

PerspECCtive

ECC 2018

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Theme:

The Next 50 Years: Capturing Transformational Possibilities



Year:

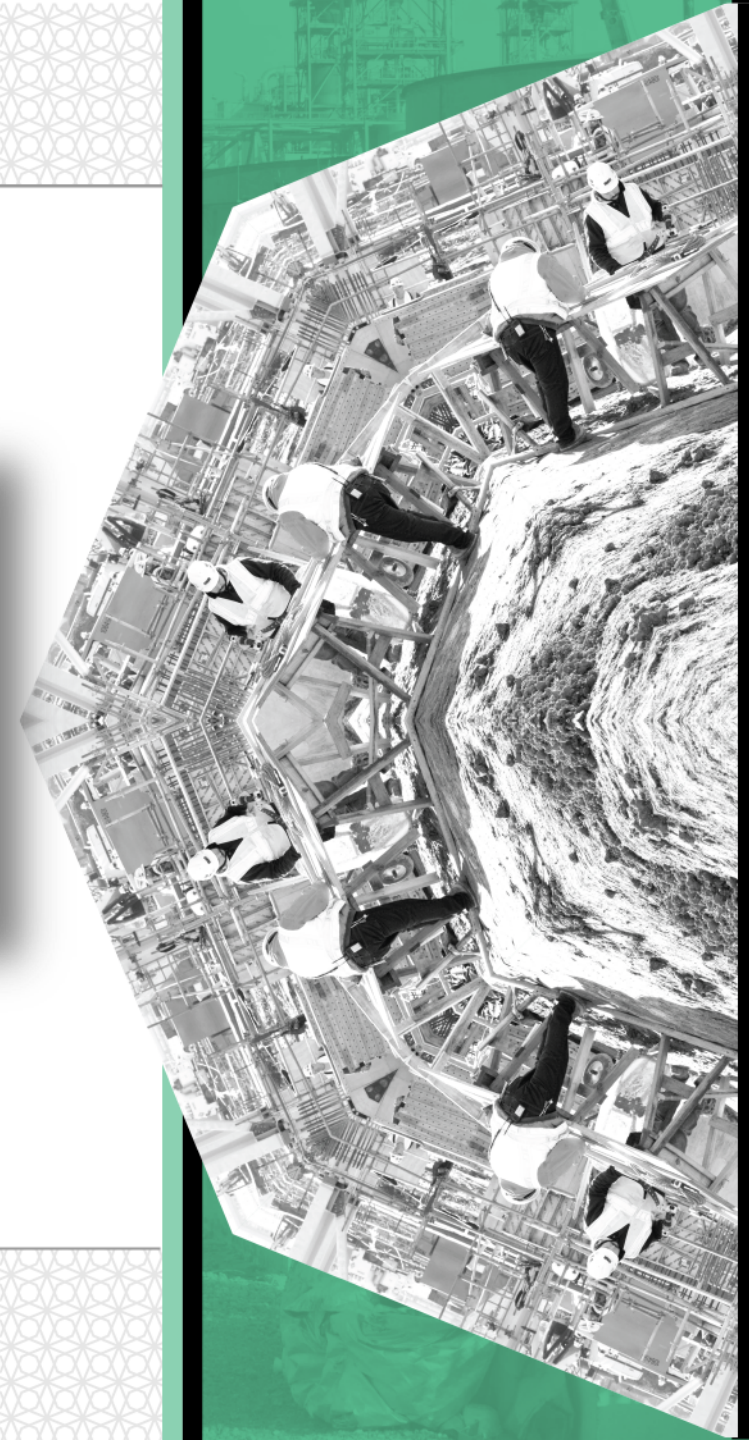
2018

Date:

Sept. 5-8

Location:

**JW Marriott Hill Country
San Antonio, TX**





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The Next 50 Years: Capturing
Transformational Possibilities

What did I tell you in September 2015?

- § Market would trade ^ \$35-\$45 based on a \$5 to \$10 terror/war premium to the real price of oil of \$33. WTI ended the year at just below \$40 and averaged \$49 for the year. WTI average price for 2016 was \$43.15.
- § 2-5 year horizon – I warned of ISIS attacks on oil installations. That faded quickly but was replaced by Houthi attacks on Saudi Arabia and other incidents of asymmetric warfare including cyber attacks against Saudi.
- § 2-5 year supply hole – I mentioned Venezuela; oil sands cancellations; US shale constraints (though at the time, it wasn't clear export ban would be lifted); Regime change risk in Mideast (hasn't happened, but you always have to mention it!)
- § 10 to 20 year horizon – I warned that peak oil demand would start to influence company strategies and market trends, based on transformational disrupters of greenhouse gas regulations, technology innovation, and geopolitical upheavals. I will talk about these trends again today.

Trumpian Tweets and Oil: Deflationary Effects

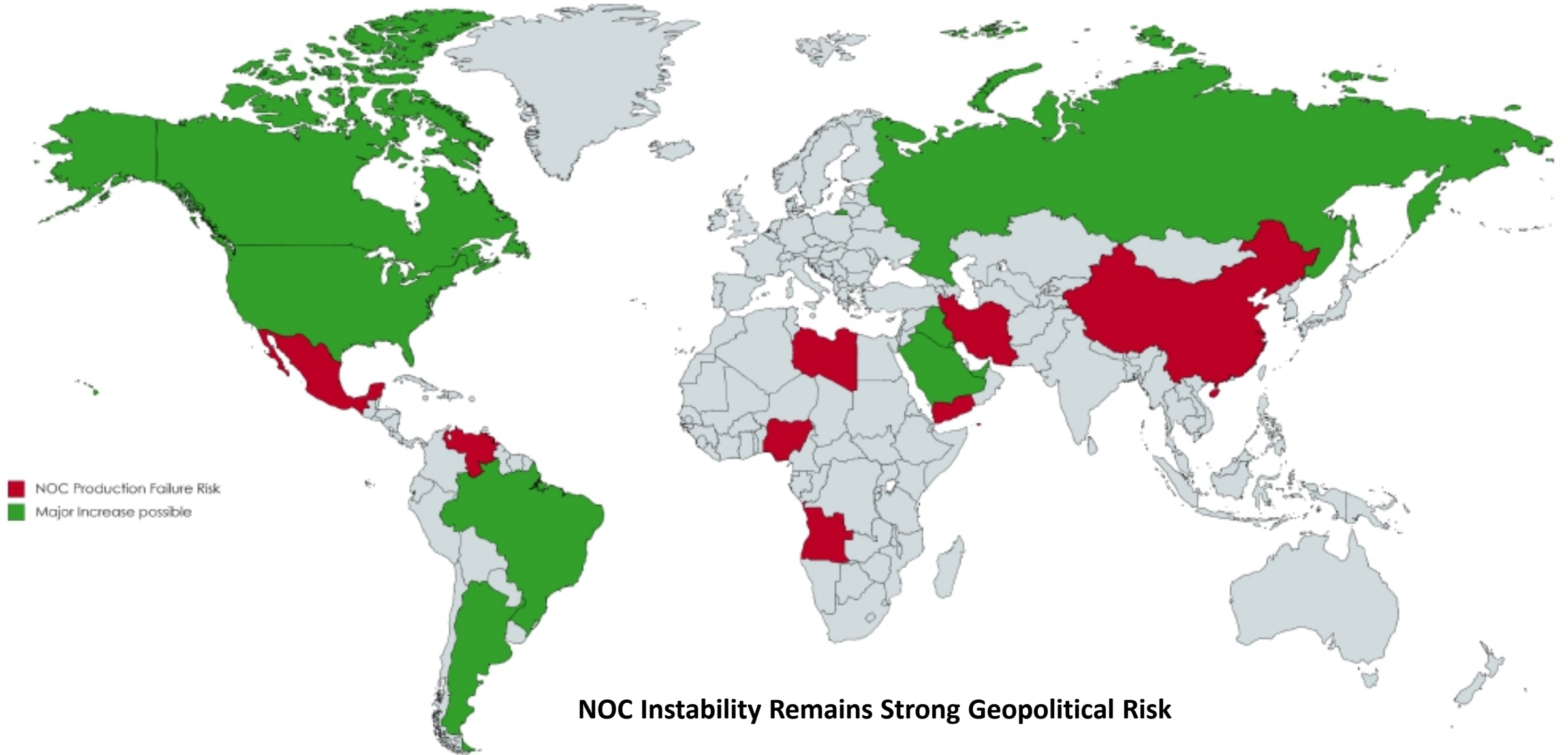
Trump tweets aim to keep oil price from weakening U.S. economic growth



- Trump continues to use U.S. global influence to prevent oil inflationary tendency
- Pressure on Saudi, UAE to act
- 11 million b/d sale from U.S. Strategic Petroleum Reserve
- Aligns with President's tweeted views on interest rates
- Iran sanctions a wildcard

Rising Oil Production Potential VS NOC Supply Risk

Corruption Scandals, Failing States, and State Raiding NOC Finances

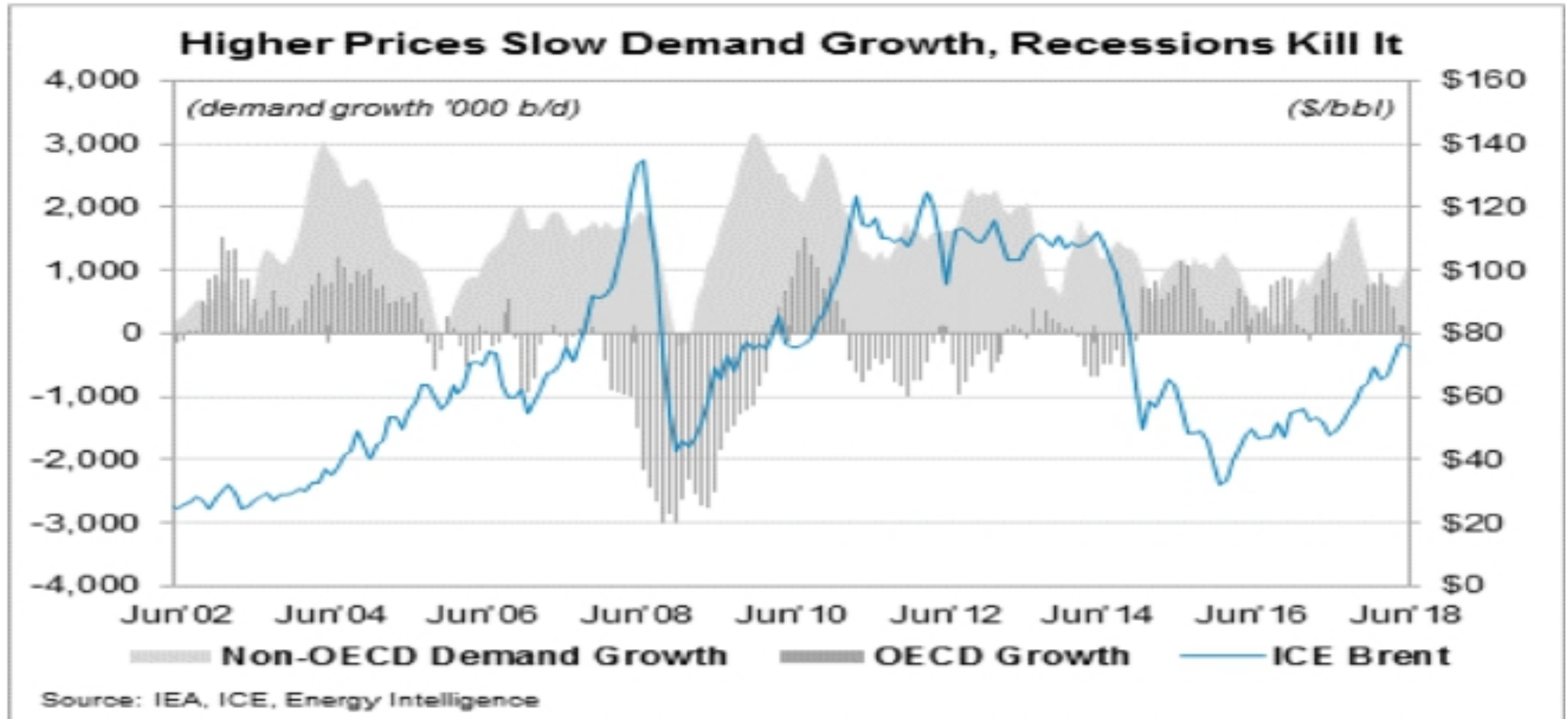


NOC Instability Remains Strong Geopolitical Risk

When Will This Upcycle End?

- § If signs emerge of sustained oil demand slowdown in China and India
- § Wall Street Journal survey: most US economists predict recession by 2020 or 2021
- § Trade war fears
- § Rising interest rates, strong dollar makes oil more expensive for developing world
- § Another sharp rise in price of oil could propel acceleration in digital technologies, alternative fuels and higher adoption rates for EVs

Rapidly decreasing currencies vs dollar makes oil and foreign debt more expensive in local currency terms. Turkey, Argentina, South Africa, Russia, Brazil and China represent one fifth of global oil demand. Oil demand trends likely to be most important indicator to possibility of lower oil prices in 2019 or 2020.

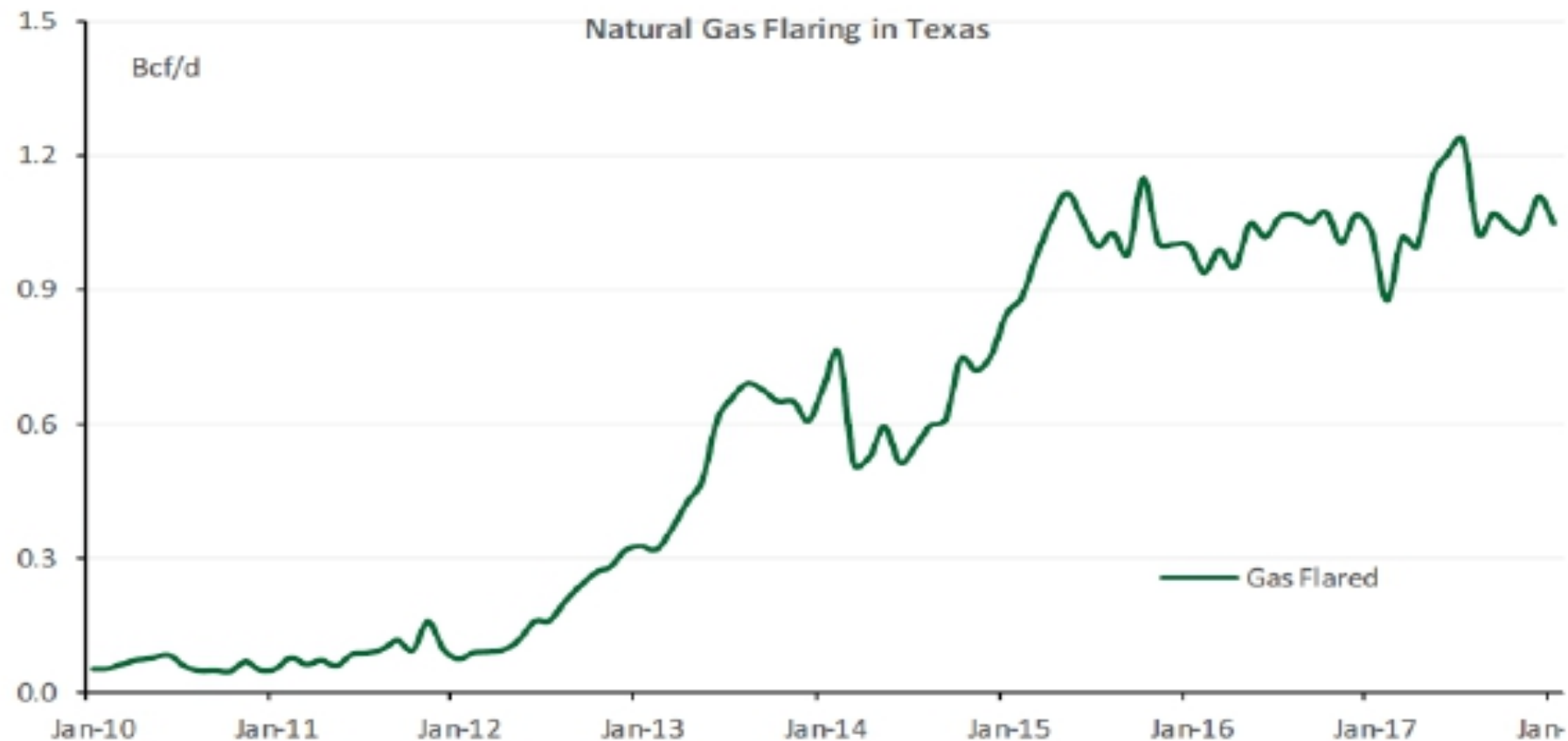


Is the WTI Boom-Bust Price Cycle Shortening?



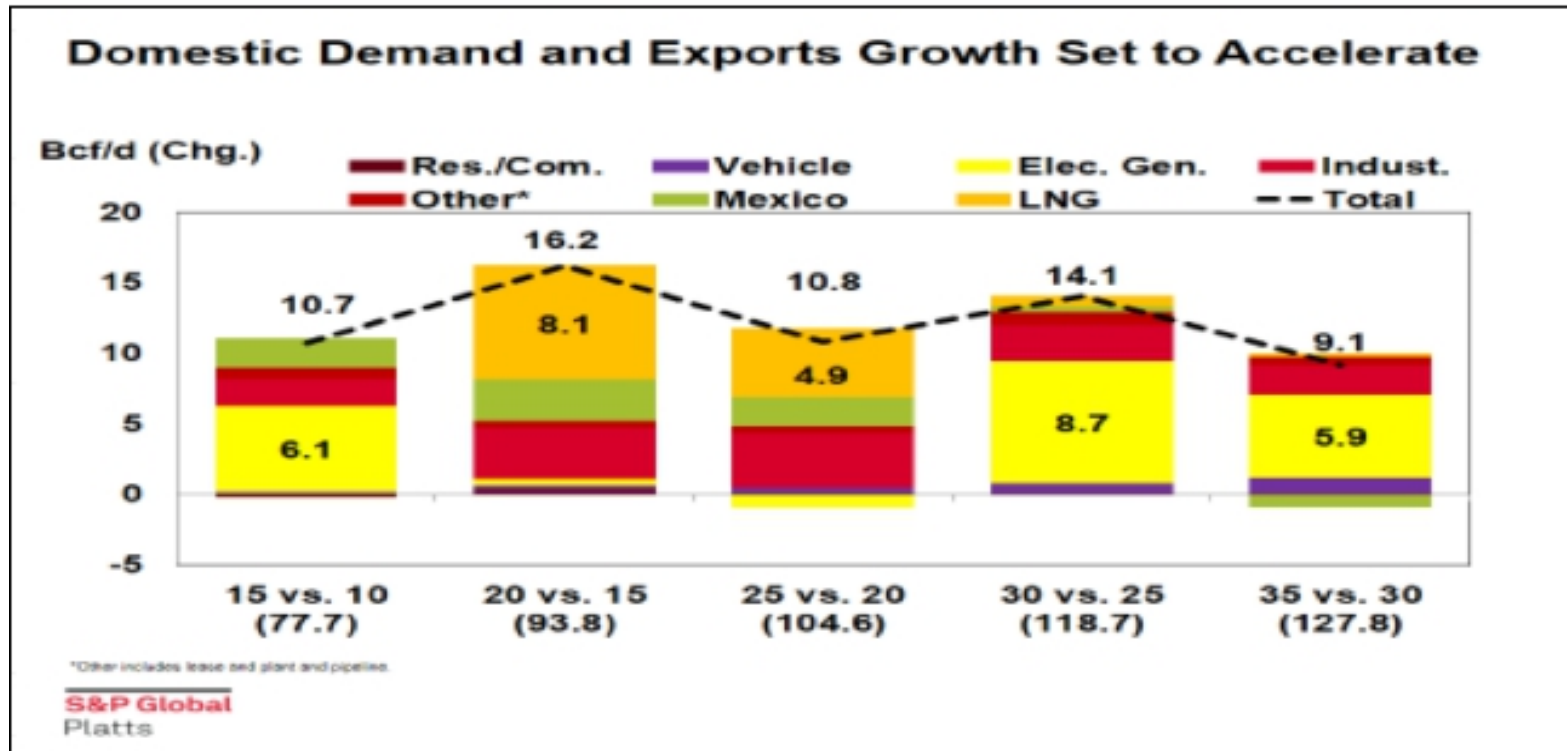
U.S. natural gas surplus will be extensive. Texas alone is currently flaring 0.8 to 1 bcf/d, equivalent to peak winter demand levels for all of New England. Source: Cornerstone Macro

NATURAL GAS: FLARING IN TEXAS HAS NEVER BEEN MUCH OF AN ISSUE



How will Russia respond to rising U.S. LNG exports?

- U.S. LNG exports expected to continue to rise significantly in 2018 to 2025 timeframe.
- Current U.S. storage injections lower than normal, potentially supportive to short term prices.
- But trade wars interfering with previous high interest in U.S. gas on gas deals. If LNG exports don't materialize as substantially as projected, expect lower U.S. prices late 2019 into 2020.
- Still, economics could help. Golden Pass and spot deals could substantially undercut even Russian gas prices.

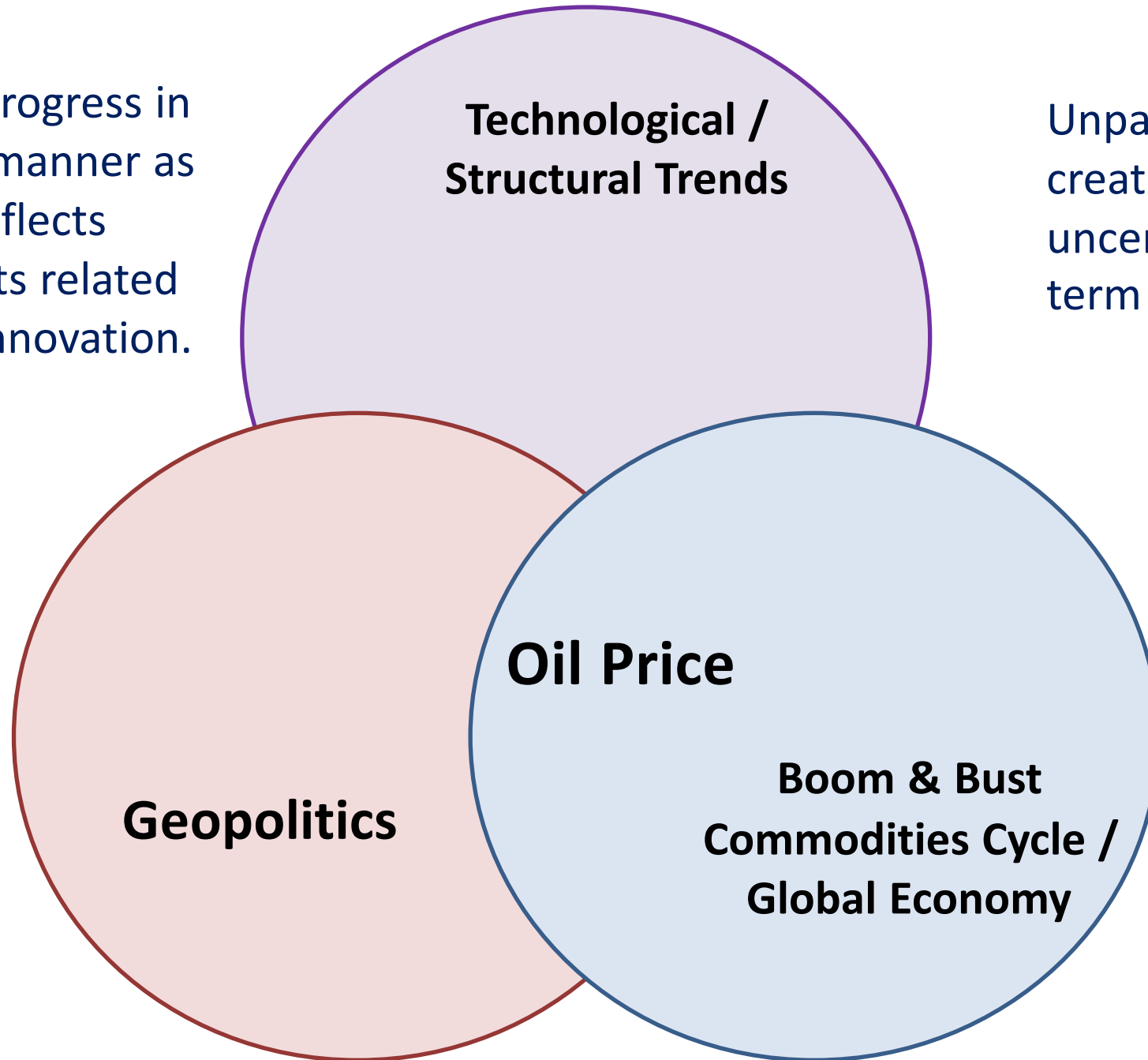


Energy in U.S.-China Relations

- § U.S. trade and national security policy focused increasingly on China 2025 industrial strategy
- § China's strategic oil importer disadvantage to U.S. prompting Beijing to promote green energy pivot including advanced, vehicles challenge
- § Trump administration initiating a more defensive posture on tech transfer, investment restrictions, but energy regulatory actions backward facing. Less attention being paid to enhancing U.S. R & D and public support for science and start-ups...
- § Trade war has been bad for the LNG business...



Cycle unlikely to progress in exactly the same manner as past cycles as it reflects structural elements related to technological innovation.

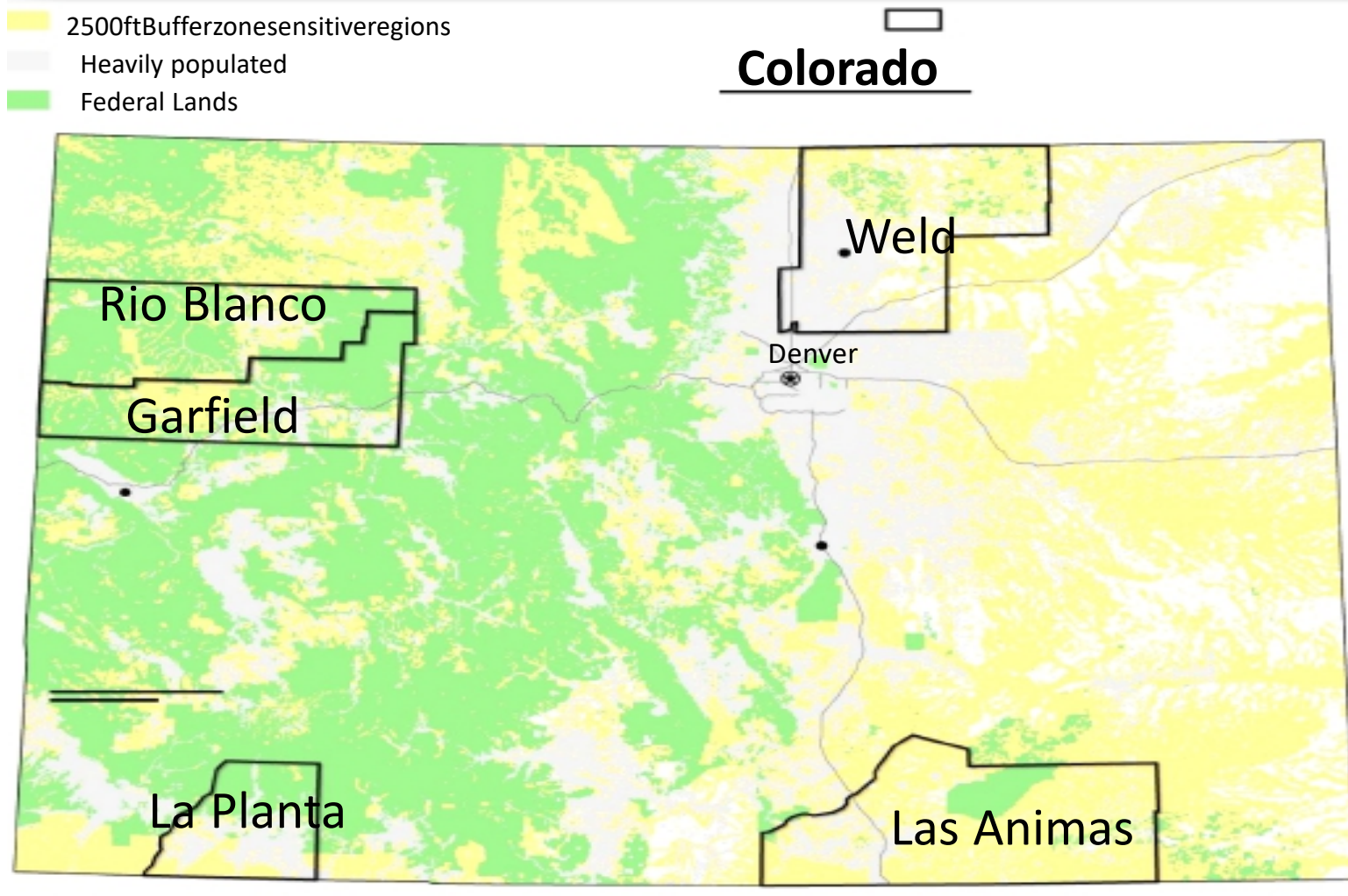


Unparalleled changes creating confusion and uncertainty about long term demand trends.

Momentum for #Keepitintheground?



BackLash Effect



- Environmental rollbacks unleashing momentum to backlash
- U.S. polarization: Politics shifting away from compromise
- Calls for environmental stewardship being replaced with support for outright bans
- Examples: Colorado 2,000 foot restriction ballot initiative and California proposed shut-in of oil production



Technology Revolution is ushering in exponential gains in productivity, via transportation logistics, automation, big data, material science and biotech, artificial intelligence, 3-D printing.

This revolution dramatically change the way we produce, sell and use energy.



For Energy, the biggest energy impact may be when Digital and Manufacturing 4.0 meets the supply side in the Permian...SOURCE: MCKINSEY & CO.

Water management optimized basin-wide, run from a digital “control tower” keeping trucks moving and safe

Teams use VR/AR goggles to inspect equipment and wells and safely communicate hands-free

Autonomous robots strengthen safety by inspecting, alerting operators and intervening in emergencies

RPA-enabled finance to manage royalty calculations and all daily profit calculations
§ Digital workforce management to ensure right people at the right places
§ Digital procurement ensuring standard materials show to site on time, consistent with contract

Streamlined digital drilling workflows driven by iPads and augmented reality

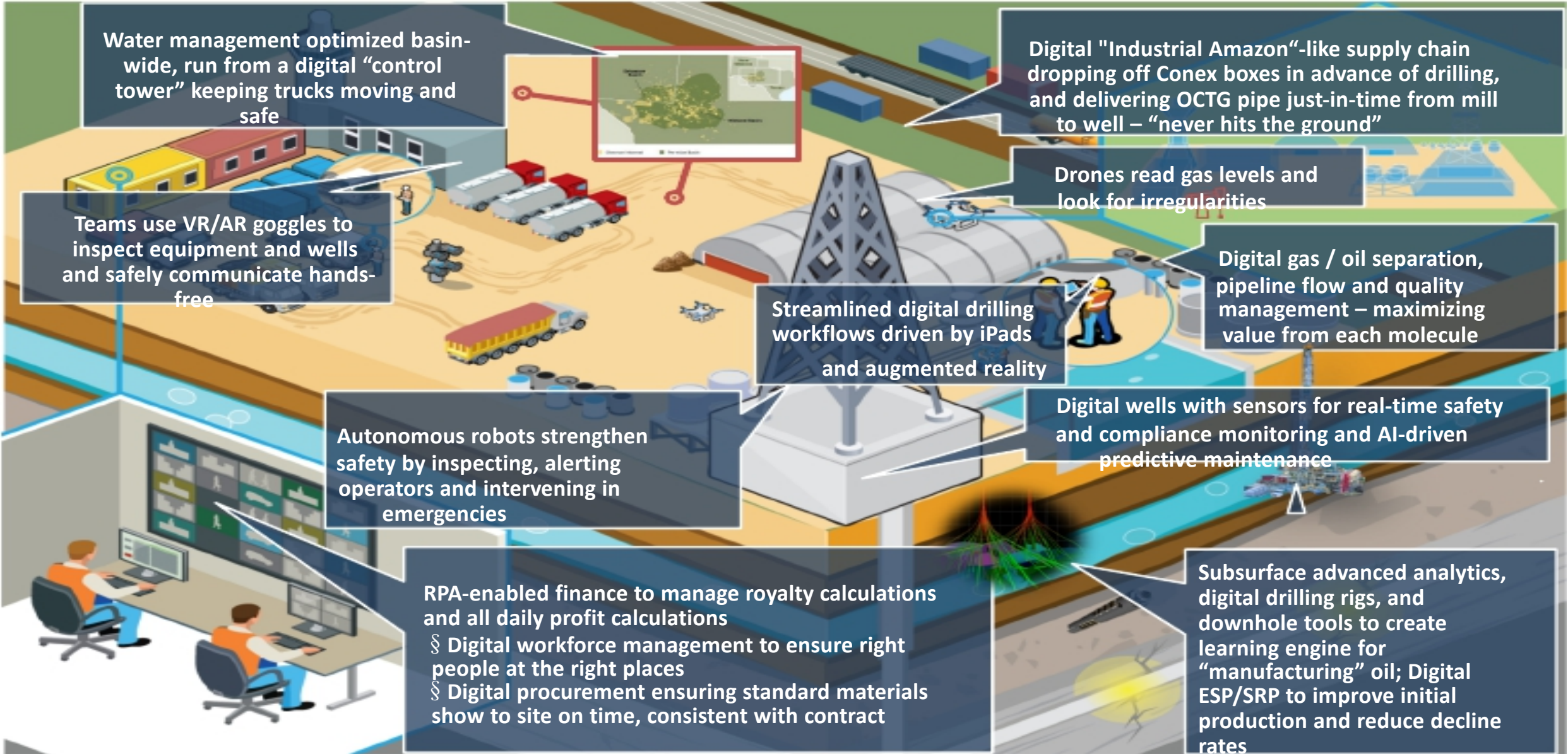
Digital “Industrial Amazon”-like supply chain dropping off Conex boxes in advance of drilling, and delivering OCTG pipe just-in-time from mill to well – “never hits the ground”

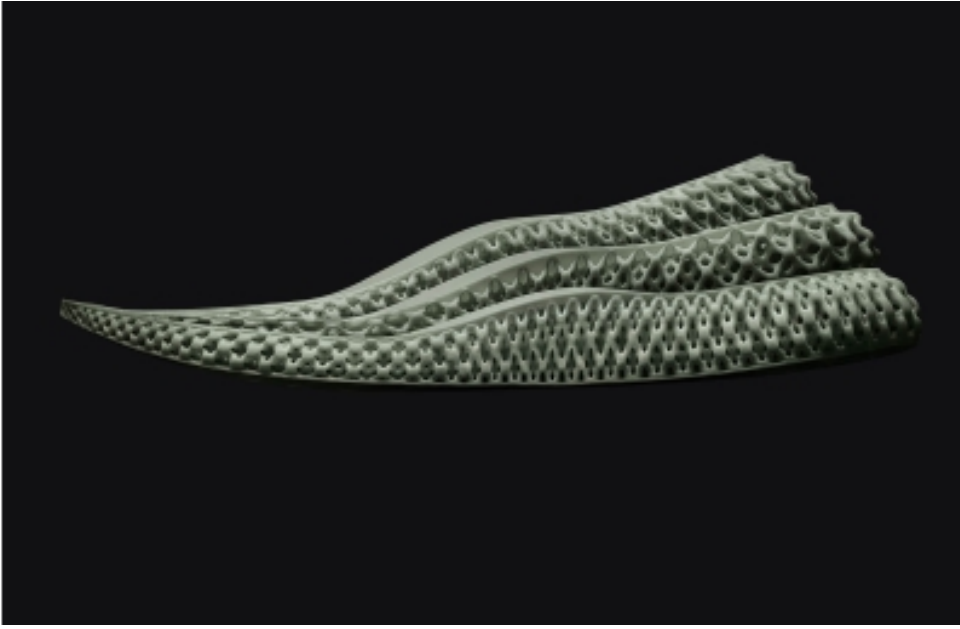
Drones read gas levels and look for irregularities

Digital gas / oil separation, pipeline flow and quality management – maximizing value from each molecule

Digital wells with sensors for real-time safety and compliance monitoring and AI-driven predictive maintenance

Subsurface advanced analytics, digital drilling rigs, and downhole tools to create learning engine for “manufacturing” oil; Digital ESP/SRP to improve initial production and reduce decline rates

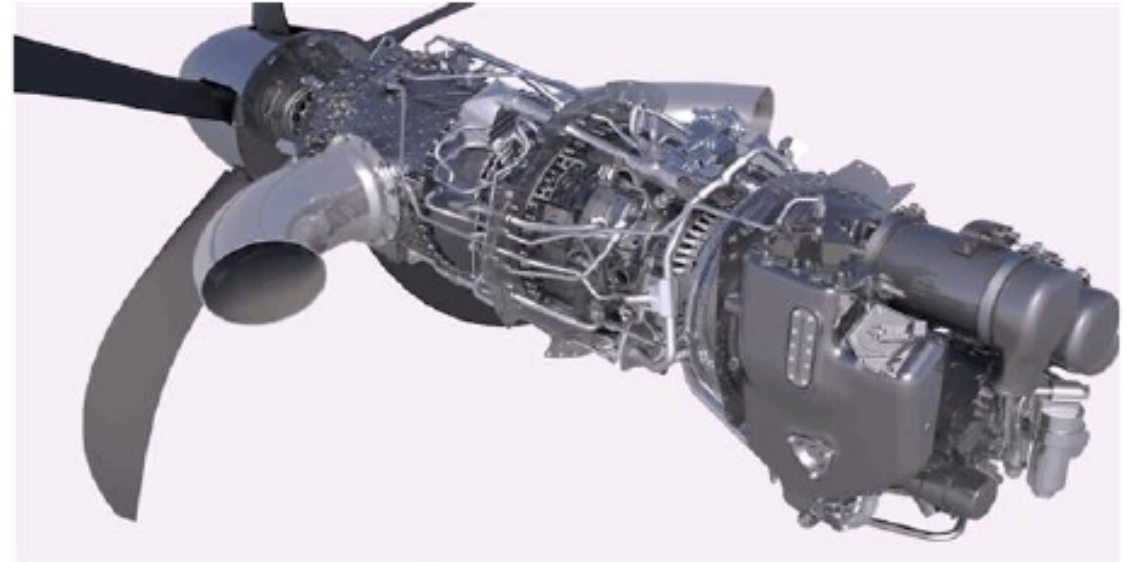




3 D printing will disrupt manufacturing as well as supply chains in ways that are not well understood.

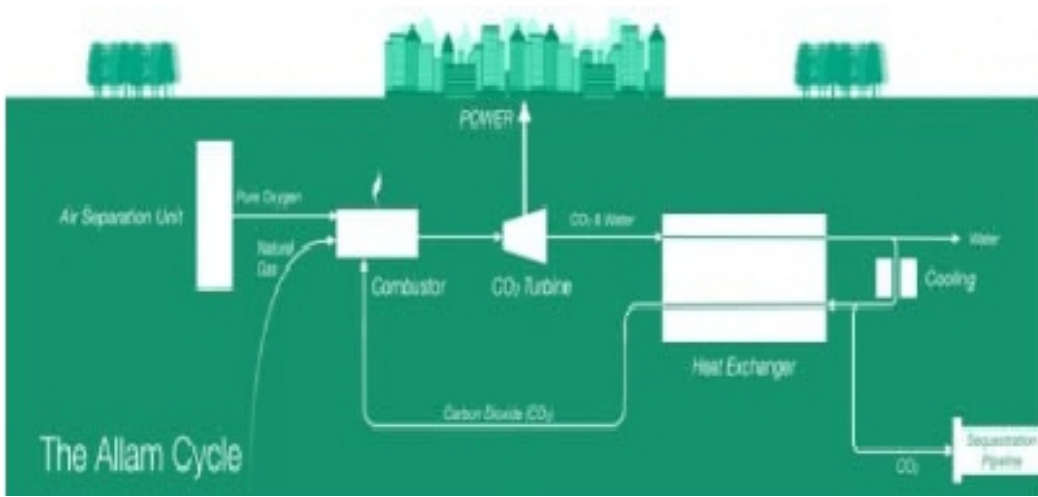
The Denali engine has 12 parts vs its predecessor with 855 parts.

Adidas plans to launch sneakers made via 3 D printing which means they won't Be produced in southeast Asia and shipped By truck, Boat and rail But made and delivered right here in the U.S., mayBe some day soon By drone or electric autonomous vehicle.



Utility of the Future : Balancing authority or integrator

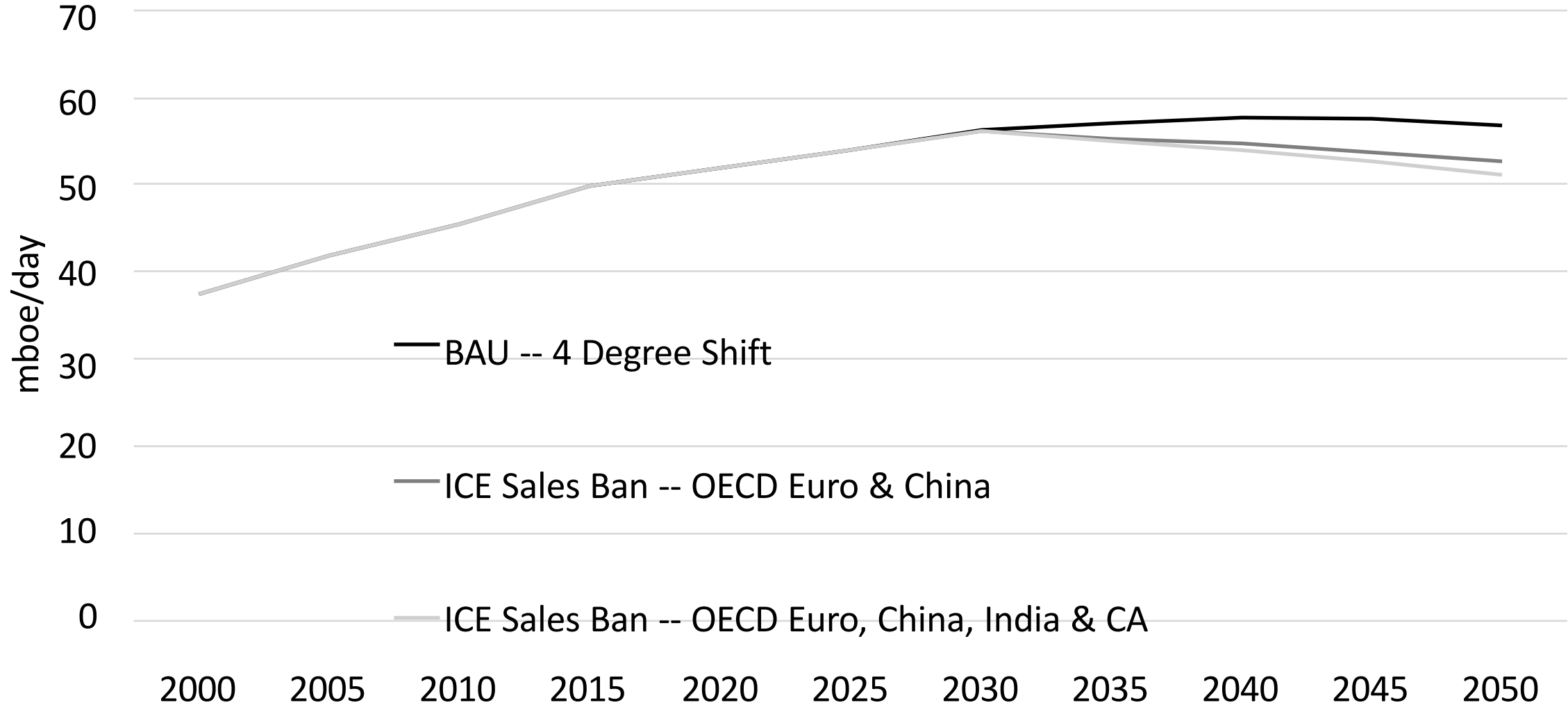
Today's utility is focused on protecting its potentially stranded assets but PG & E's multi-billion \$ in wildfire liabilities is a warning that much of this infrastructure and distribution system is already obsolete.



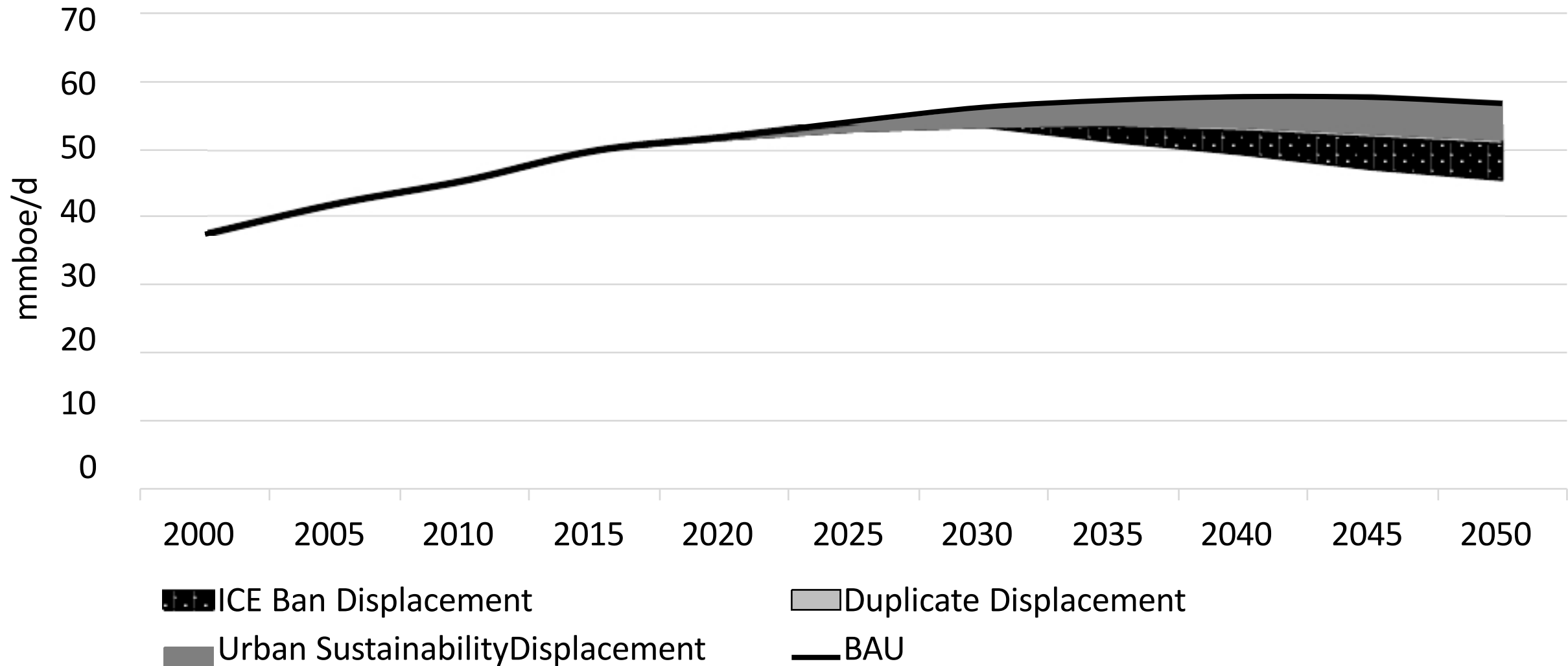
There are real drivers to technology revolution unrelated to climate policy

- **National industrialization policies: Global cost reduction and technology innovation competition**
- **Urbanization**
- **Congestion!**
- **Cities – Sustainability and livability, pedestrian centers and urban road pricing policies**
- **Air pollution, air pollution, air pollution**
- **Optimized freight and other logistics-driven big data applications**
- **Rise in last mile delivery services**
- **Demographic trends in countries with declining populations**
- **Millennial behavior change**

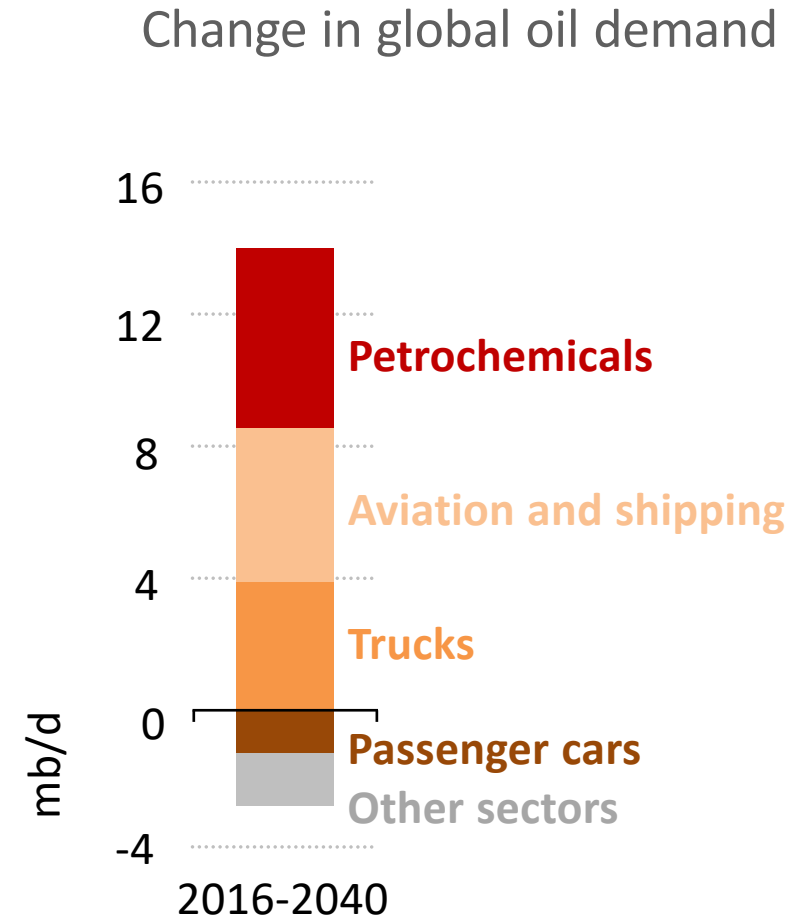
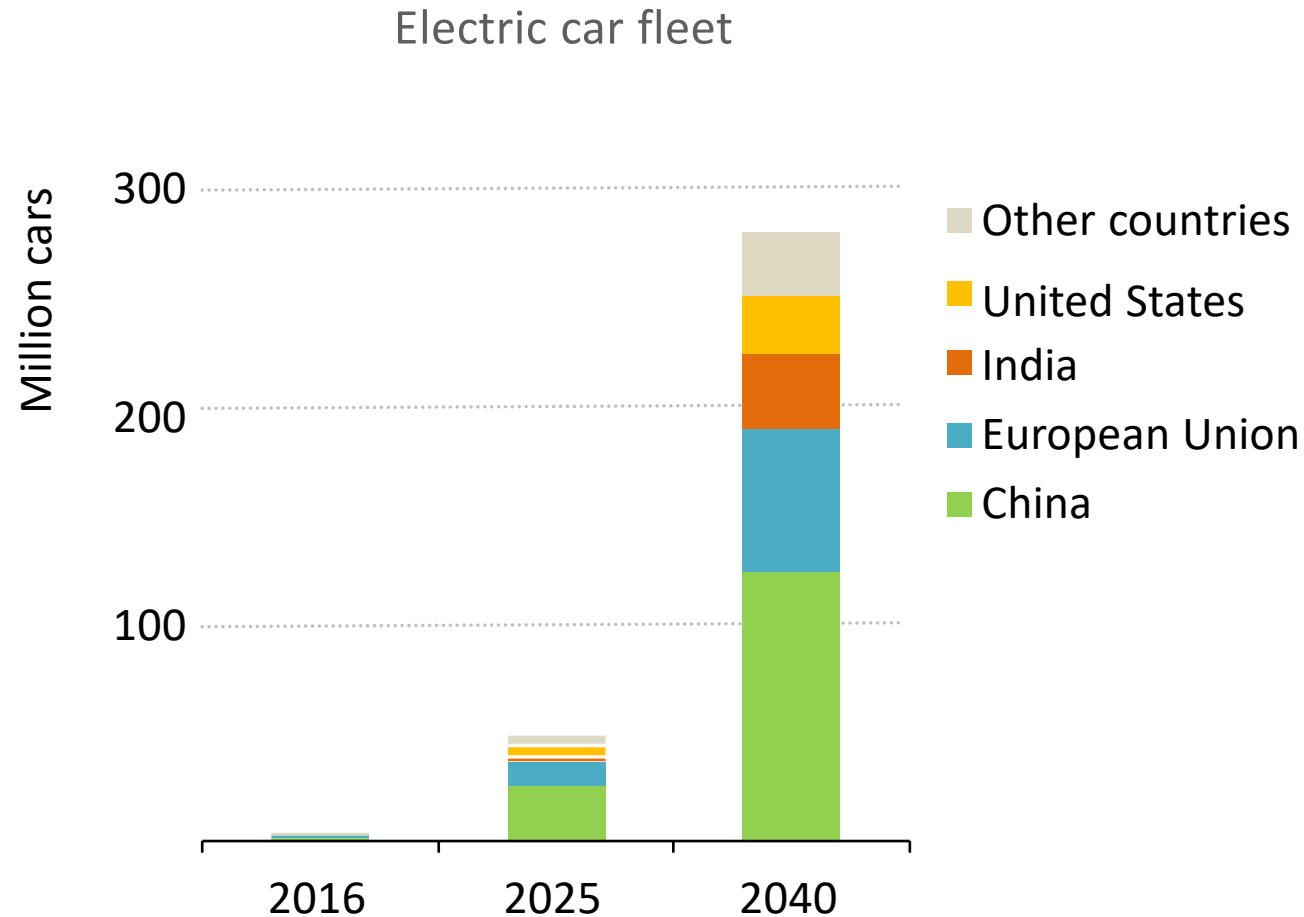
Planned ICE Engine Bans Will Peak Demand



What if cities got serious about closing off access for passenger cars?



EVs are on the way, but IEA says oil demand will keep rising



Electric cars are helping to transform energy use for passenger cars, slowing the pace of growth in global oil demand: however, trucks, aviation, shipping & petrochemicals keep oil on an rising trend

It's not just about EVs

Peak Oil Demand and Plastics

McKinsey & Co. study finds that if global plastics recycling increases from 8% currently to 20% by 2035 and the circular economy movement successfully achieves a 5% reduction in plastics packaging, oil demand for use for chemicals would be 2.5 million barrels a day lower than a business as usual forecast where per annum growth is equal to or slightly higher than GDP growth.

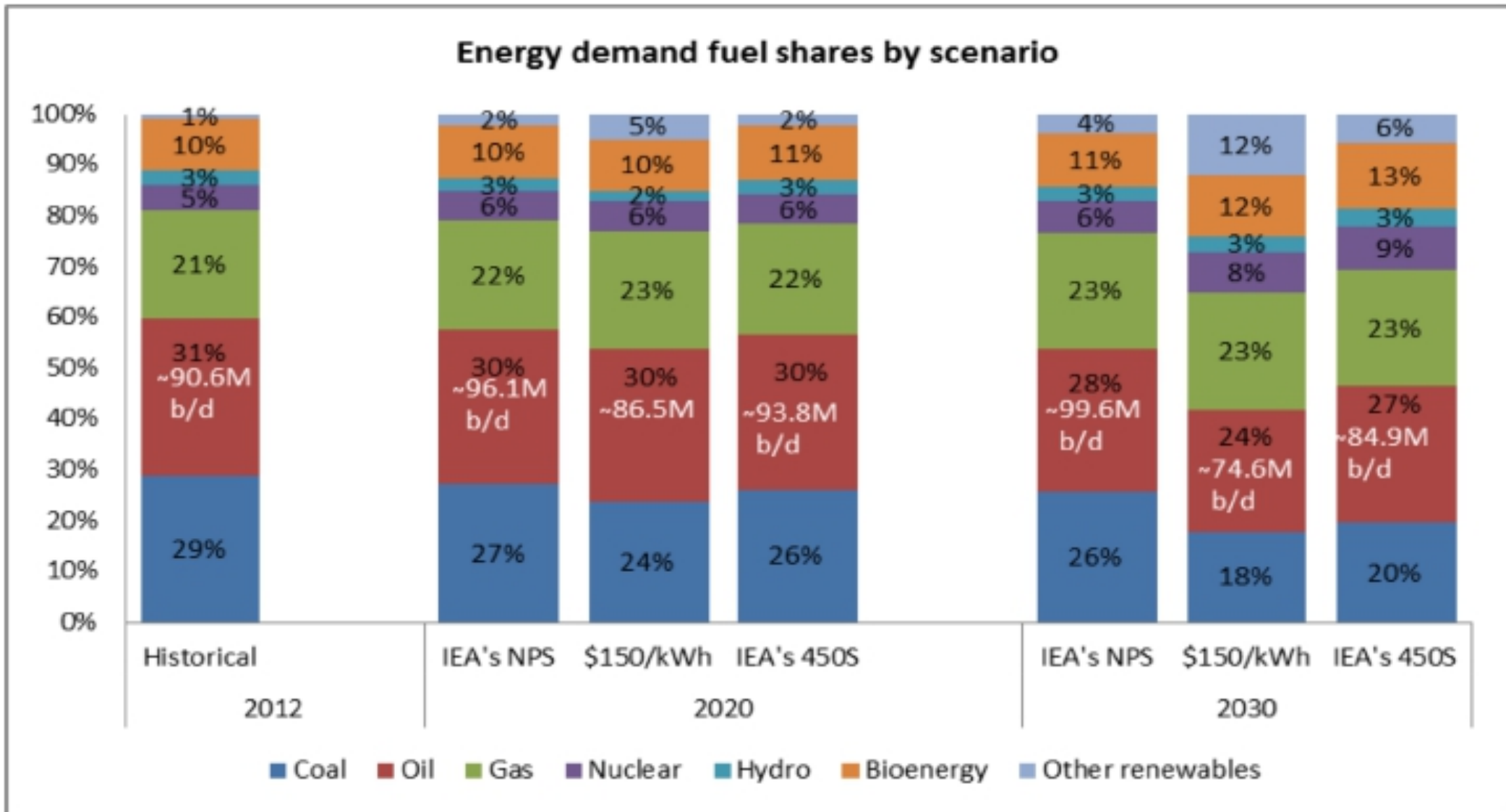


Three strategies to transform the global plastic packaging market



World Economic Forum and Ellen MacArthur Foundation, with analytical support from SYSTEMIQ The New Plastics Economy - Catalysing action (2017, www.newplasticseconomy.org).

It is hard to move global primary energy mix away from fossil fuels quickly, but majors are starting to expect demand to decline by 2030s.



Source: IEA World Energy Outlook 2015, oil company estimates