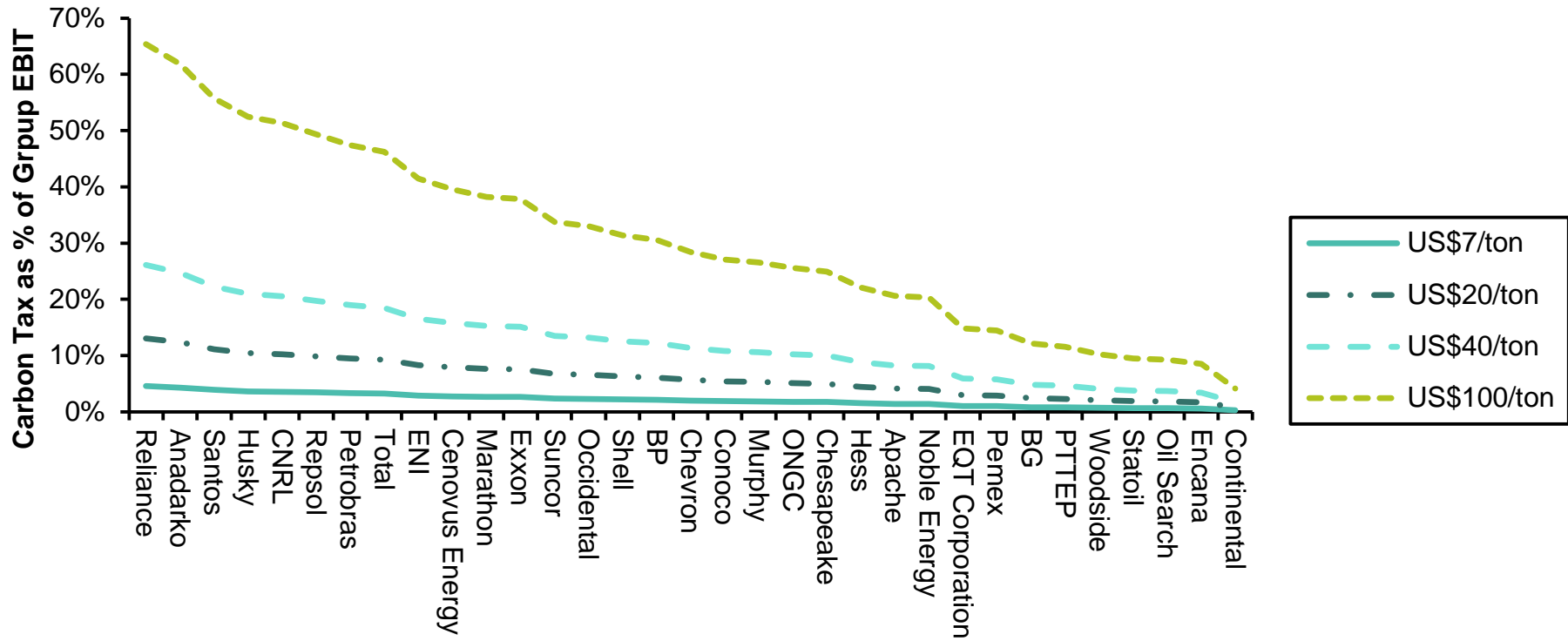


Carbon Intensity Of PetChem Production



Source: Company reports and Bernstein analysis

Carbon Tax As % Of Group Operating Income



Source: Company reports and Bernstein analysis

What The Oil Majors Have Been Responding To Climate Change Policies

- + 10 global oil & gas CEOs called for a global carbon pricing system and for gas to be part of the solution to lower carbon emissions
- + 10 companies included European Majors, Saudi Aramco and Pemex, but not US Majors
- + They recognize that current GHG emissions were inconsistent with the goal of limiting global warming to 2°C
- + New technologies need to be developed such as carbon capture and storage (CCS)
- + OPEC countries including Saudi Arabia, Iraq, Ecuador, Algeria and UAE all submitted climate change pledges ahead of COP21

Source: Company reports and Bernstein analysis

Majors' Actions/Investments Responding To Climate Change



Carbon Price: \$40/Ton for major investment decisions

CCS solutions: 14 large-scale CCS projects in operations and 8 under construction (40MTA) + 14 large-scale projects in development planning stage (20MTA)

LNG as transport fuel:

- + For trucks: LNG fueling stations in the Netherlands and the US
- + For shipping: Greenstream – Shell's first LNG powered barge, and building of more specialized LNG bunker vessels
- + Developing two LNG transport corridors in N. America (Great Lakes and Gulf Coast) for trucking and commercial transportation



Carbon Price: Eur25/Ton

Investment in Renewables (66% stake in SunPower Corp., one of the largest solar panel producers globally)



Carbon Price: \$40/Ton for major investment decisions

Investment in Renewables: \$8Bn in alternative energy technologies



Carbon Price: \$60/Ton by 2030

BG GROUP



Carbon Price:

- \$50/Ton (OECD) by 2040
- \$35/Ton (non-OECD) by 2040



Carbon Price: N/A

Investment in Renewables: Industry-leading geothermal technology

Agenda

- + **Climate Change Policies – The Single Greatest Threat to the Oil & Gas Industry**
 - + Is This 2°C Limit Really Achievable?
 - + Oil & Gas Emissions Lifecycle

- + **Gas – Low Carbon Bridge to the Future or Road to Ruin?**
 - + Why Other Energy Sources Are Not Competitive Enough?
 - + The Shift To Natural Gas

- + **Implications For The Oil & Gas Industry**
 - + Myths And Realities of Stranded Carbon
 - + Countries/Companies At Risk
 - + Majors' Response To Climate Change

- + **Conclusion**

- + **Appendix**

Conclusion

- + **Climate change policies are the single greatest threat to the oil & gas industry**
- + **Commitments made by the US/EU and China curbing carbon emissions will not be enough to keep global warming below 2°C**
- + **While energy efficiency, other technologies might help, switching to gas is our most likely bridge to a low-carbon future**
- + **A global carbon tax will strongly put natural gas/LNG producers in favour over oil producers**
- + **For the oil & gas industry:**
 - + **Unburnable carbon is not an issue for natural gas, but an issue for oil producers, with heavy oil and OPEC countries most impacted**
 - + **Oil majors have been responding to climate change policies, with most actions we've seen from Shell and TOTAL**

Agenda

- + Climate Change Policies – The Single Greatest Threat to the Oil & Gas Industry
 - + Is This 2°C Limit Really Achievable?
 - + Oil & Gas Emissions Lifecycle

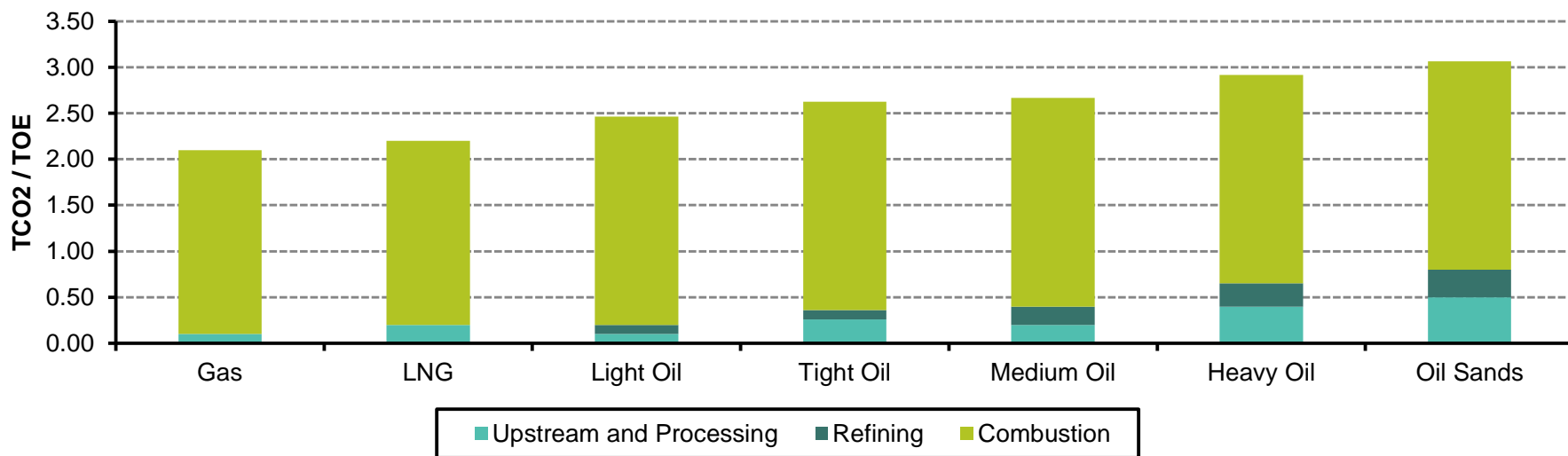
- + Gas – Low Carbon Bridge to the Future or Road to Ruin?
 - + Why Other Energy Sources Are Not Competitive Enough?
 - + The Shift To Natural Gas

- + Implications For The Oil & Gas Industry
 - + Myths And Realities of Stranded Carbon
 - + Countries/Companies At Risk
 - + Majors' Response To Climate Change

- + Conclusion

- + **Appendix**

Carbon Emissions Per Unit of Reserve For Different Categories of Reserves



Source: Carbon Intensity of Crude, company reports, IEA, Bernstein analysis

Reserves By Category, R/P Ratio and CO2 Emissions Associated with Reserves and Carbon Intensity

Company	2P COMMERCIAL RESERVE					2015 PRODUCTION			R/P	Emssions	Intensity
	Oil mmbbl	Oil Sands mmbbl	Gas mmboe	LNG mmboe	TOTAL mmboe	Liquid kbpd	Gas mcf/d	TOTAL kboepd	TOTAL	MTCO2	TCO@/TOE
TOTAL	245,335	30,244	154,541	46,508	476,628	34,827	118,623	54,598	23.9	159,556	2.47
Anadarko	4,369	-	3,117	502	7,989	416	2,360	809	27.0	2,610	2.41
Antero Resources	804	-	3,545	-	4,349	37	1,152	229	52.1	1,291	2.19
Apache	2,958	-	1,925	23	4,906	346	1,400	579	23.2	1,603	2.41
BG	3,426	-	2,652	1,621	7,698	280	2,364	674	31.3	2,488	2.38
BHP Billiton	1,795	-	3,391	329	5,515	289	2,273	668	22.6	1,720	2.30
BP	7,194	1,128	5,479	3,849	17,650	1,224	5,495	2,140	22.6	5,807	2.42
Canadian Nat. Res.	1,041	4,612	2,397	-	8,049	578	1,701	861	25.6	3,000	2.75
Cenovus Energy	196	1,961	319	-	2,475	196	431	268	25.3	990	2.95
Chesapeake Energy	1,773	-	7,402	-	9,175	177	2,745	635	39.6	2,749	2.21
Chevron	14,162	501	7,606	5,250	27,519	1,922	5,390	2,820	26.7	9,080	2.43
CNOOC	-	-	432	-	432	-	137	23	51.8	124	2.12
CNOOC Ltd	4,164	987	1,206	344	6,702	1,062	1,433	1,300	14.1	2,385	2.62
CNPC	3,580	-	802	1,295	5,677	433	758	559	27.8	1,941	2.52
ConocoPhillips	5,397	2,247	3,657	2,084	13,385	956	3,863	1,600	22.9	4,562	2.51
Continental Res.	3,313	-	1,083	-	4,396	156	291	204	58.9	1,453	2.44
Devon Energy	3,363	665	4,062	-	8,090	369	1,613	638	34.7	2,630	2.40
Ecopetrol	1,579	-	381	-	1,959	614	604	714	7.5	712	2.68
Encana Corporation	1,555	-	4,004	-	5,559	127	2,104	478	31.9	1,699	2.25
Eni	12,831	-	2,447	1,734	17,011	874	3,601	1,474	31.6	5,700	2.47
EOG Resources	3,749	-	2,230	27	6,006	380	1,242	587	28.0	1,996	2.45
EQT Corporation	364	-	2,718	-	3,082	17	1,321	237	35.6	866	2.07
ExxonMobil	13,375	3,316	11,578	7,521	35,789	2,075	10,356	3,801	25.8	11,745	2.42
Gazpromneft	9,071	-	4,869	-	13,940	919	2,363	1,313	29.1	4,690	2.48
Hess Corporation	2,724	-	865	-	3,589	236	544	327	30.1	1,224	2.51
Husky Energy	877	1,273	727	-	2,877	217	614	319	24.7	1,059	2.71
INPEX Corporation	1,776	7	333	2,198	4,316	245	1,114	431	27.4	1,397	2.38
LINN Energy	866	-	467	-	1,333	104	487	186	19.7	452	2.50
LUKOIL	13,817	-	4,562	18	18,397	1,879	1,816	2,182	23.1	6,313	2.53
Marathon	2,130	501	604	246	3,482	267	709	385	24.8	1,219	2.58
MEG Energy	-	1,902	-	-	1,902	78	-	78	66.4	798	3.09
Noble Energy	2,231	-	3,755	2,168	8,154	165	1,153	357	62.6	2,530	2.29
NOVATEK	1,714	-	7,943	2,395	12,052	194	6,751	1,320	25.0	3,604	2.20
Occidental Petroleum	3,402	-	1,314	-	4,715	438	1,057	614	21.0	1,597	2.50
Oil Search	92	-	8	375	475	24	298	73	17.8	146	2.27
OMV	715	-	708	-	1,423	123	626	228	17.1	463	2.40
ONGC	3,394	-	1,689	452	5,535	633	1,942	956	15.9	1,831	2.44
Pemex	7,386	-	1,348	-	8,733	2,233	2,562	2,660	9.0	3,162	2.67
Petrobras	19,081	-	1,974	-	21,055	2,138	1,967	2,466	23.4	7,551	2.64
PetroChina	12,347	1,050	12,949	575	26,921	2,286	8,922	3,773	19.5	8,901	2.44
PTTEP	407	-	1,153	161	1,721	110	1,441	350	13.5	518	2.22
Range Resources	0	-	-	-	0	0	-	0	4.0	0	2.69
Reliance	405	-	1,552	-	1,957	38	710	156	34.3	592	2.23
Repsol	1,242	-	1,306	420	2,967	156	1,371	385	21.1	956	2.37
Rosneft	35,832	-	10,365	149	46,346	3,793	4,603	4,560	27.8	15,986	2.54
Santos	151	-	808	194	1,154	36	671	148	21.3	344	2.20
Sasol	50	-	313	-	363	5	322	58	17.1	108	2.19
Shell	10,137	2,343	5,994	6,211	24,685	1,467	8,367	2,862	23.6	8,232	2.46
Sinopec Corp	3,422	-	2,126	-	5,548	879	2,212	1,248	12.2	1,869	2.48
Sinopec Group	2,232	322	1,091	79	3,725	408	568	502	20.3	1,281	2.53
Statoil	6,934	669	6,904	1,592	16,098	1,035	4,592	1,800	24.5	5,264	2.41
Suncor Energy	432	5,368	76	-	5,875	593	20	597	27.0	2,433	3.05
Talisman	686	-	1,371	50	2,107	125	1,194	324	17.8	659	2.30
Total	9,304	1,391	4,165	2,691	17,551	1,142	4,694	1,924	25.0	5,889	2.47
Woodside Petroleum	343	-	45	1,955	2,342	61	1,079	241	26.6	722	2.27
YPF	1,148	-	727	-	1,874	271	1,221	474	10.8	618	2.43

Disclosure Appendix

SRO REQUIRED DISCLOSURES

- References to "Bernstein" relate to Sanford C. Bernstein & Co., LLC, Sanford C. Bernstein Limited, Sanford C. Bernstein (Hong Kong) Limited 盛博香港有限公司, and Sanford C. Bernstein (business registration number 53193989L), a unit of AllianceBernstein (Singapore) Ltd. which is a licensed entity under the Securities and Futures Act and registered with Company Registration No. 199703364C, collectively.
- Bernstein analysts are compensated based on aggregate contributions to the research franchise as measured by account penetration, productivity and proactivity of investment ideas. No analysts are compensated based on performance in, or contributions to, generating investment banking revenues.
- Bernstein rates stocks based on forecasts of relative performance for the next 6-12 months versus the S&P 500 for stocks listed on the U.S. and Canadian exchanges, versus the MSCI Pan Europe Index for stocks listed on the European exchanges (except for Russian companies), versus the MSCI Emerging Markets Index for Russian companies and stocks listed on emerging markets exchanges outside of the Asia Pacific region, and versus the MSCI Asia Pacific ex-Japan Index for stocks listed on the Asian (ex-Japan) exchanges - unless otherwise specified. We have three categories of ratings:
 - Outperform: Stock will outpace the market index by more than 15 pp in the year ahead.
 - Market-Perform: Stock will perform in line with the market index to within +/-15 pp in the year ahead.
 - Underperform: Stock will trail the performance of the market index by more than 15 pp in the year ahead.
 - Not Rated: The stock Rating, Target Price and estimates (if any) have been suspended temporarily.
- As of 11/18/2015, Bernstein's ratings were distributed as follows: Outperform - 49.4% (1.0% banking clients) ; Market-Perform - 42.0% (0.4% banking clients); Underperform - 8.4% (0.0% banking clients); Not Rated - 0.2% (0.0% banking clients). The numbers in parentheses represent the percentage of companies in each category to whom Bernstein provided investment banking services within the last twelve (12) months.
- Accounts over which Bernstein and/or their affiliates exercise investment discretion own more than 1% of the outstanding common stock of the following companies BG/.LN / BG Group PLC, PMO.LN / Premier Oil PLC, RDSB.LN / Royal Dutch Shell PLC, RDSB.NA / Royal Dutch Shell PLC.
- The following companies are or during the past twelve (12) months were clients of Bernstein, which provided non-investment banking-securities related services and received compensation for such services BP/.LN / BP PLC, BP / BP PLC.
- An affiliate of Bernstein received compensation for non-investment banking-securities related services from the following companies BP/.LN / BP PLC, BP / BP PLC.
- This research publication covers six or more companies. For price chart disclosures, please visit www.bernsteinresearch.com, you can also write to either: Sanford C. Bernstein & Co. LLC, Director of Compliance, 1345 Avenue of the Americas, New York, N.Y. 10105 or Sanford C. Bernstein Limited, Director of Compliance, 50 Berkeley Street, London W1J 8SB, United Kingdom; or Sanford C. Bernstein (Hong Kong) Limited 盛博香港有限公司, Director of Compliance, Suites 3206-11, 32/F, One International Finance Centre, 1 Harbour View Street, Central, Hong Kong, or Sanford C. Bernstein (business registration number 53193989L) , a unit of AllianceBernstein (Singapore) Ltd. which is a licensed entity under the Securities and Futures Act and registered with Company Registration No. 199703364C, Director of Compliance, 30 Cecil Street, #28-08 Prudential Tower, Singapore 049712.

12-Month Rating History as of 11/18/2015

Ticker	Rating Changes
BG/.LN	O (IC) 01/22/09
BP	O (RC) 09/10/15 M (IC) 08/03/10
BP/.LN	O (RC) 09/10/15 M (IC) 08/03/10
CNE.LN	M (RC) 01/29/13
E	O (RC) 06/14/13
ENI.IM	O (RC) 06/14/13
FP.FP	M (RC) 05/01/15 O (IC) 08/03/10
GALP.PL	O (RC) 05/26/10
GAZP.RM	O (IC) 10/16/13
LKOD.LI	M (RC) 06/28/12
LKOH.RM	M (IC) 10/16/13
NVTK.LI	M (RC) 10/16/13
NVTK.RM	M (IC) 10/16/13
OGZD.LI	O (RC) 07/16/09
PMO.LN	O (RC) 06/28/12
RDS/A	O (RC) 09/30/14
RDS/B	O (RC) 09/30/14
RDSA.LN	O (RC) 09/30/14
RDSA.NA	O (RC) 09/30/14
RDSB.LN	O (RC) 09/30/14
RDSB.NA	O (RC) 09/30/14
REP.SM	M (RC) 12/03/13
ROSN.LI	M (RC) 01/29/13
ROSN.RM	M (IC) 10/16/13
SGGD.LI	M (RC) 06/28/12
SNGS.RM	
STL.NO	O (RC) 12/03/13
STO	O (RC) 12/03/13
TLW.LN	O (IC) 01/22/09
TOT	M (RC) 05/01/15 O (IC) 08/03/10

Rating Guide: O - Outperform, M - Market-Perform, U - Underperform, N - Not Rated

Rating Actions: IC - Initiated Coverage, DC - Dropped Coverage, RC - Rating Change

OTHER DISCLOSURES

A price movement of a security which may be temporary will not necessarily trigger a recommendation change. Bernstein will advise as and when coverage of securities commences and ceases. Bernstein has no policy or standard as to the frequency of any updates or changes to its coverage policies. Although the definition and application of these methods are based on generally accepted industry practices and models, please note that there is a range of reasonable variations within these models. The application of models typically depends on forecasts of a range of economic variables, which may include, but not limited to, interest rates, exchange rates, earnings, cash flows and risk factors that are subject to uncertainty and also may change over time. Any valuation is dependent upon the subjective opinion of the analysts carrying out this valuation.

Bernstein produces a number of different types of research product including, among others, fundamental analysis and quantitative analysis. Recommendations contained within one type of research product may differ from recommendations contained within other types of research product, whether as a result of differing time horizons, methodologies or otherwise.

This document may not be passed on to any person in the United Kingdom (i) who is a retail client (ii) unless that person or entity qualifies as an authorised person or exempt person within the

meaning of section 19 of the UK Financial Services and Markets Act 2000 (the "Act"), or qualifies as a person to whom the financial promotion restriction imposed by the Act does not apply by virtue of the Financial Services and Markets Act 2000 (Financial Promotion) Order 2005, or is a person classified as an "professional client" for the purposes of the Conduct of Business Rules of the Financial Conduct Authority.

To our readers in the United States: Sanford C. Bernstein & Co., LLC is distributing this publication in the United States and accepts responsibility for its contents. Any U.S. person receiving this publication and wishing to effect securities transactions in any security discussed herein should do so only through Sanford C. Bernstein & Co., LLC.

To our readers in the United Kingdom: This publication has been issued or approved for issue in the United Kingdom by Sanford C. Bernstein Limited, authorised and regulated by the Financial Conduct Authority and located at 50 Berkeley Street, London W1J 8SB, +44 (0)20-7170-5000.

To our readers in member states of the EEA: This publication is being distributed in the EEA by Sanford C. Bernstein Limited, which is authorised and regulated in the United Kingdom by the Financial Conduct Authority and holds a passport under the Markets in Financial Instruments Directive.

To our readers in Hong Kong: This publication is being distributed in Hong Kong by Sanford C. Bernstein (Hong Kong) Limited 盛博香港有限公司, which is licensed and regulated by the Hong Kong Securities and Futures Commission (Central Entity No. AXC846). This publication is solely for professional investors only, as defined in the Securities and Futures Ordinance (Cap. 571).

To our readers in Singapore: This publication is being distributed in Singapore by Sanford C. Bernstein, a unit of AllianceBernstein (Singapore) Ltd., only to accredited investors or institutional investors, as defined in the Securities and Futures Act (Chapter 289). Recipients in Singapore should contact AllianceBernstein (Singapore) Ltd. in respect of matters arising from, or in connection with, this publication. AllianceBernstein (Singapore) Ltd. is a licensed entity under the Securities and Futures Act and registered with Company Registration No. 199703364C. It is regulated by the Monetary Authority of Singapore and located at 30 Cecil Street, #28-08 Prudential Tower, Singapore 049712, +65-62304600. The business name "Bernstein" is registered under business registration number 53193989L.

To our readers in the People's Republic of China: The securities referred to in this document are not being offered or sold and may not be offered or sold, directly or indirectly, in the People's Republic of China (for such purposes, not including the Hong Kong and Macau Special Administrative Regions or Taiwan), except as permitted by the securities laws of the People's Republic of China.

To our readers in Japan: This document is not delivered to you for marketing purposes, and any information provided herein should not be construed as a recommendation, solicitation or offer to buy or sell any securities or related financial products.

To our readers in Australia: Sanford C. Bernstein & Co., LLC, Sanford C. Bernstein Limited and Sanford C. Bernstein (Hong Kong) Limited 盛博香港有限公司 are exempt from the requirement to hold an Australian financial services licence under the Corporations Act 2001 in respect of the provision of the following financial services to wholesale clients:

- providing financial product advice;
- dealing in a financial product;
- making a market for a financial product; and
- providing a custodial or depository service.

Sanford C. Bernstein & Co., LLC., Sanford C. Bernstein Limited, Sanford C. Bernstein (Hong Kong) Limited 盛博香港有限公司 and AllianceBernstein (Singapore) Ltd. are regulated by, respectively, the Securities and Exchange Commission under U.S. laws, by the Financial Conduct Authority under U.K. laws, by the Hong Kong Securities and Futures Commission under Hong Kong laws, and by the Monetary Authority of Singapore under Singapore laws, all of which differ from Australian laws.

One or more of the officers, directors, or employees of Sanford C. Bernstein & Co., LLC, Sanford C. Bernstein Limited, Sanford C. Bernstein (Hong Kong) Limited 盛博香港有限公司, Sanford C. Bernstein (business registration number 53193989L), a unit of AllianceBernstein (Singapore) Ltd. which is a licensed entity under the Securities and Futures Act and registered with Company Registration No. 199703364C, and/or their affiliates may at any time hold, increase or decrease positions in securities of any company mentioned herein.

Bernstein or its affiliates may provide investment management or other services to the pension or profit sharing plans, or employees of any company mentioned herein, and may give advice to others as to investments in such companies. These entities may effect transactions that are similar to or different from those recommended herein.

Bernstein Research Publications are disseminated to our customers through posting on the firm's password protected website, www.bernsteinresearch.com. Additionally, Bernstein Research

Publications are available through email, postal mail and commercial research portals. If you wish to alter your current distribution method, please contact your salesperson for details.

Bernstein and/or its affiliates do and seek to do business with companies covered in its research publications. As a result, investors should be aware that Bernstein and/or its affiliates may have a conflict of interest that could affect the objectivity of this publication. Investors should consider this publication as only a single factor in making their investment decisions.

This publication has been published and distributed in accordance with Bernstein's policy for management of conflicts of interest in investment research, a copy of which is available from Sanford C. Bernstein & Co., LLC, Director of Compliance, 1345 Avenue of the Americas, New York, N.Y. 10105, Sanford C. Bernstein Limited, Director of Compliance, 50 Berkeley Street, London W1J 8SB, United Kingdom, or Sanford C. Bernstein (Hong Kong) Limited 盛博香港有限公司, Director of Compliance, Suites 3206-11, 32/F, One International Finance Centre, 1 Harbour View Street, Central, Hong Kong, or Sanford C. Bernstein (business registration number 53193989L) , a unit of AllianceBernstein (Singapore) Ltd. which is a licensed entity under the Securities and Futures Act and registered with Company Registration No. 199703364C, Director of Compliance, 30 Cecil Street, #28-08 Prudential Tower, Singapore 049712. Additional disclosures and information regarding Bernstein's business are available on our website www.bernsteinresearch.com.

CERTIFICATIONS

- I/(we), Oswald Clint, Ph.D., ACA, Senior Analyst(s)/Analyst(s), certify that all of the views expressed in this publication accurately reflect my/(our) personal views about any and all of the subject securities or issuers and that no part of my/(our) compensation was, is, or will be, directly or indirectly, related to the specific recommendations or views in this publication.

Copyright 2015, Sanford C. Bernstein & Co., LLC, Sanford C. Bernstein Limited, Sanford C. Bernstein (Hong Kong) Limited 盛博香港有限公司, and AllianceBernstein (Singapore) Ltd., subsidiaries of AllianceBernstein L.P. ~1345 Avenue of the Americas ~ NY, NY 10105 ~212/756-4400. All rights reserved.

This publication is not directed to, or intended for distribution to or use by, any person or entity who is a citizen or resident of, or located in any locality, state, country or other jurisdiction where such distribution, publication, availability or use would be contrary to law or regulation or which would subject Bernstein or any of their subsidiaries or affiliates to any registration or licensing requirement within such jurisdiction. This publication is based upon public sources we believe to be reliable, but no representation is made by us that the publication is accurate or complete. We do not undertake to advise you of any change in the reported information or in the opinions herein. This publication was prepared and issued by Bernstein for distribution to eligible counterparties or professional clients. This publication is not an offer to buy or sell any security, and it does not constitute investment, legal or tax advice. The investments referred to herein may not be suitable for you. Investors must make their own investment decisions in consultation with their professional advisors in light of their specific circumstances. The value of investments may fluctuate, and investments that are denominated in foreign currencies may fluctuate in value as a result of exposure to exchange rate movements. Information about past performance of an investment is not necessarily a guide to, indicator of, or assurance of, future performance.