OLIVER WYMAN

ENERGY BY THE NUMBERS

MARSH GUY CARPENTER MERCER OLIVER WYMAN

MARSH & McLENNAN COMPANIES

The energy industry is at a historical turning point that is analogous to when a global flurry of discoveries at the turn of the 19th century ushered in the modern energy industry. An outbreak of energy-related entrepreneurial innovations worldwide is unleashing a raft of new opportunities and risks that will once again remap the energy sector.

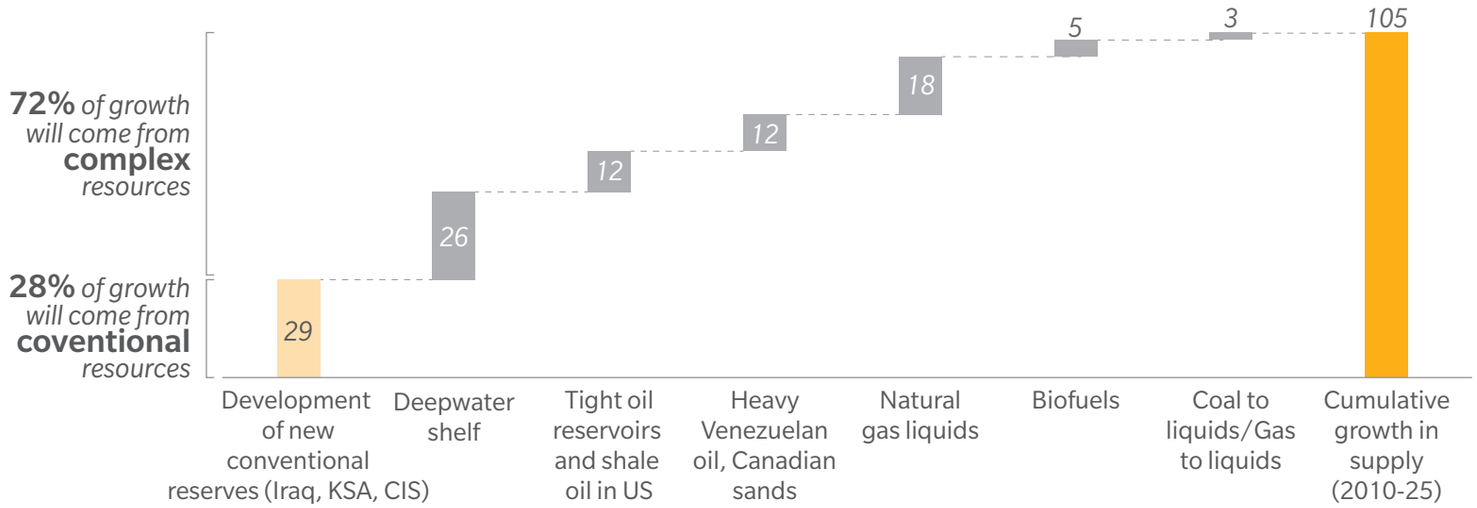
Flip through to see how these shifts will impact not just the energy industry but also every company and person that depends on it.

OLIVER WYMAN

THE MAJORITY OF GROWTH IN HYDROCARBON SUPPLY IS SHIFTING TO **COMPLEX RESOURCES**...

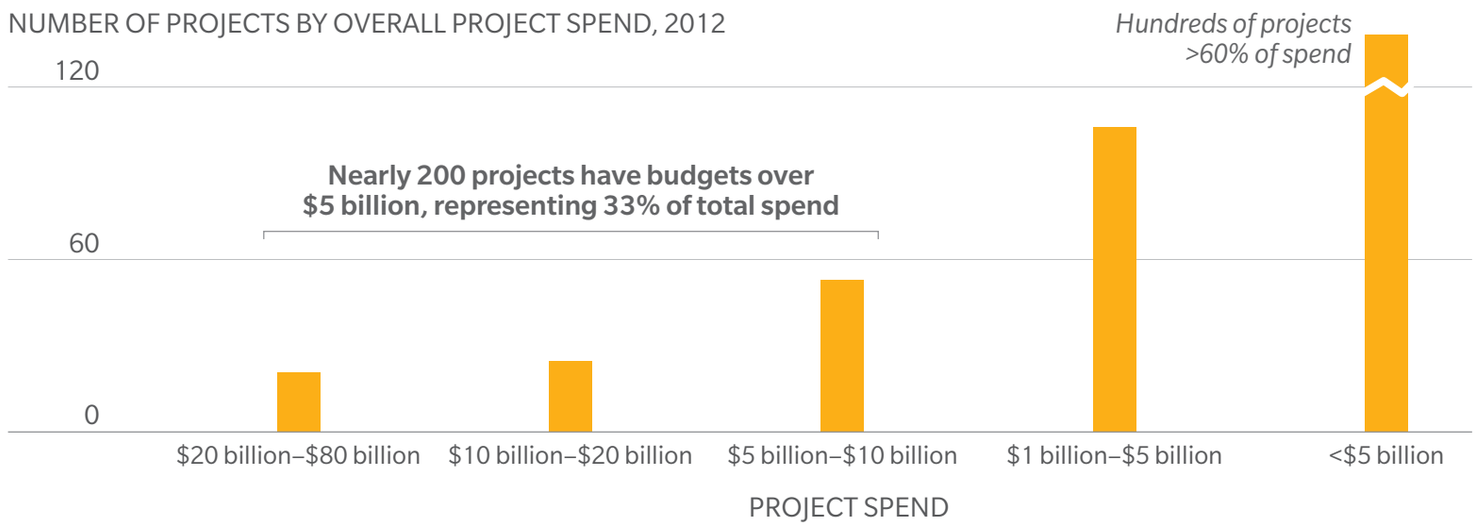
CUMULATIVE FORECASTED GROWTH IN SUPPLY OF LIQUID HYDROCARBONS

IN MILLION BARRELS PER DAY, 2010–2025



OVERALL PROJECTS BY SIZE

NUMBER OF PROJECTS BY OVERALL PROJECT SPEND, 2012

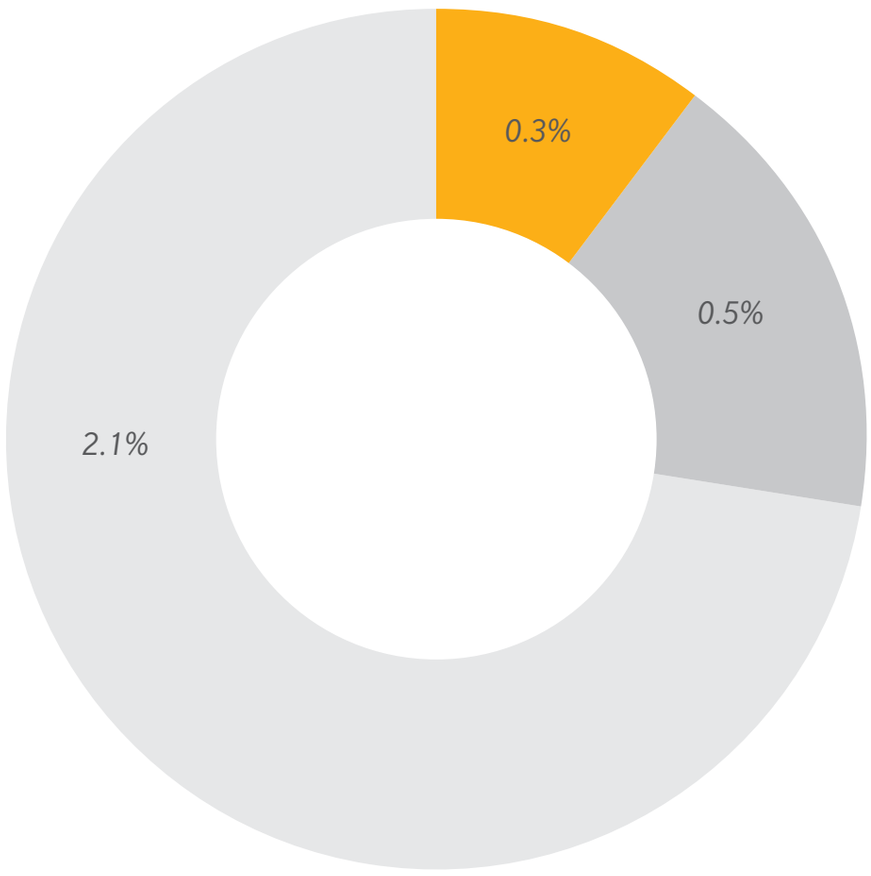


Source: IEA, IHS CERA, IHS Herold, Oliver Wyman analysis.

NATIONAL OIL COMPANIES INVEST MORE IN RESEARCH AND DEVELOPMENT, BUT **ISSUE FEWER PATENTS** THAN PUBLICLY TRADED FIRMS

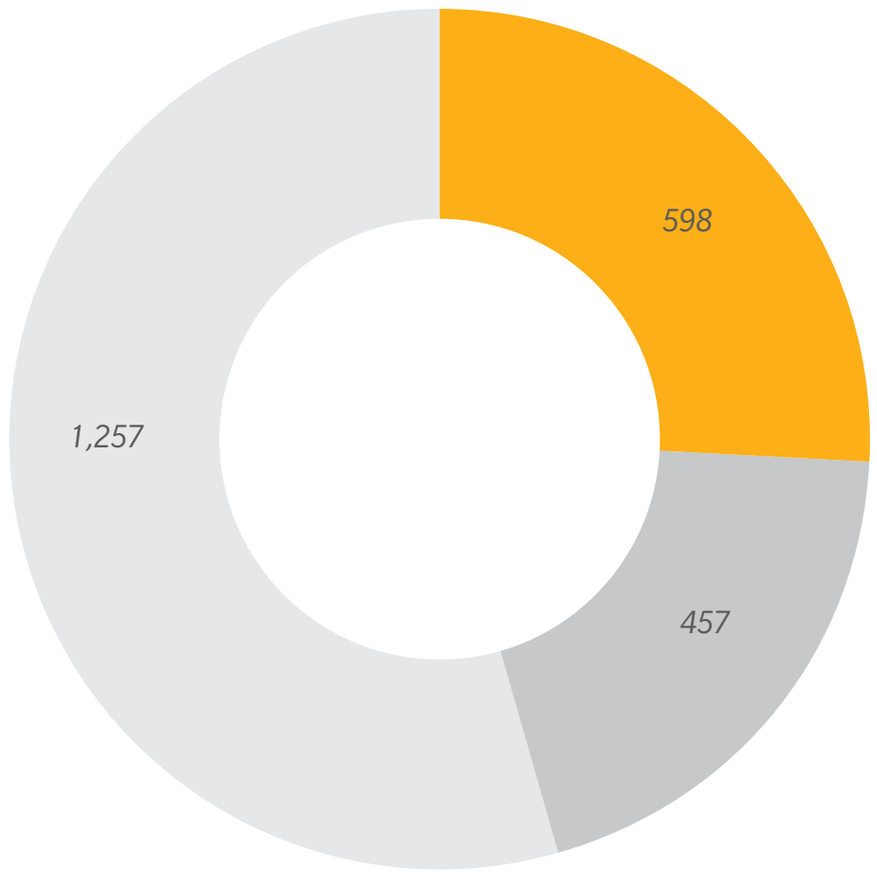
RESEARCH AND DEVELOPMENT INVESTMENTS BY COMPANY TYPE

PERCENT OF SALES, 2011



PATENTS ISSUED BY COMPANY

NUMBER OF PATENTS ISSUED, 2012

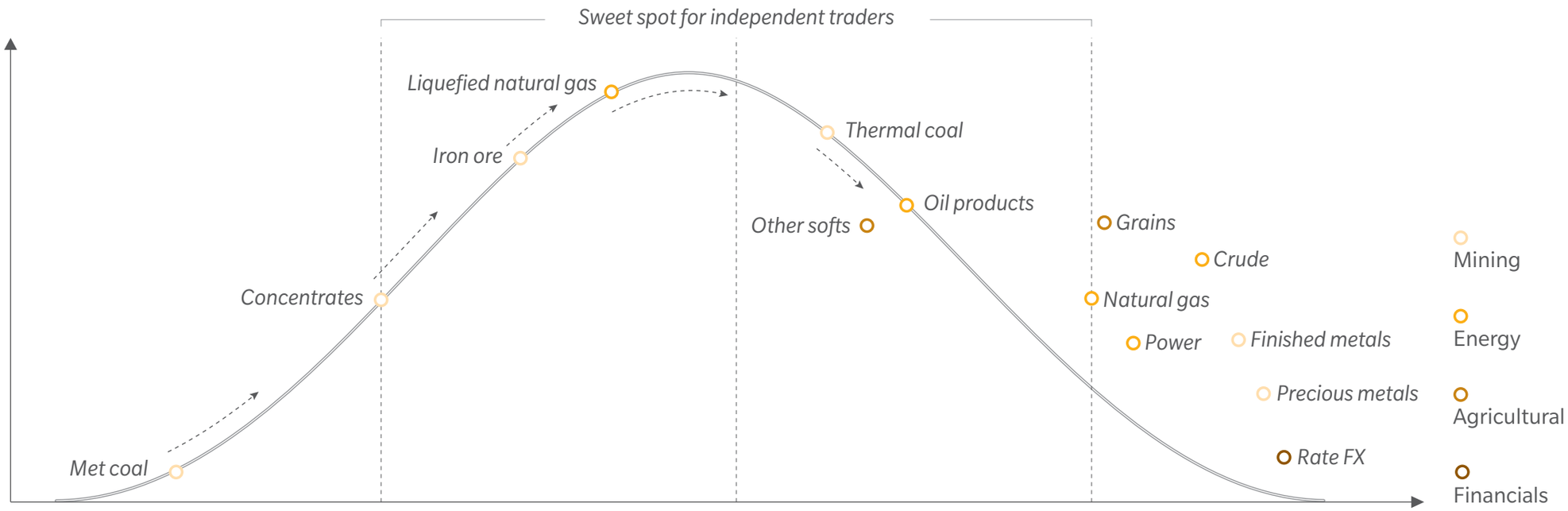


Source: FactSet, Energy Evolution, company reports, Oliver Wyman analysis.

TRADING MARKETS MATURE

SOME COMMODITIES TRADED MOST PROFITABLY BY INDEPENDENT TRADERS ARE MOVING OUT OF THE "SWEET SPOT"

TRADING ATTRACTIVENESS (MARGIN AND VOLUME CONSIDERATIONS)

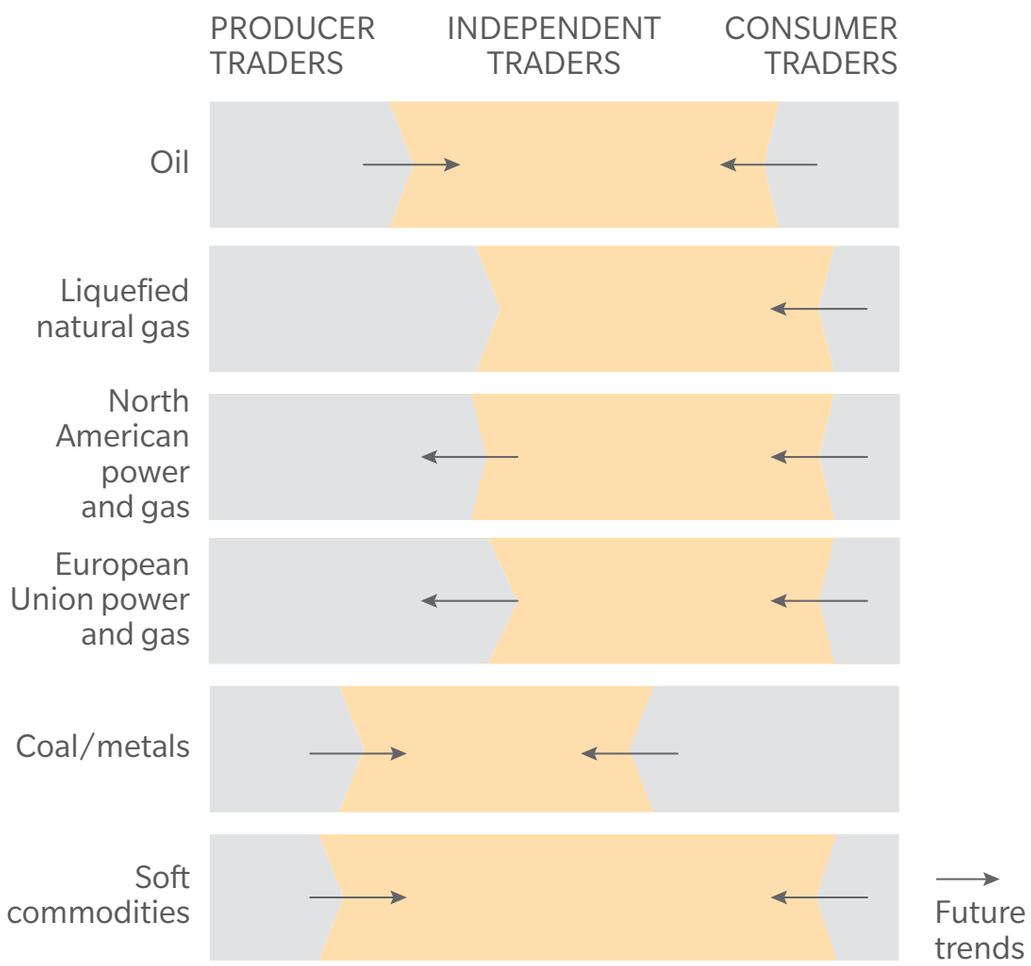


ILLIQUID – NOT TRADED	SEMI-LIQUID	LIQUID	NEARLY PERFECT MARKETS
• Difficult to enter and exit, potentially high margins • Natural playing ground of asset-backed traders and marketing units • Met coal slowly developing into a commodity	• Attractive for traders who are able to secure structural longs and build network • Iron ore slowly joining metal concentrates activities • LNG becoming more and more liquid and accessible, still high margin	• Liquidly traded, often the sweet spot for commodity traders because of high margins and big volumes	• Decreasing margins, but high volumes. High barriers for new entrants • Dominated by established players

Source: Oliver Wyman analysis.

HOMOGENIZATION OF MARKET PLAYER STRUCTURE

MARKET STRUCTURES ACROSS COMMODITIES WILL FURTHER HARMONIZE, LEADING TO A THREE-TIER MODEL



MARKET PLAYER STRUCTURE WILL BE MORE HOMOGENEOUS IN THE FUTURE, ON THE BACK OF SCALE REQUIREMENTS AND VALUE-DRIVEN TRADING BUILD-OUT

POTENTIAL TREND IN PLAYER STRUCTURE

FRAGMENTED MARKET STRUCTURE

- Oil and gas
- Power

with 20+ significant players

Scale-driven consolidation

TREND TO HOMOGENEOUS PLAYER STRUCTURE

- Few significant players on long and short side
- 2-3 independent players per asset class

CONCENTRATED MARKET STRUCTURE

- Metals and minerals
- Softs

with 3-5 significant players

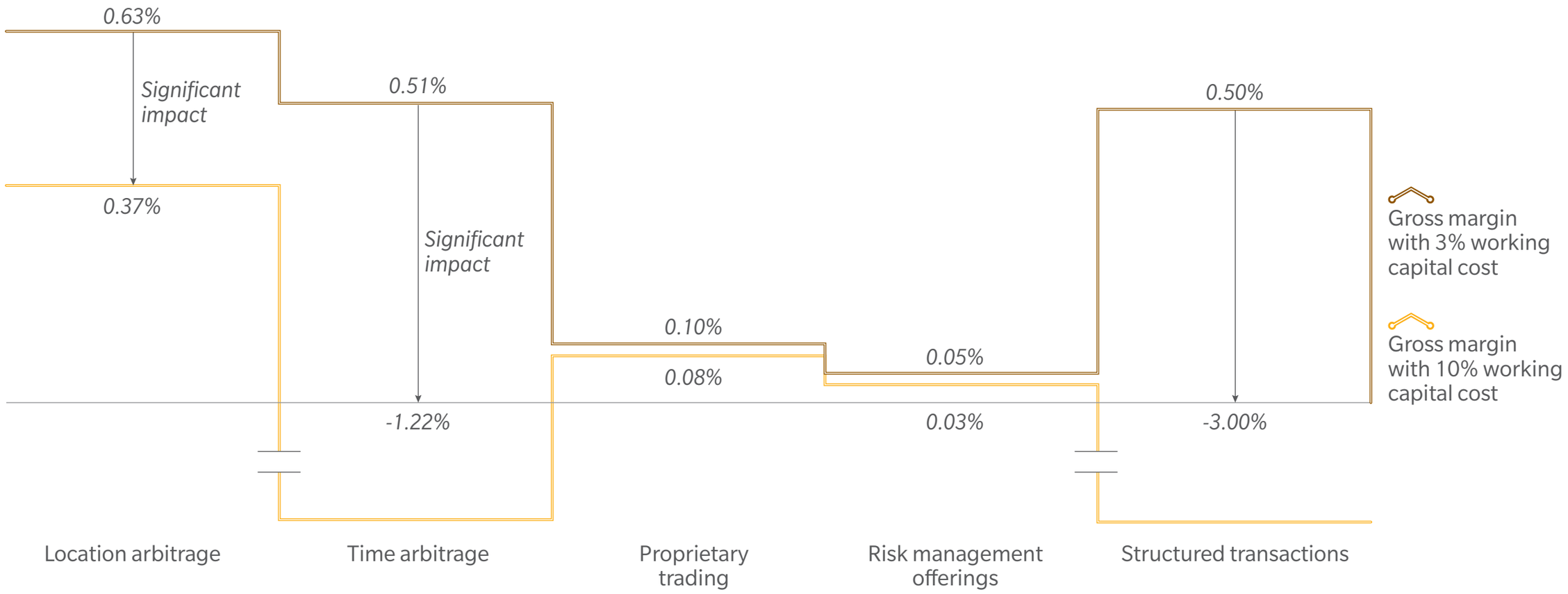
Value-driven trading build-out

Source: Oliver Wyman analysis.

COMPRESSED MARGINS

STANDARD TRADING PLAYS WILL BECOME SIGNIFICANTLY LESS ATTRACTIVE IF TRADERS ARE CHARGED MORE FOR WORKING CAPITAL

IMPACT OF A CHANGE IN WORKING CAPITAL COST ACROSS STANDARD DEAL TYPES

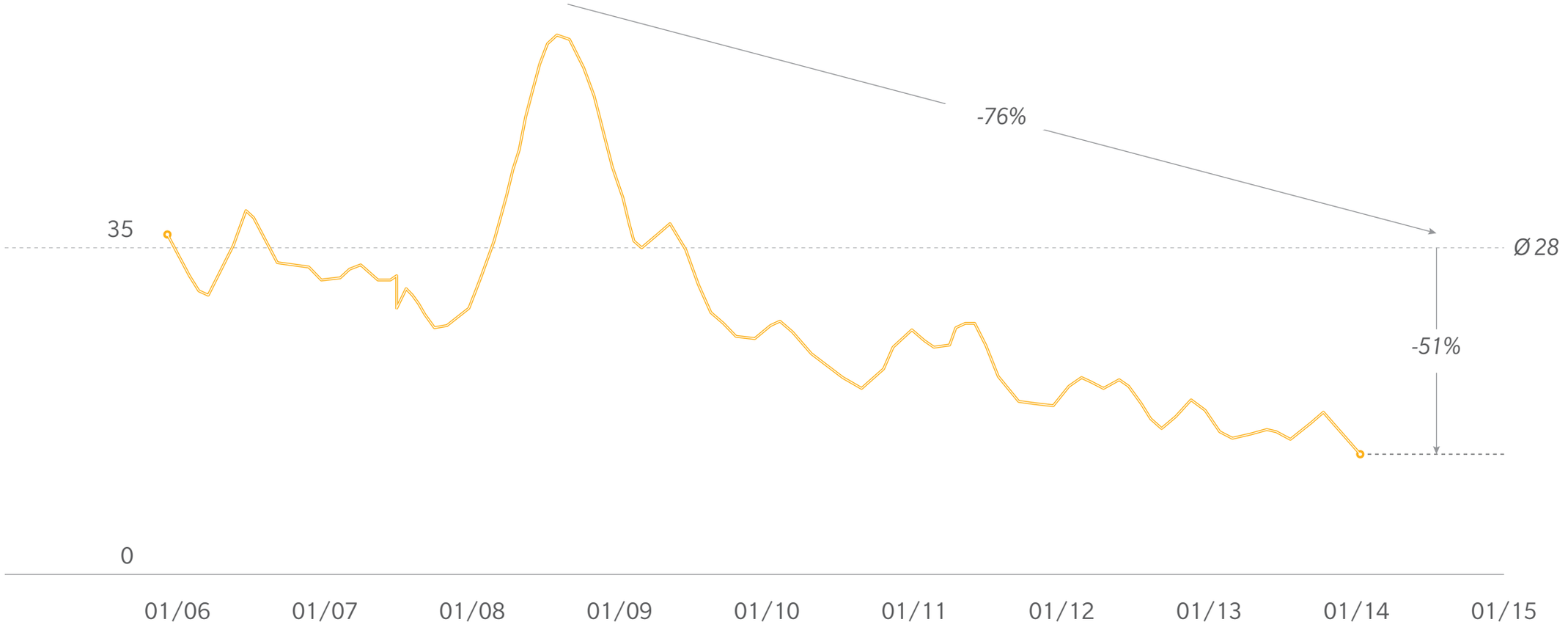


Source: Oliver Wyman analysis.

LOW VOLATILITY

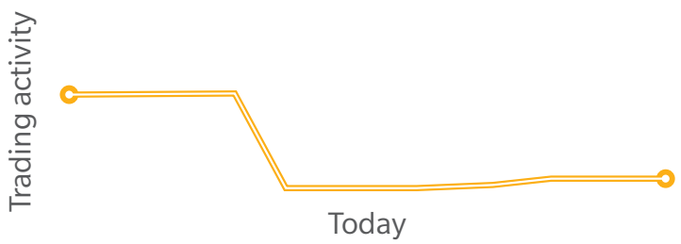
VOLATILITY IS CURRENTLY AT HISTORIC LOWS

AVERAGE ROLLING 60 DAYS IMPLIED VOLATILITY FOR KEY ENERGY FUTURES*
(PERCENT YEARLY STANDARD DEVIATION)



Source: Reuters, Oliver Wyman analysis.
* Average includes: Brent, WTI, ICE Gasoil, RBOB, ULSD, NatGas HH, Nat Gas NBP.

THREE KEY MARKET SCENARIOS

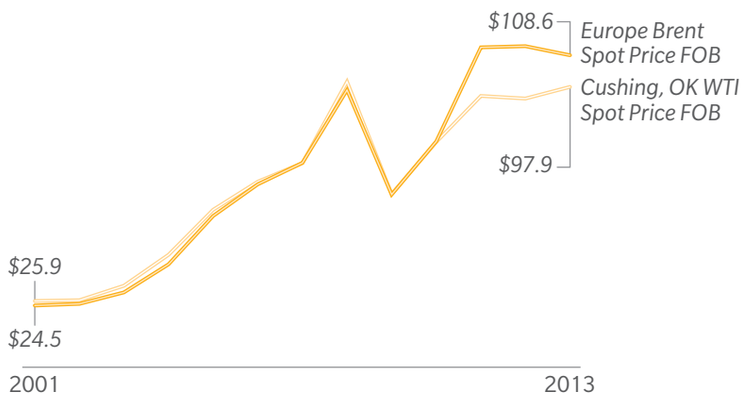
		DESCRIPTION
"TRADING IS NOT WHAT IT USED TO BE" 	**Banks exiting the commodity trading space** **Homogenization of market structure**	• Banks leaving the market, no substitution, limited activity of independents, producer and consumer traders • Alternative usages for capital preferred • Prolonged period of low volatility
"BACK TO NORMAL" 	**Pressure on independent trader model** **Regulator changes (Dodd-Frank, Basel III, IFRS...)**	• Substitution of the banks' activities through producer/ consumer traders • Alternative providers established for RM offerings and market liquidity • Increase to an average level of market volatility
"THE RETURN OF THE BANKS" 	**Commodity market dynamics and oversupplied markets** **Maturing across commodity classes**	• Change in regulation (potential for 3-4 year horizon) and/or engagement of emerging markets banks (BRIC, Singapore, Middle East) • Banks in commodities trading supported by consumer/ producer traders • Increased market volatility

Source: Reuters, Oliver Wyman analysis.

THE OIL MAJORS' DILEMMA

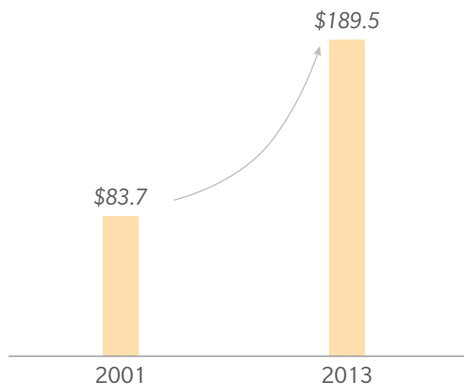
OIL PRICES HAVE QUADRUPLED...

DOLLARS PER BARREL



...BUT OIL MAJORS' OPERATING CASH FLOWS HAVE BARELY DOUBLED...

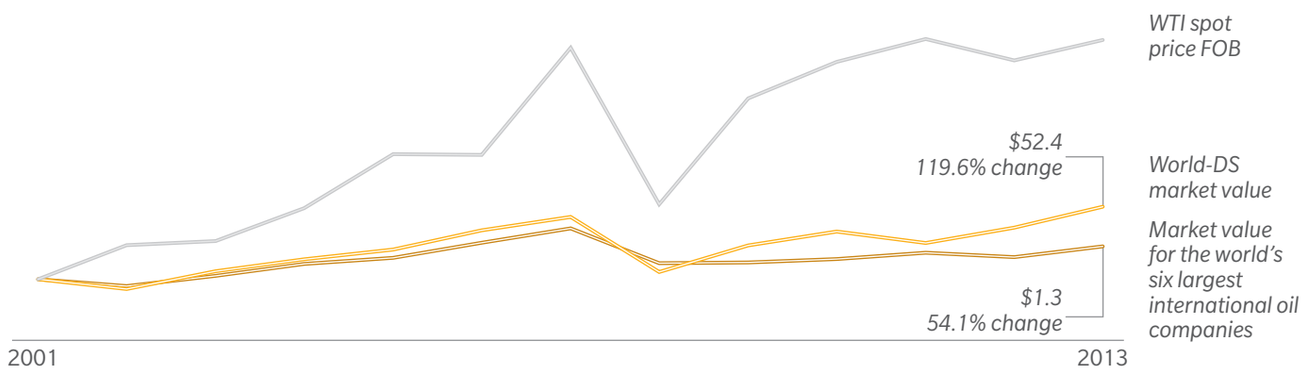
US$ BILLION



Source: Thomson Reuters: Datastream, Oliver Wyman analysis. Calculations reflect the world's six largest international oil companies.

...AND THEIR STOCK MARKET VALUATIONS HAVE LAGGED THE BROADER STOCK MARKET

US$ TRILLION

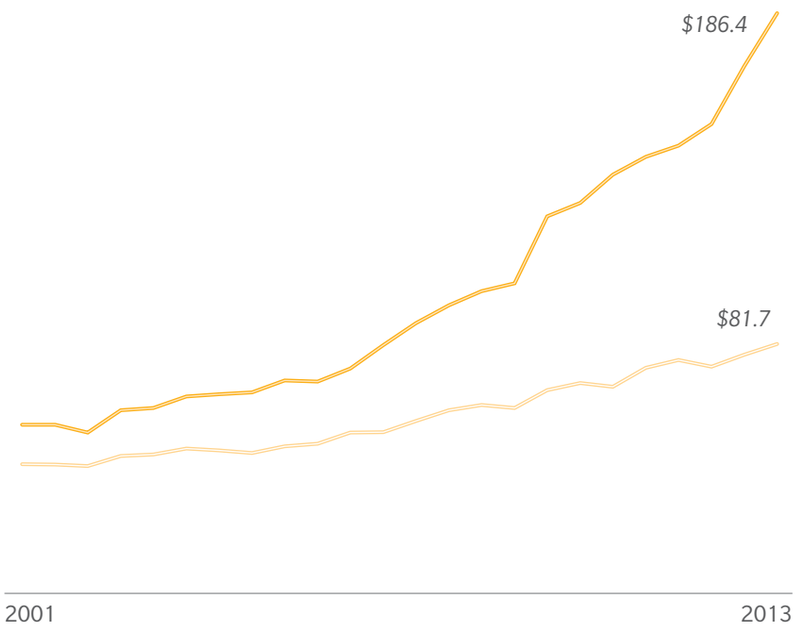


Source: Thomson Reuters: Datastream, Oliver Wyman analysis.

THE OIL MAJORS' DILEMMA

THE RELATIONSHIP BETWEEN CAPITAL EXPENDITURES AND DEPRECIATION FOR MOST INTERNATIONAL OIL COMPANIES HAS FUNDAMENTALLY CHANGED...

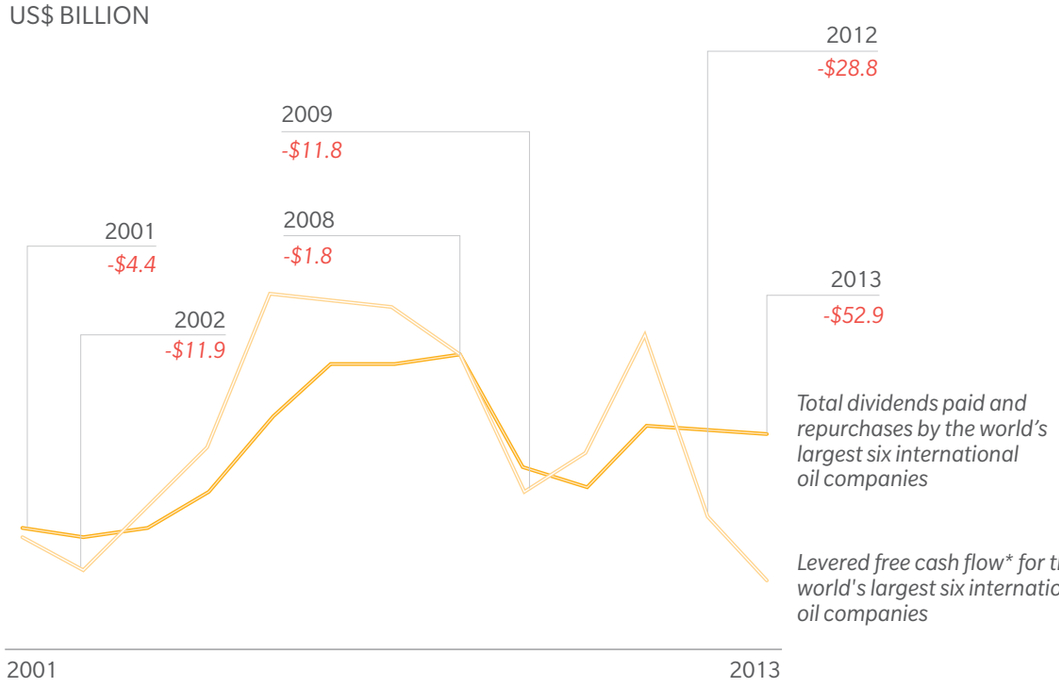
US$ BILLION



Source: Thomson Reuters: Datastream, Oliver Wyman analysis.

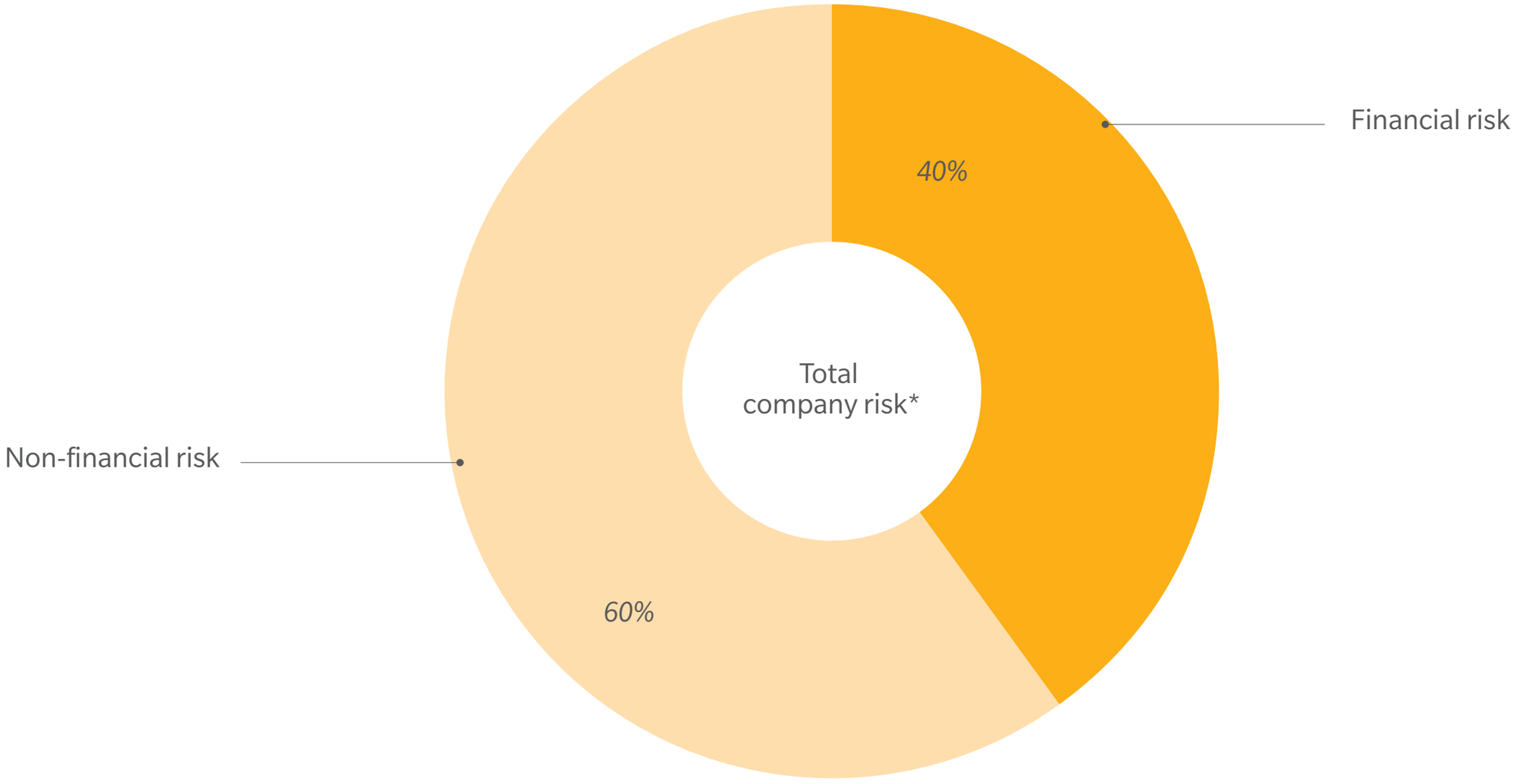
...AND MANY ARE PAYING DIVIDENDS TO SHAREHOLDERS THAT MEET OR EXCEED THEIR FREE CASH FLOW

US$ BILLION



Source: Thomson Reuters: Datastream, Oliver Wyman analysis.
* Levered free cash flow is defined as the amount of cash left over for stockholders and for investments after all obligations are covered.

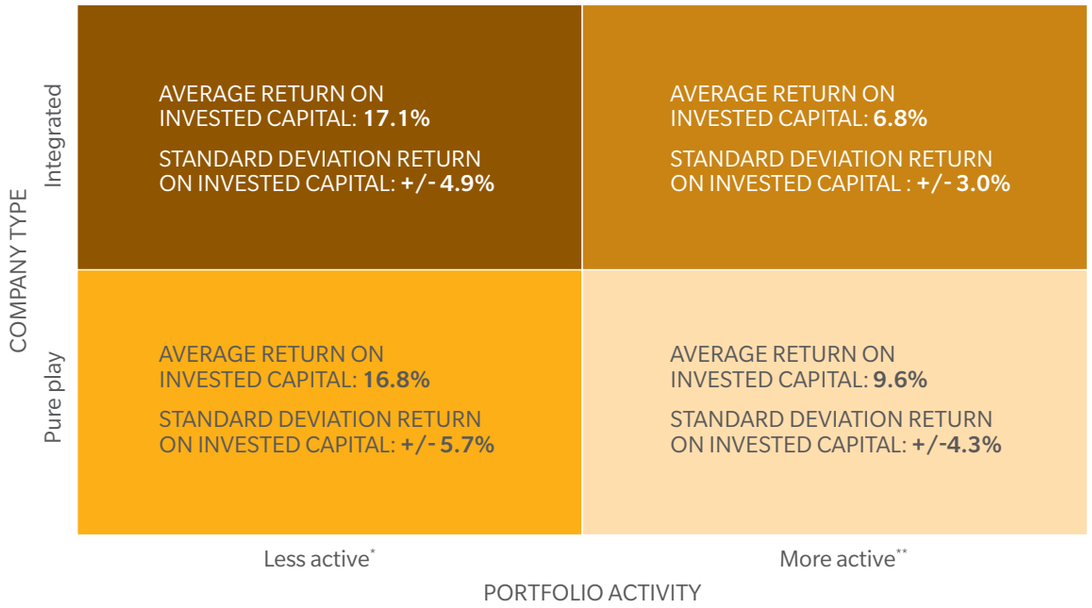
NET RISK EXPOSURE OF INDUSTRIAL COMPANIES



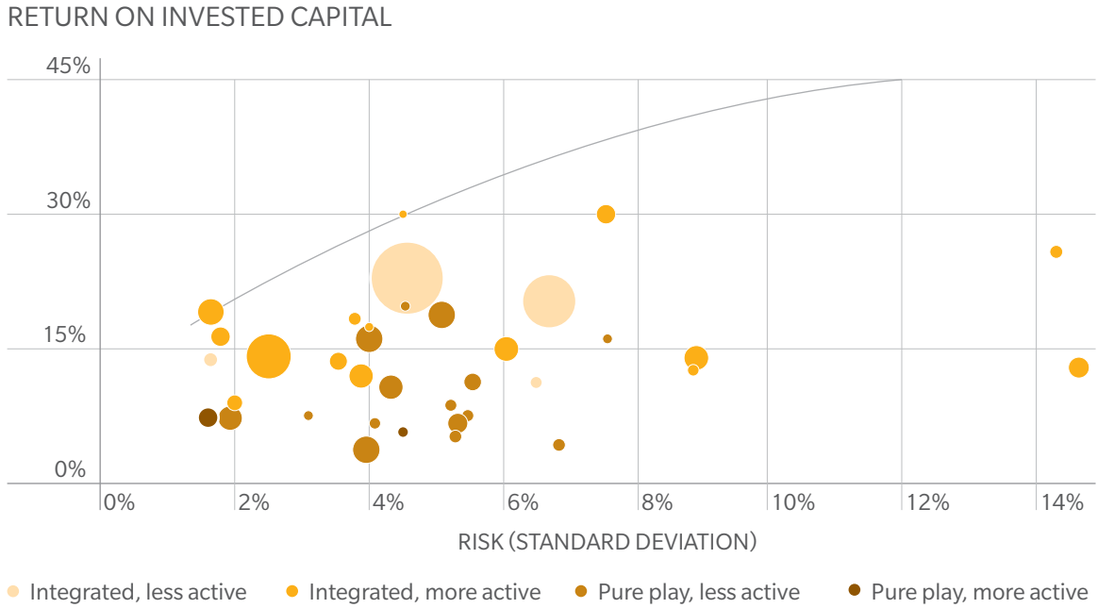
Source: Oliver Wyman analysis.
* Net exposure.

MORE ACTIVE PORTFOLIO MANAGEMENT IS NOT A SUBSTITUTE FOR QUALITY INVESTMENT DECISIONS

THE 40 ENERGY COMPANIES IN THE S&P 500 THAT HAVE DEVOTED A LARGER PERCENTAGE OF REVENUES TO CAPITAL EXPENDITURES AND DIVESTITURES ARE UNDERPERFORMING THEIR PEERS...



...BUT THEY CAN IMPROVE THEIR PERFORMANCE BY OPTIMIZING THEIR PORTFOLIO ALONG A "RISK-RETURN EFFICIENT CORPORATE INVESTMENT FRONTIER"



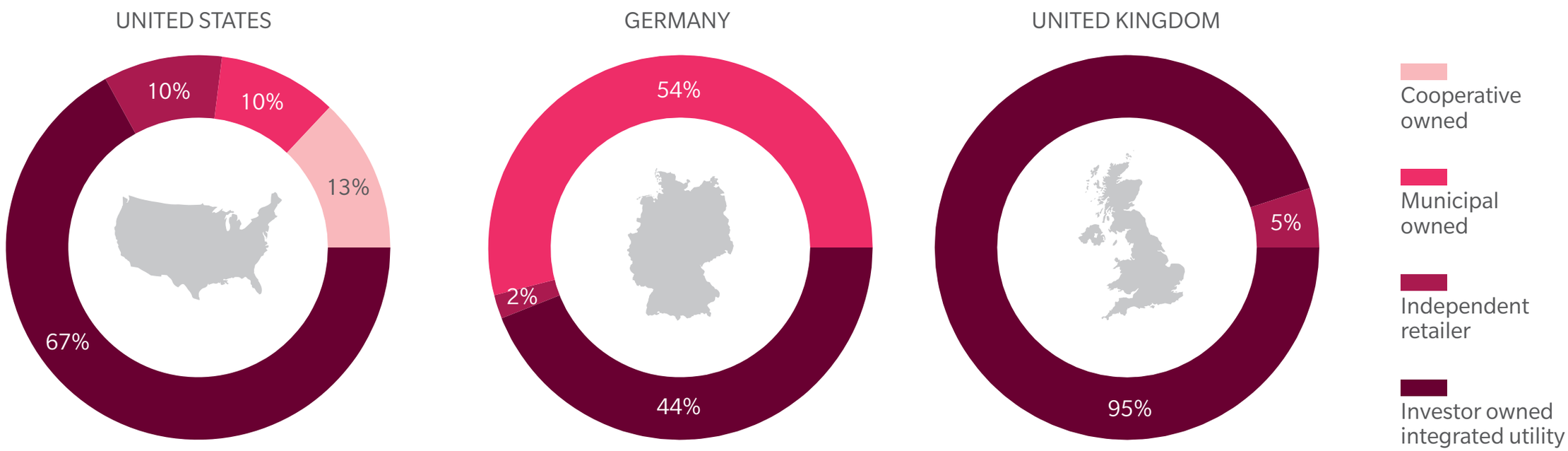
Source: Oliver Wyman market analysis of industrial companies.
* Invest (or divest) less than 30% of annual revenue.
** Investment (divestment) activity = Balancing activity = [Absolute value (capital expenditures) + absolute value (divestitures)]/Revenue return on invested capital =
Earnings before interest and taxes/(Total assets – cash – accounts payable – accounts receivable).

Source: Oliver Wyman market analysis of industrial companies.
* Invest (or divest) less than 30% of annual revenue.
** Investment (divestment) activity = Balancing activity = [Absolute value (capital expenditures) + absolute value (divestitures)]/Revenue return on invested capital =
Earnings before interest and taxes/(Total assets – cash – accounts payable – accounts receivable).

A TALE OF THREE MARKETS

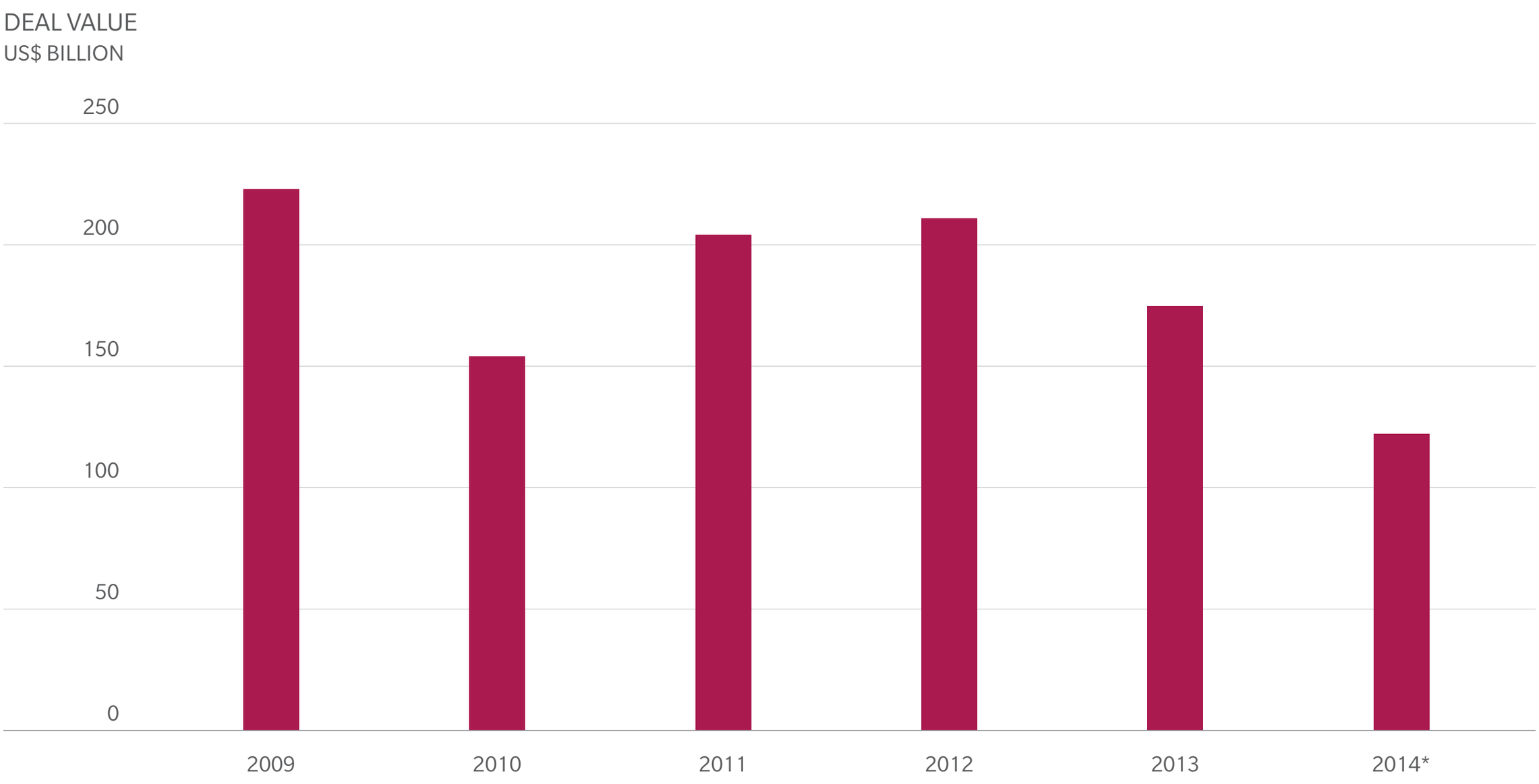
LOCAL UTILITIES ACCOUNT FOR THE MAJORITY OF GERMANY'S INDUSTRY, WHILE THEY REMAIN THE MINORITY IN THE US AND THE UK

PERCENT OF CONNECTED ELECTRICITY CUSTOMERS



Source: Oliver Wyman analysis: EIA, DECC, UKV.

UTILITIES ACQUIRED IN THE PAST FIVE YEARS



Source: Dealogic, Oliver Wyman analysis.
* As of October 17, 2014.

POTENTIAL ALTERNATIVE FUELS FOR AVIATION

SHORT-TERM

HEFA PROCESS
(conversion of natural oils and animal fats into hydroprocessed esters and fatty acids)

Advantage: Already used at commercial scale at several biorefineries.

Challenge: Facilities tend to favor biodiesel production for subsidized ground transportation markets. Jet fuels are produced more opportunistically. Need to reduce refining and conversion costs.

FISCHER-TROPSCH PROCESS
(synthetic fuel from biomass or fossil fuels)

Advantage: Used at commercial scale, with coal and natural gas as feedstocks.

Challenge: Has not yet been proven at commercial scale using biomass as a feedstock.

MEDIUM-TERM

ALCOHOL-TO-JET
(jet fuel from alcohols such as ethanol)

Advantage: Feedstocks include corn, sugarcane, wood chips and agricultural waste.

Challenge: First-generation feedstock supply chain is mature. Additional research and development needed to bring to economic viability. May also require sustainability-certified feedstocks in the future.

CRYOGENIC FUELS
(such as liquefied natural gas)

Advantage: Could cut aviation carbon emissions by about 15 percent and reduce nitrogen oxide pollution by 40 percent.

Challenge: Would require new engines and substantial infrastructure upgrades at airports.

LONG-TERM

ELECTRICITY

Advantage: Lower-cost option; could significantly reduce carbon and pollution from planes, depending on the fuel used to generate electricity.

Challenge: Would require development of electric propulsion systems, sufficiently powerful batteries, airport recharging systems.

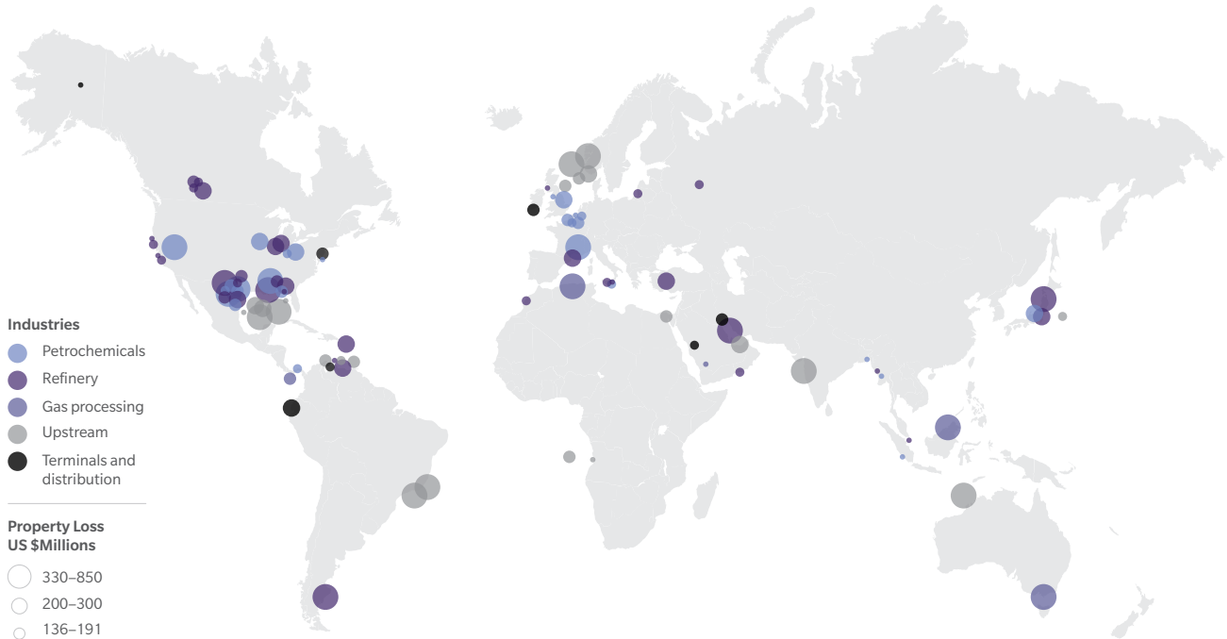
Source: Oliver Wyman analysis.

THE **100 LARGEST LOSSES**

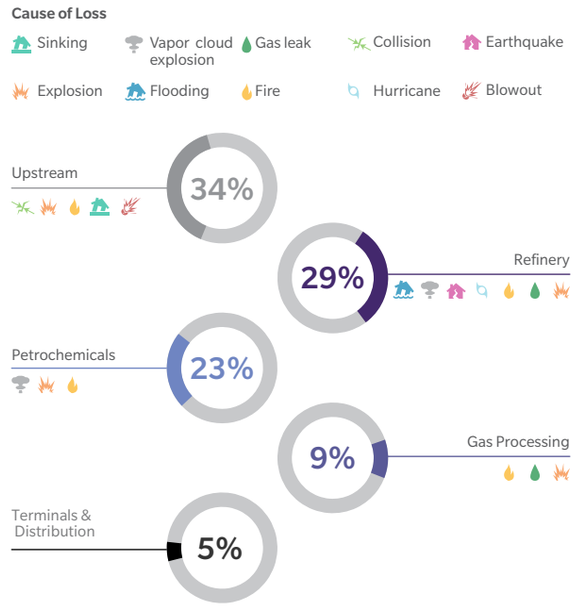
For the 23rd edition of ***The 100 Largest Losses report for the hydrocarbon industry***, Marsh, like Oliver Wyman a subsidiary of Marsh & McLennan Companies, examined the property damage losses suffered globally by the energy industry over the past four decades. These pages summarize the results.

Marsh discovered an outsized concentration of incidents resulting in more losses exceeding $130 million after 1999 than in the preceding three decades. Since 2011 alone, eight new losses have entered the 100 largest losses list. Most of the largest losses did not result from so-called "black swan" events, but instead from the failure of prevention and mitigation measures taken to manage operational risks.

Note that the loss values have been adjusted to reflect the equivalent value of the loss at the end of 2013. And yet, they do not reflect the entire cost to a company's operations, since costs of business interruption, extra expense, employee injuries/fatalities and liability claims are excluded from this analysis.

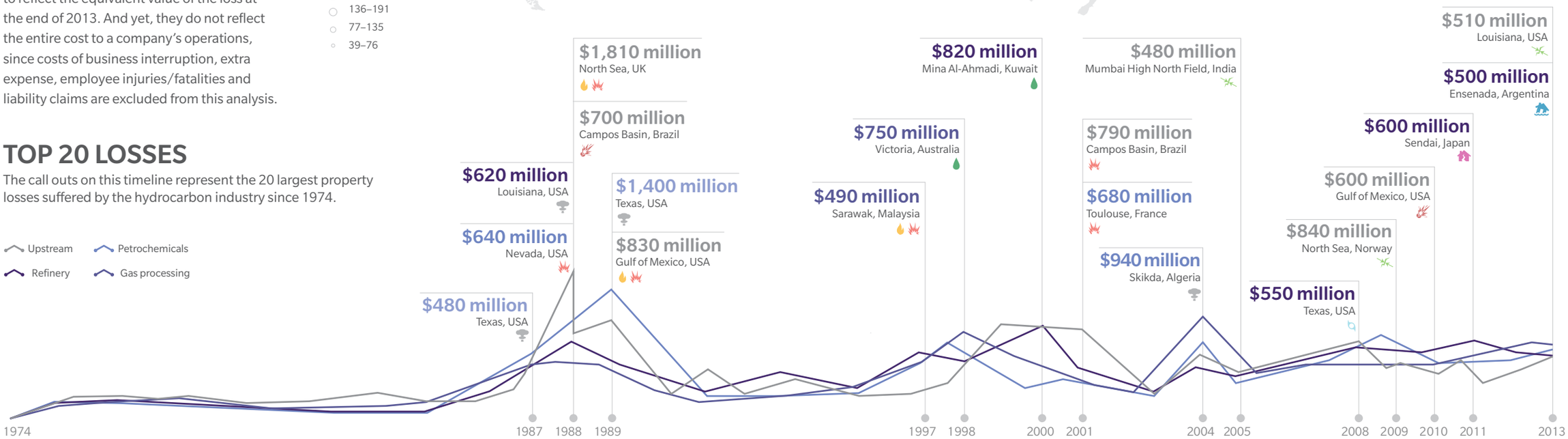


LARGEST LOSSES BY SECTOR



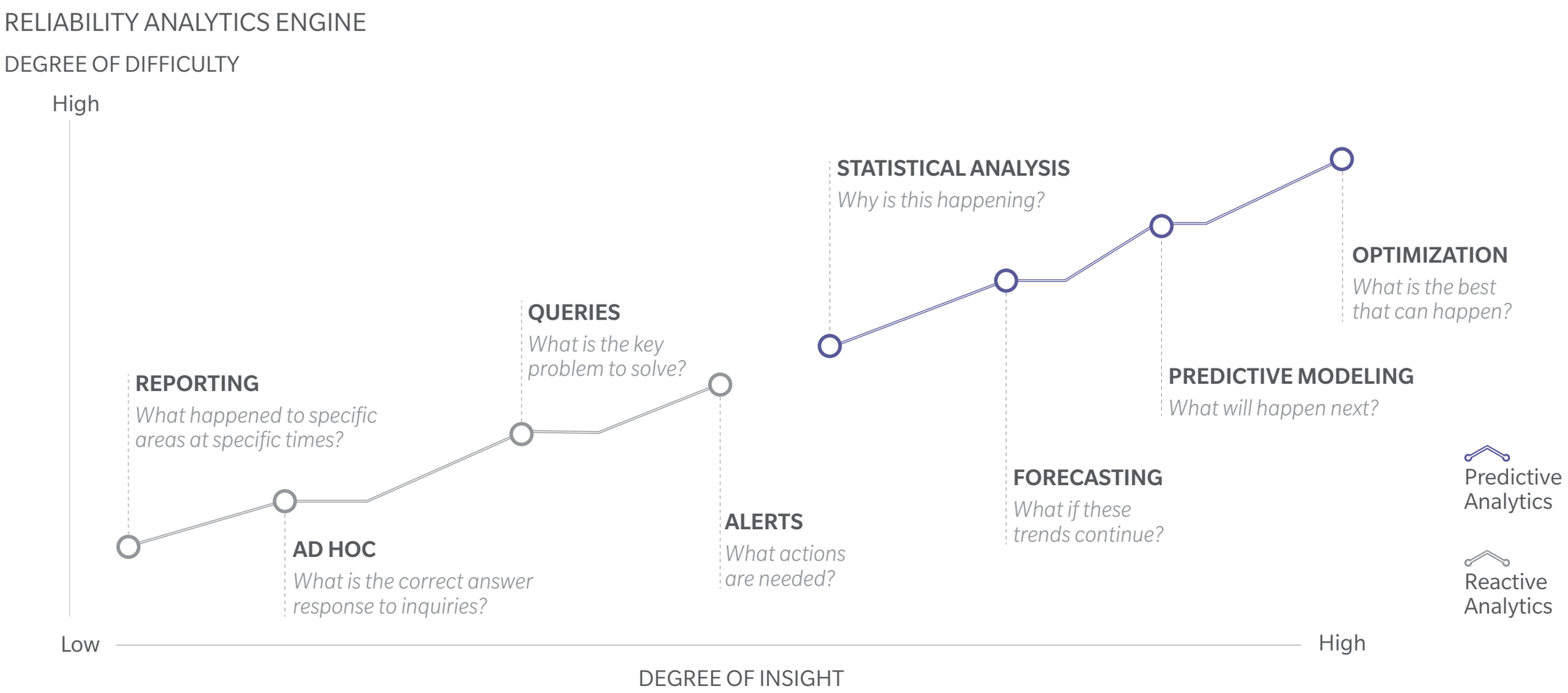
TOP 20 LOSSES

The call outs on this timeline represent the 20 largest property losses suffered by the hydrocarbon industry since 1974.



Source: The 100 Largest Losses: 23rd edition, Marsh. Marsh, like Oliver Wyman, is a subsidiary of Marsh & McLennan Companies.

PREDICTIVE AND REACTIVE ANALYTICS



Source: Oliver Wyman analysis.

THE OIL AND GAS TALENT GAP

Mercer, like Oliver Wyman a subsidiary of Marsh & McLennan Companies, recently conducted a landmark study of the talent outlook and workforce practices in the oil and gas industry.

Mercer's study showed that the industry is confronting a chronic, global talent shortfall, especially among the more experienced workers. To fill that gap, many companies plan to recruit workers away from their competitors. But it is unlikely that this approach will be sufficient to meet demand. Not only is the strategy impossible to sustain, but oil and gas is in competition for the same pool of talent with other industries.

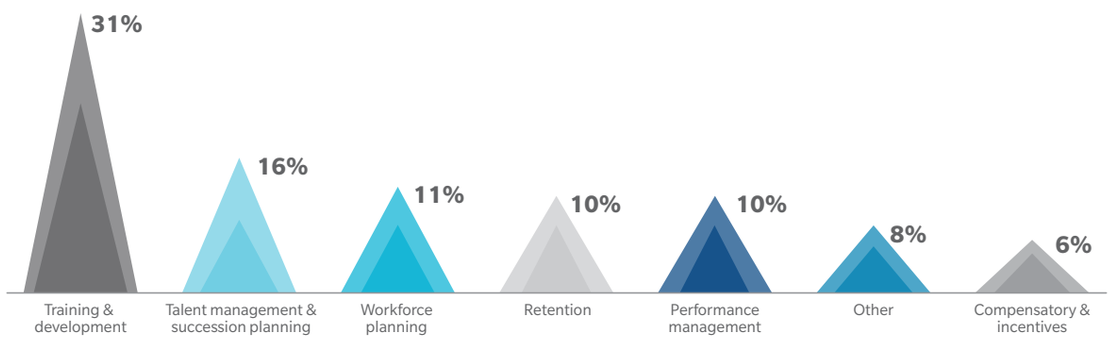
Addressing the talent gap will require industrywide solutions that start with companies understanding the internal and external market forces at work. To that end, these pages summarize the results of the survey that consisted of 126 participants from 112 organizations with more than one million employees, representing a cross-section of company types in 50 countries.

SKILLS GAPS IN EXISTING WORKFORCE

Percentage of respondents facing a gap in the skill set identified

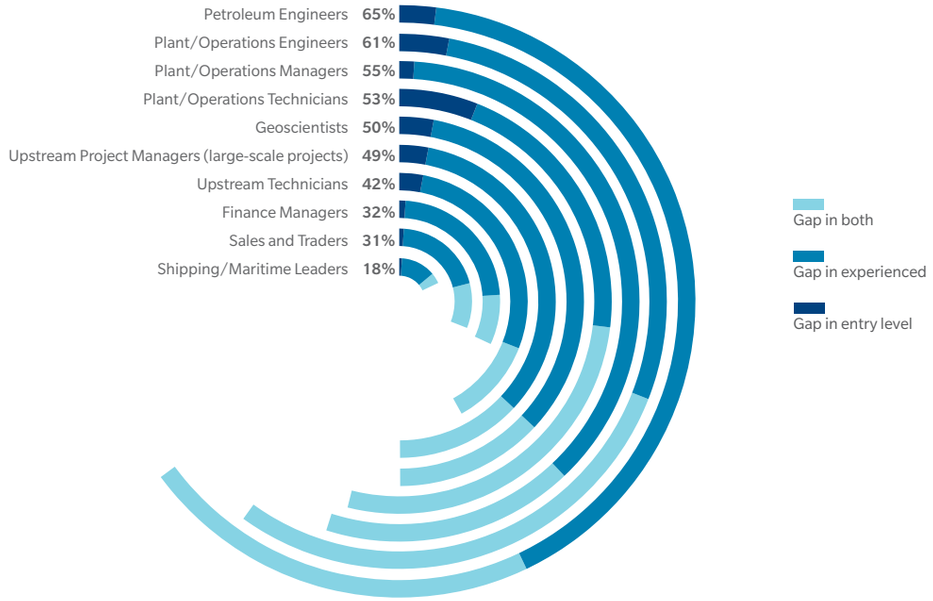
TOP TALENT MANAGEMENT INITIATIVES UNDERWAY

Percentage of respondents selecting initiative



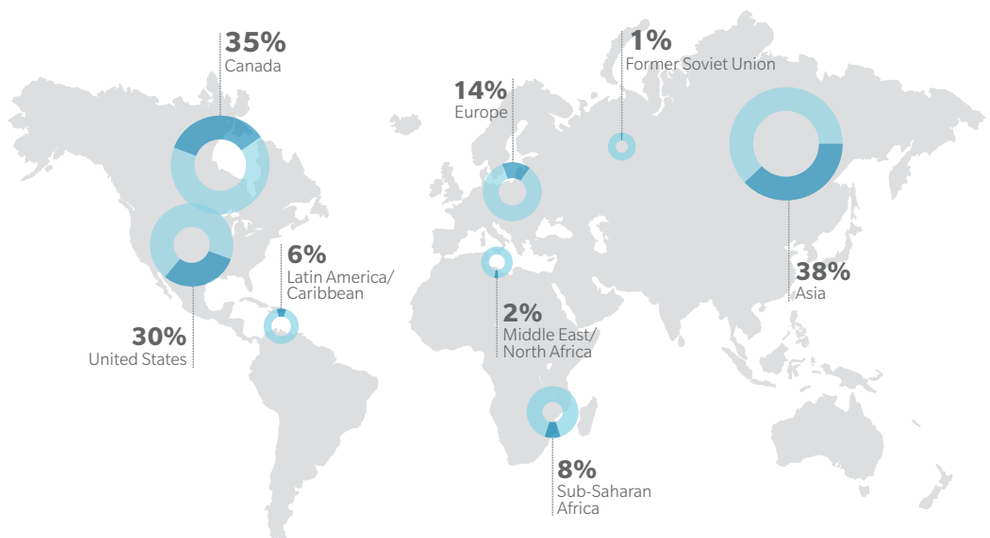
PERCENTAGE OF COMPANIES ANTICIPATING A TALENT GAP

Industry perception of pending talent gaps across occupational groups



REGIONS WHERE OIL AND GAS FIRMS FACE SIGNIFICANT TALENT MANAGEMENT CHALLENGES

Respondents were asked to indicate the regions in which they face their toughest challenges. Below are the percentage of respondents who are experiencing difficulties meeting manpower needs in a particular region. Multiple selections were possible.

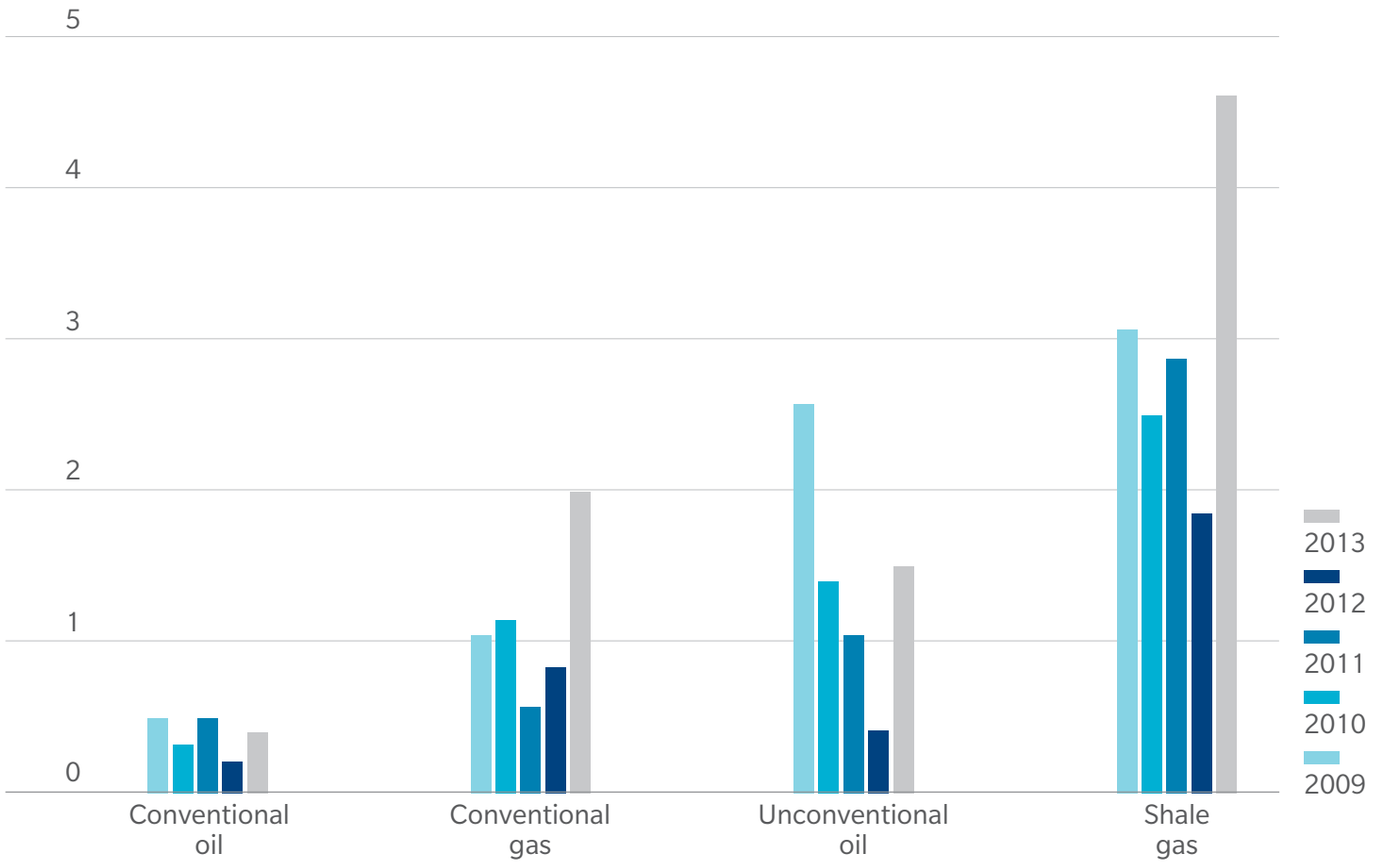


Source: Mercer's Global Oil and Gas Talent Outlook and Workforce Practices Survey. Mercer, like Oliver Wyman, is a subsidiary of Marsh & McLennan Companies.

BLOWOUTS IN TEXAS

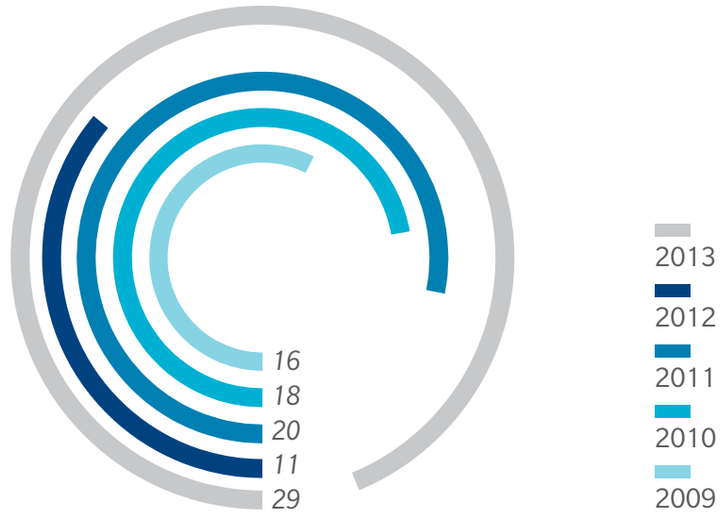
TEXAS HAS MORE BLOWOUTS IN SHALE VERSUS CONVENTIONAL OPERATIONS...

TEXAS BLOWOUTS BY WELL TYPE
PER 1,000 WELLS



...AND THE NUMBER OF BLOWOUTS IS DRAMATICALLY INCREASING.

TOTAL BLOWOUT INCIDENTS IN TEXAS



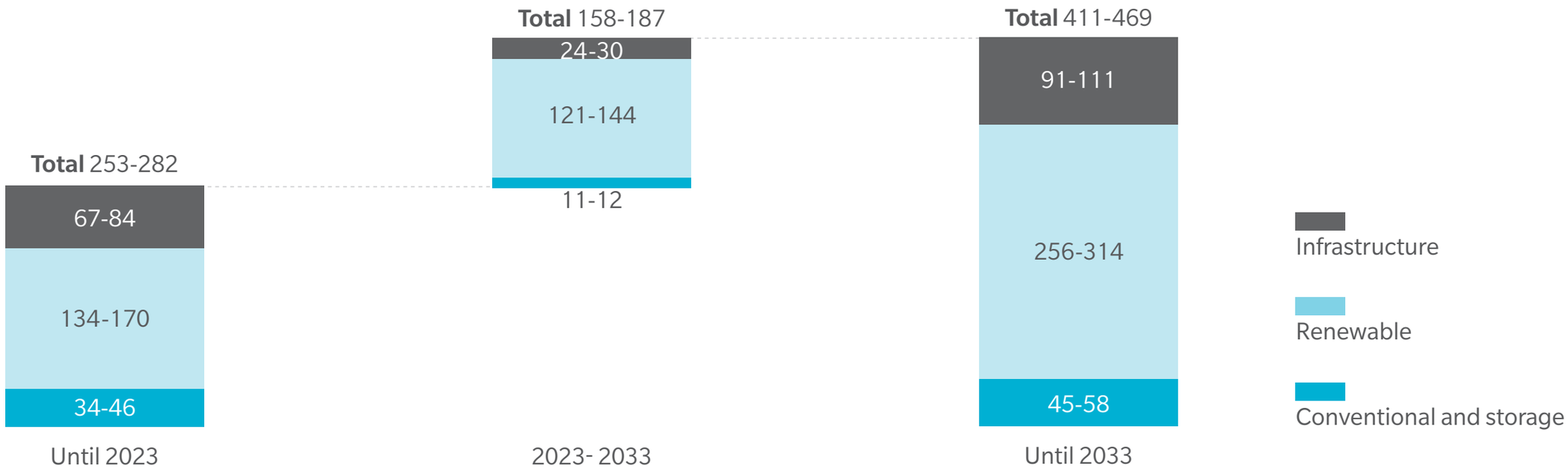
2.6x
How much the number of blowout incidents in Texas increased from 2012 to 2013

Source: Railroad Commission of Texas, EIA, Oliver Wyman analysis.

INVESTMENTS REQUIRED FOR GERMANY'S ENERGY TRANSITION

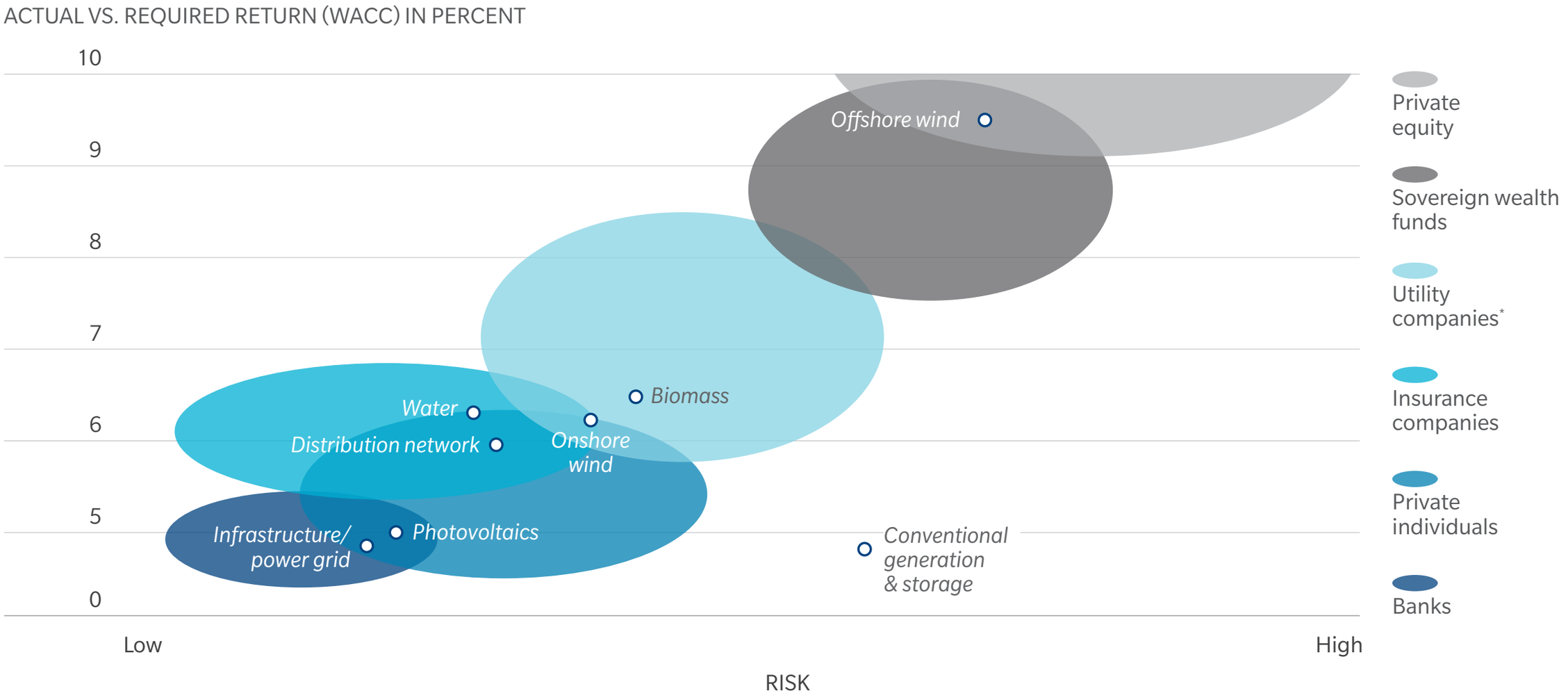
RANGES FOR INFRASTRUCTURE, RENEWABLE POWER AND CONVENTIONAL POWER AND STORAGE, REFLECTING MULTIPLE SCENARIOS MODELED BY OLIVER WYMAN

ESTIMATED COSTS BY INVESTMENT AREA IN BILLIONS OF DOLLARS



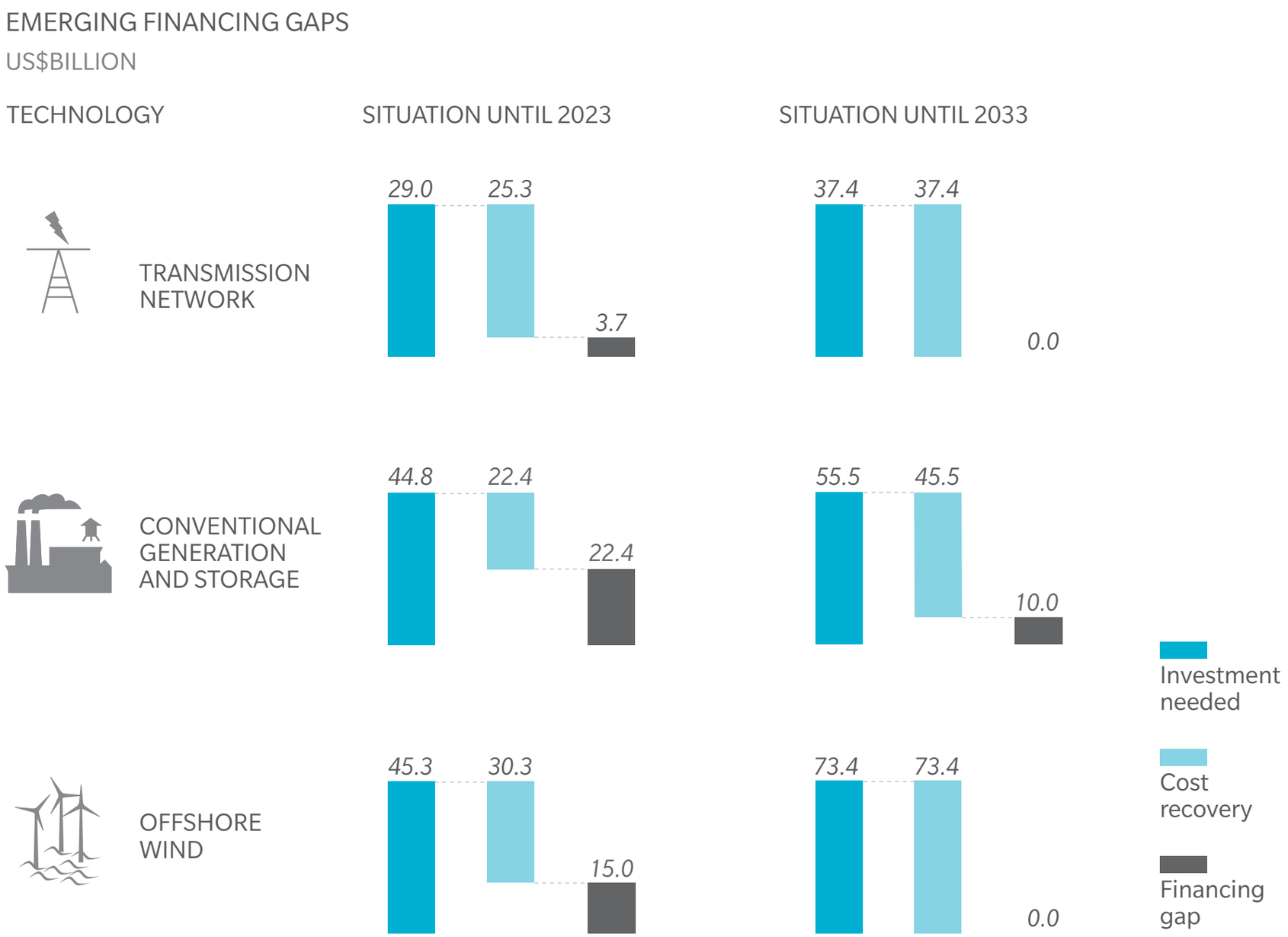
Source: Network development plan 2013, 2nd draft, DENA distribution network study, Fraunhofer study "Electricity production costs of renewable energies" (2012), Oliver Wyman analysis.

LIKELY **CORE INVESTORS** FOR EACH **TECHNOLOGY BASED ON THEIR RISK PROFILES**



Source: Dealogic, Oliver Wyman analysis.
* Mean of the risk-return profile, investments in higher risk (offshore wind) as well as lower returns (distribution network) are common.

ESTIMATED FINANCING GAPS FOR GERMANY'S ENERGY TRANSITION

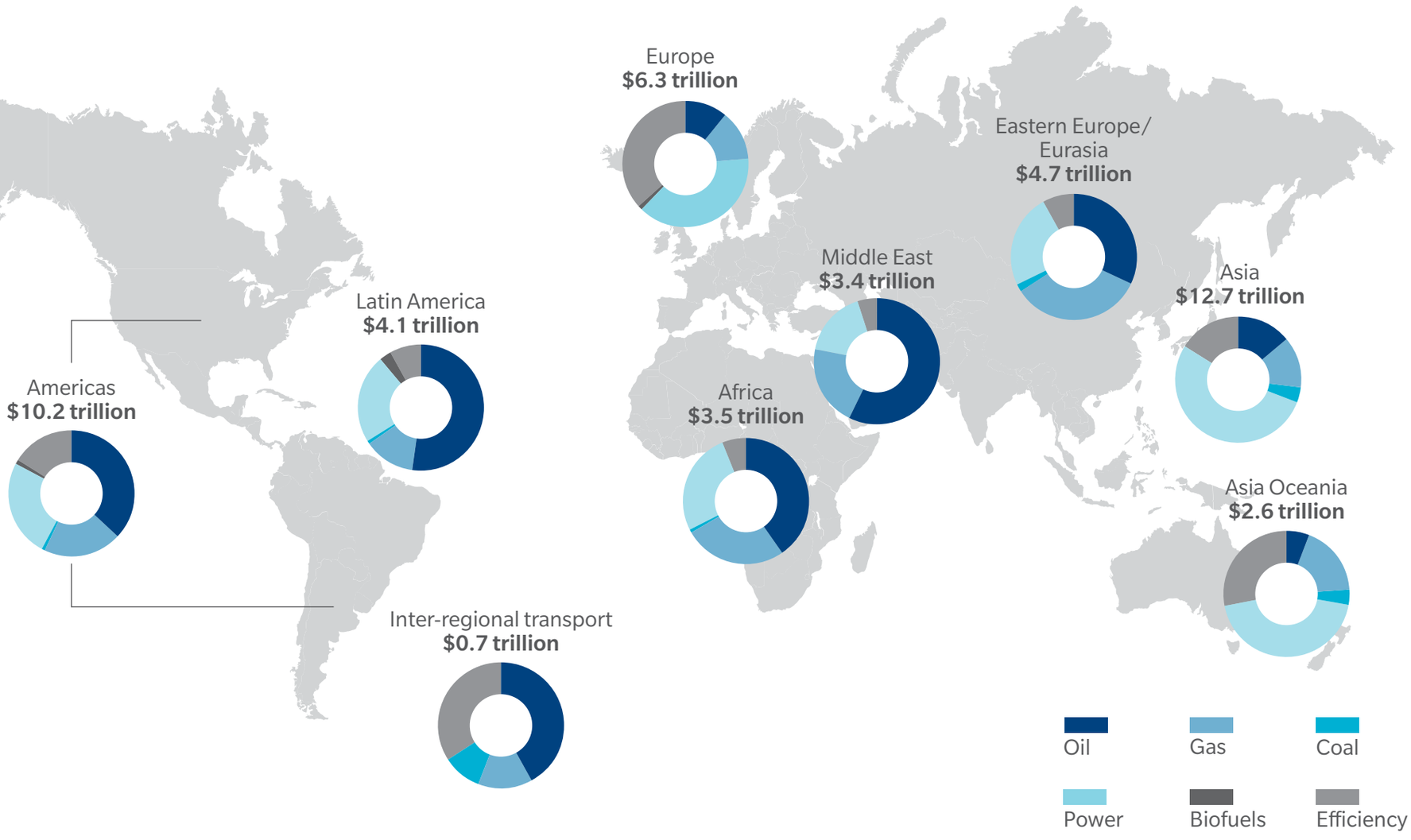


Source: Oliver Wyman analysis.

MEETING THE WORLD'S ENERGY FINANCING NEEDS

THE WORLD NEEDS $48.2 TRILLION IN ENERGY INVESTMENTS BY 2035

INVESTMENT NEEDED BY REGION
US$TRILLION



Source: World Energy Investment Outlook, IEA 2014.

OLIVER WYMAN