Kepler Cheuvreux

Sustainability Research

1st for SRI / Sustainability Research Brokerage Firm 2010, 2011 & 2012

THOMSON REUTERS EXTEL SURVEYS

Toil for Oil Spells Danger for Majors

Unsustainable Dynamics Mean Oil Majors Should Become Energy Majors

Energy Finance 2015

NYU, 19 March 2015

Mark C. Lewis
Senior Analyst, Energy Transition & Climate-Change Research
mlewis@keplercheuvreux.com (33) 1 70 81 57 60

Contents

"It goes so heavily with my disposition that this goodly frame, the earth, seems to me a sterile promontory; this most excellent canopy, the air, look you, this brave o'erhanging firmament, this majestical roof fretted with golden fire, why, it appears no other other thing to me but a foul and pestilent congregation of vapours"

William Shakespeare

Hamlet

(Act II, sc. ii)

”Like one that draws the model of an house
Beyond his power to build it, who, half-through,
Gives o’er, and leaves his part-created cost
A naked subject to the weeping clouds,
And waste for churlish winter’s tyranny"

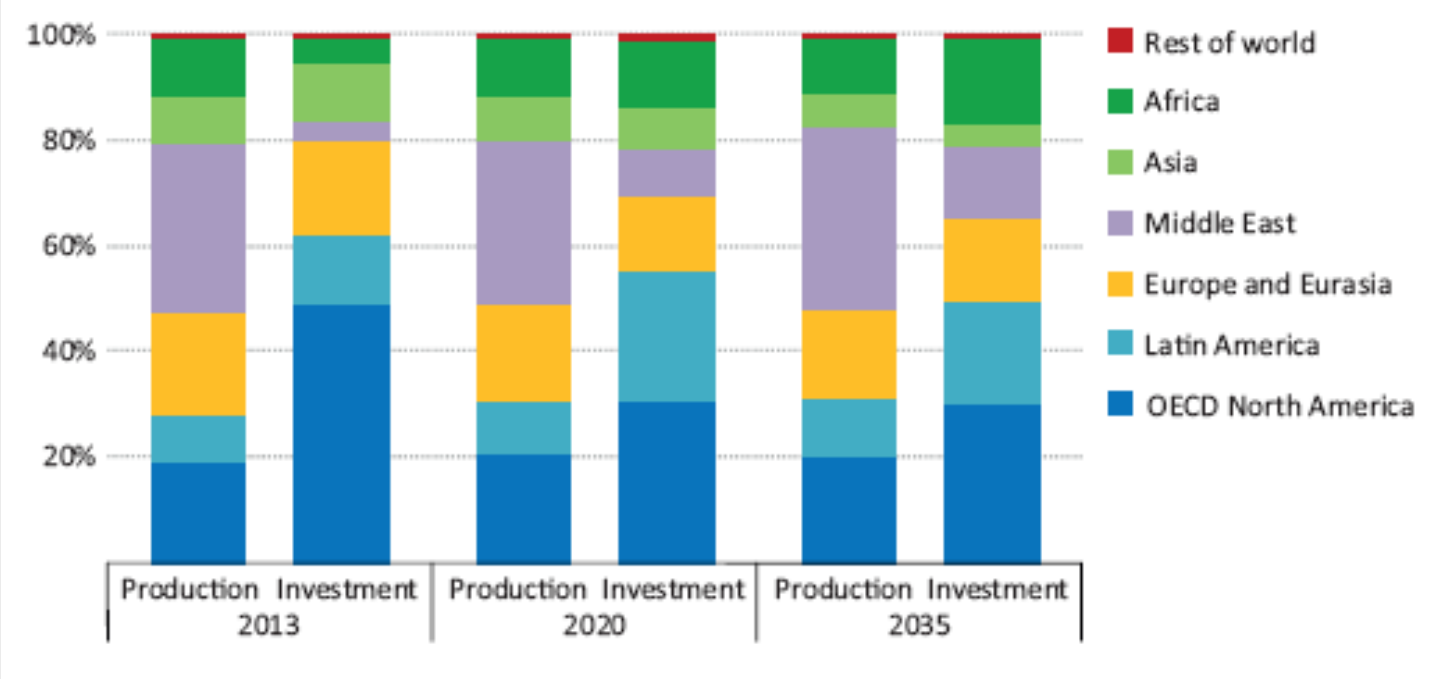
William Shakespeare
King Henry IV Part II
(Act I, sc. iii)

1) Toil for Oil:

E&P a much harder game since 2005

The capital intensity of US shale-oil production is phenomenal

Key points

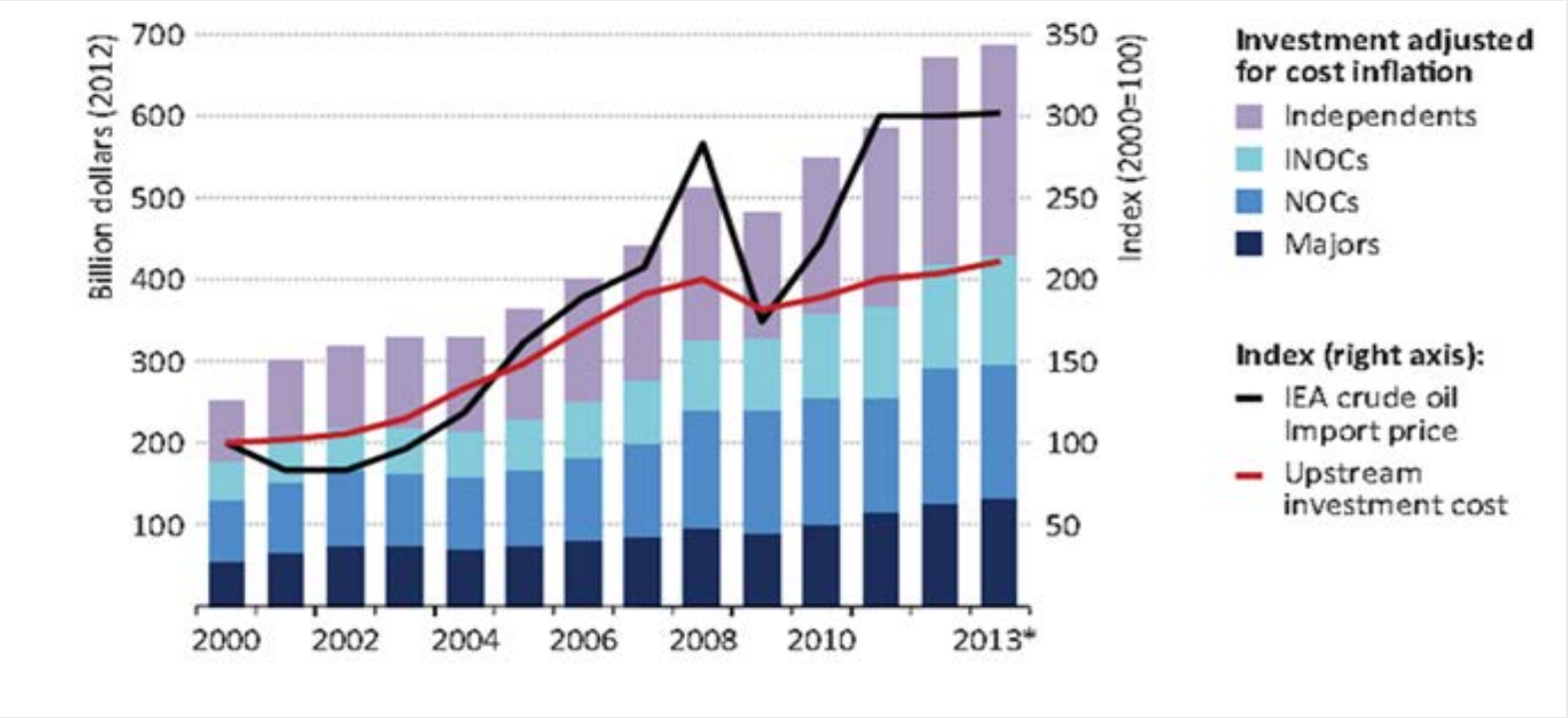


Source: IEA, 2013 World Energy Outlook, (© OECD/IEA)

Key points

- North America accounts for 18% of global oil production but 50% of global upstream capex
- The decline rates for US shale-oil plays are astronomical, averaging 30-40% already in the second year of production
- By contrast, oil sands are also very capital-intensive upfront but have very long production lifetimes

Upstream oil & gas capex, costs, and prices



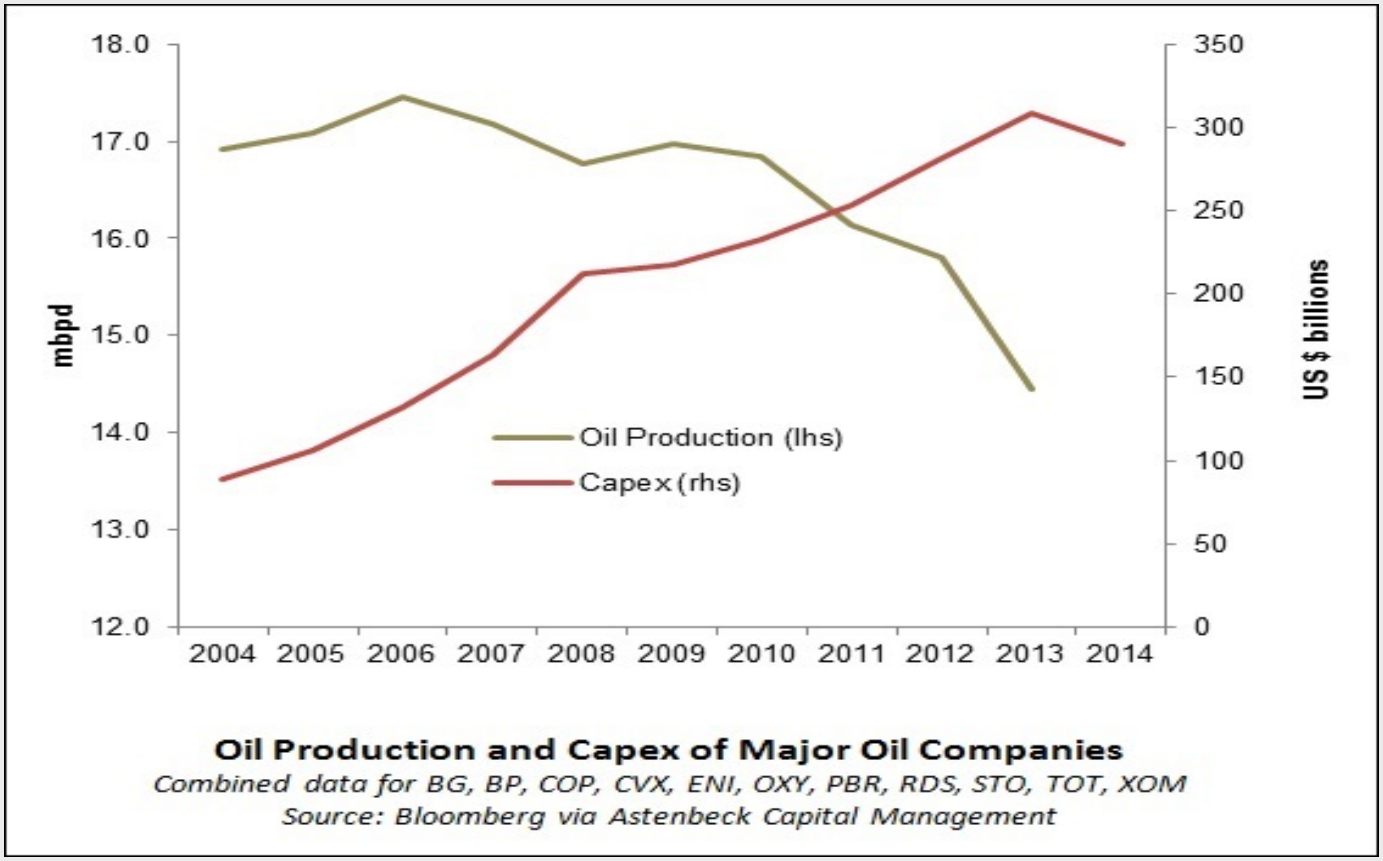
Source: IEA, 2013 World Energy Outlook
(© OECD/IEA)

**Budgeted spending. Notes: The IEA Upstream Investment Cost Index, set at 100 in 2000, measures the change in underlying capital costs for exploration and production. It uses weighted averages to remove the effects of spending on different types and locations of upstream projects*

Key points

- Upstream capex has nearly trebled in real terms since 2000, reaching $700bn in 2013 versus $250bn in 2000
- Prices have also increased roughly threefold in real terms over 200-13, but since 2011 prices have been flat
- Over the same period, however, headline production of petroleum liquids has increased by only 14%

Oil majors' capital productivity has declined sharply since 2005



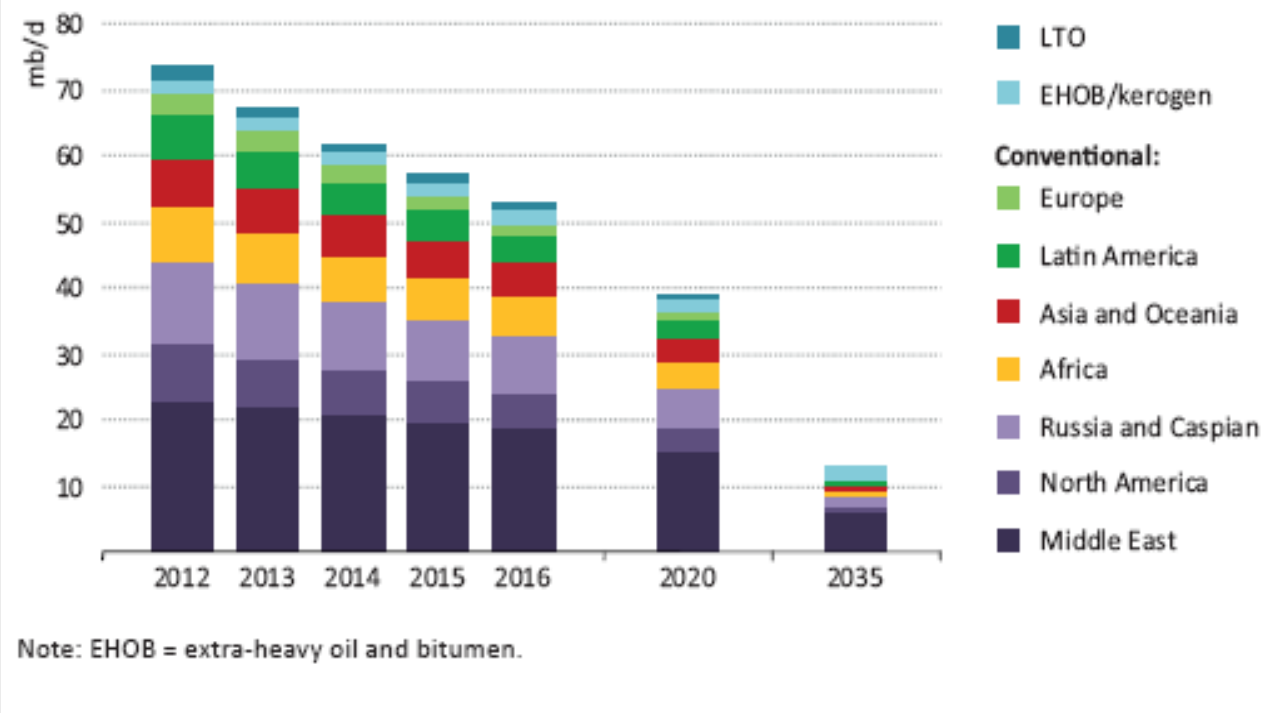
Source: Bloomberg via Astenbeck capital Management

Key points

- The majors' capital productivity has declined more sharply than that of the industry overall

2) The IEA's Projections to 2035: A Critique

IEA estimate of future production from currently producing oil fields if all capex were stopped today

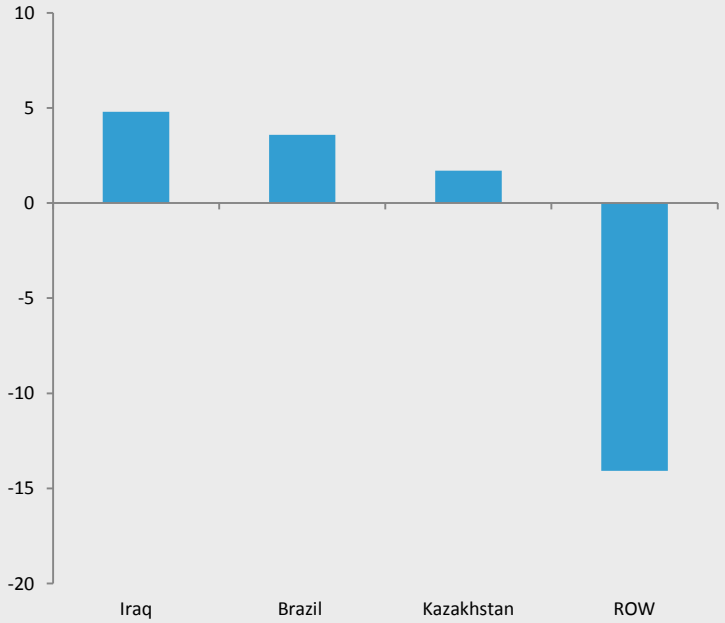


Source: IEA, 2013 World Energy Outlook, (© OECD/IEA)

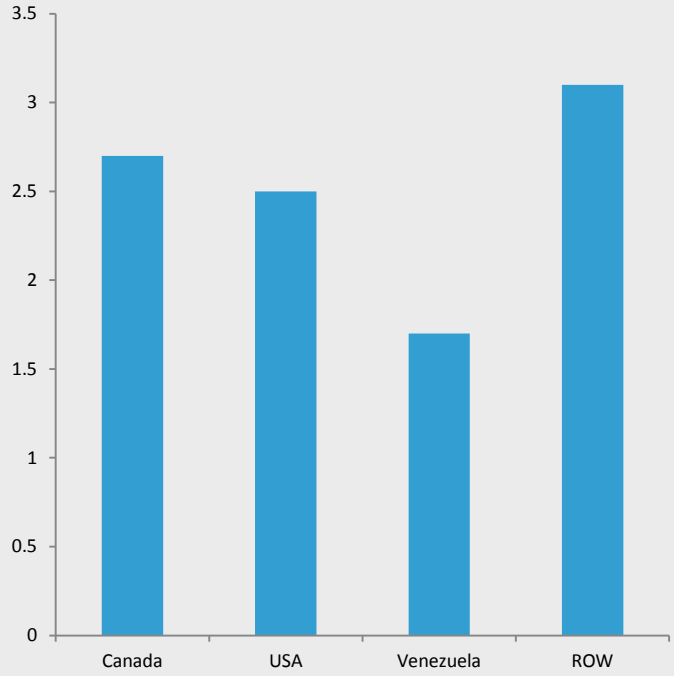
Key points

- IEA estimates that if all upstream-oil capex stopped today, output would fall to 13mbd by 2035 v. 74mbd today
- This implies an average annual natural rate of decline in production of c.2.6mbd, or c.3mbd for all petroleum liquids
- We estimate that this implies just over half of all currently producing fields are past their peak

Change in world conventional and unconventional Crude-oil output by source, 2013-35 (mbd)



Source: Kepler-Cheuvreux estimates based on IEA data from 2013 World Energy Outlook



Source: Kepler-Cheuvreux estimates based on IEA data from 2013 World Energy Outlook

Key point

- IEA is betting very heavily on Iraq, Brazil and Kazakhstan to limit the decline in conventional crude-oil production
- At the same time, the world will become much more dependent on unconventional crude in future

The IEA has recently increased its capex estimates for the upstream oil industry over 2013-35

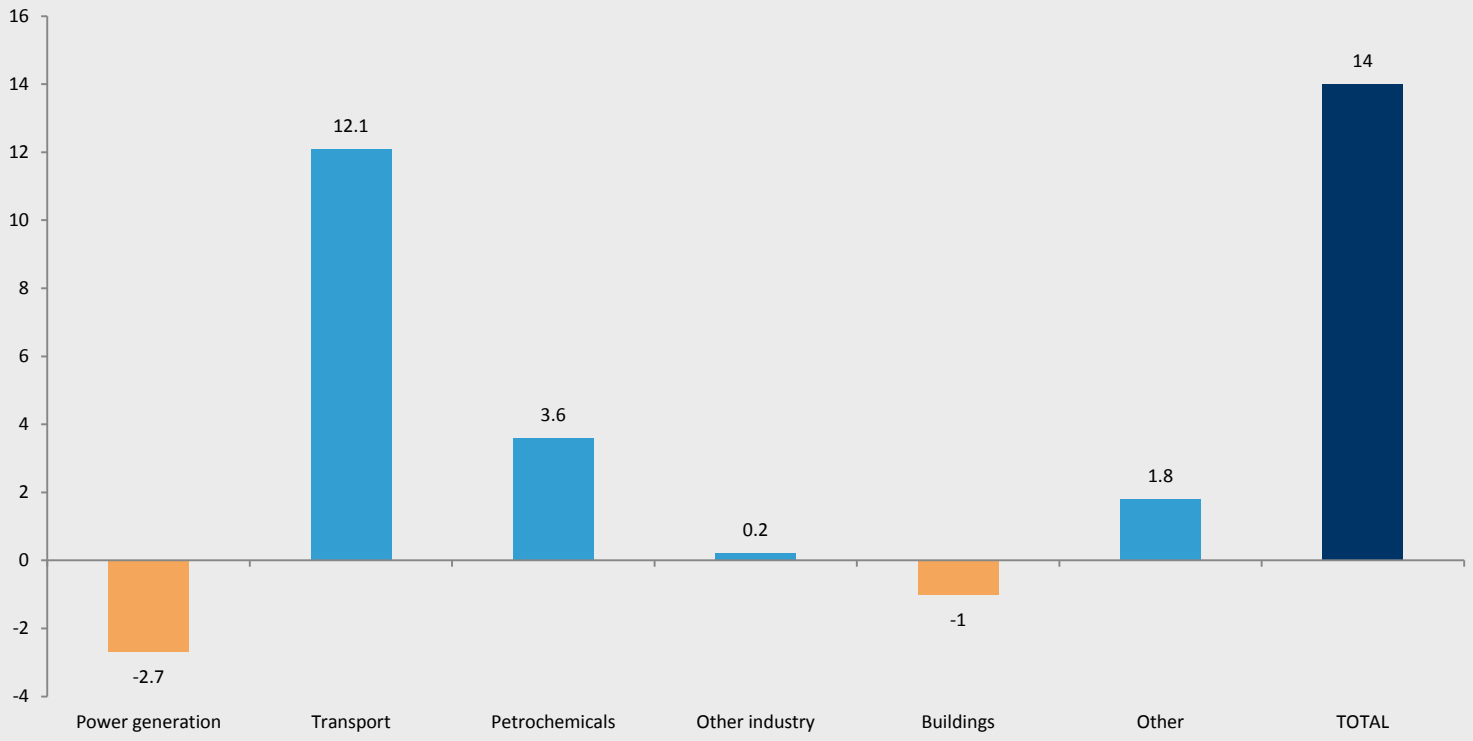
Key points

IEA's estimate of cumulative upstream oil capex necessary out to 2035 under NPS (constant 2012 $)				
	2013 WEO *	WEIO 2014*	Change ($bn)**	Change (%)**
OECD	3,354	4,087	**733**	21.8
Americas	2,826	3,488	**662**	23.5
o/w US	2,060	2,021	**-39**	-1.9
Europe	450	500	**50**	11.1
Asia/Oceania	77	98	**21**	27.3
Non-OECD	6,041	7,197	**1,156**	19.1
E . Europe /Eurasia	1,180	1,345	**165**	13.9
Asia	664	1,079	**415**	62.5
Middle East	872	1,578	**706**	81.0
Africa	1,507	1,291	**-216**	-14.3
Latin America	1,818	1,905	**87**	4.8
TOTAL	**9,394**	**11,284**	**1,890**	**20.1**

*Source: *IEA, 203 WEO, and IEA World energy Investment Outlook, June 2014 (© OECD/IEA); ** Kepler-Cheuvreux estimates*

3) Pricing Scenarios, Future Capex Risk, and Energy Return on Capital Invested (EROCI)

Projected growth in world oil demand by activity to 2035 (mbd)

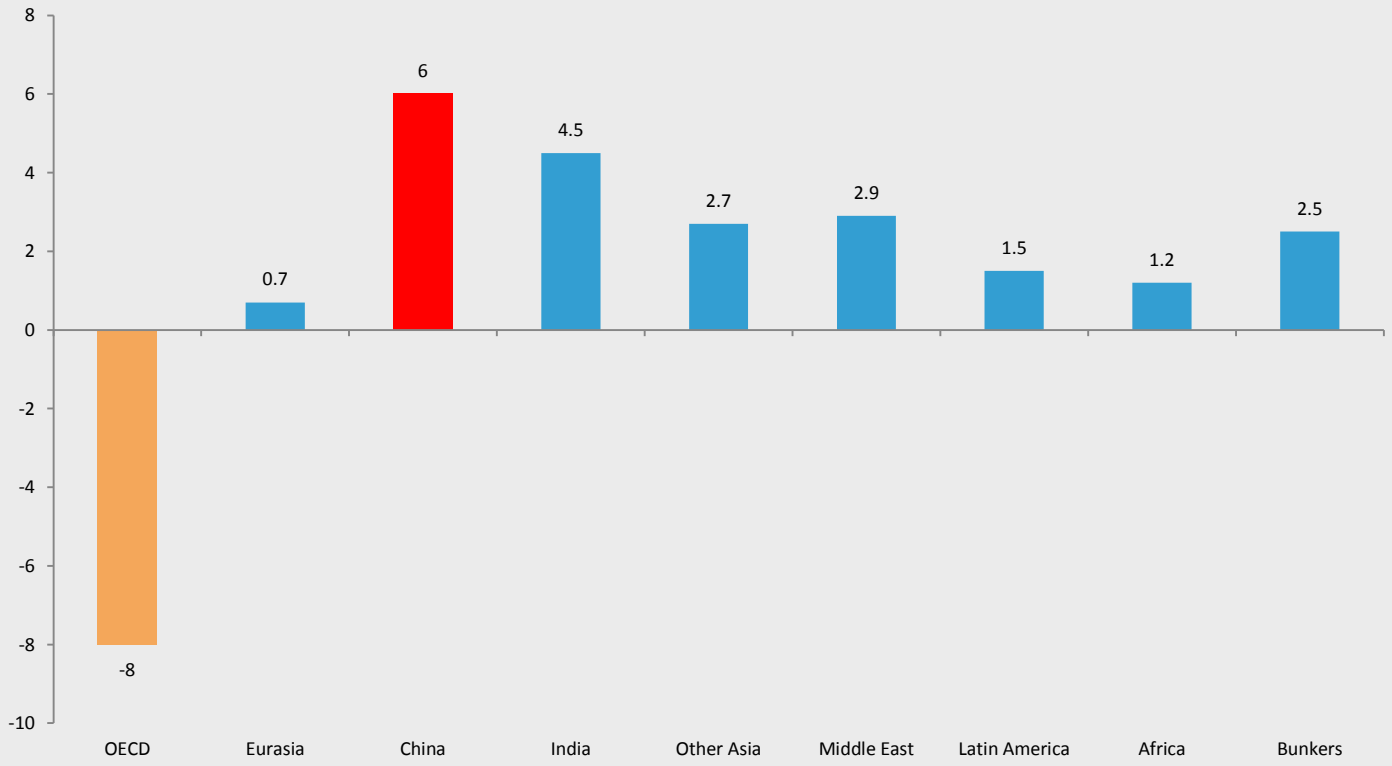


Source: Kepler-Cheuvreux estimates based on IEA data from 2013 World Energy Outlook

Key points

- Transport accounts for overwhelming majority of future oil-demand growth

Projected growth in world oil demand by country and region (mbd)

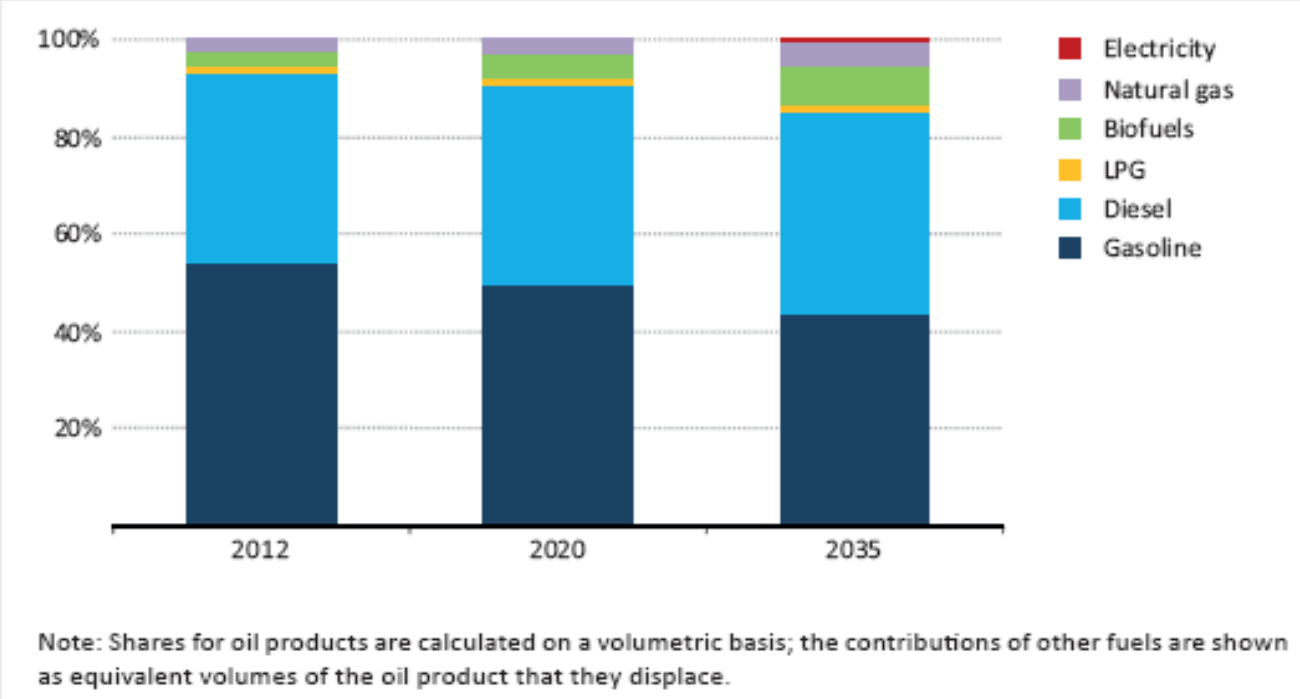


Source: Kepler-Cheuvreux estimates based on IEA data from 2013 World Energy Outlook

Key points

- China is 43% of total global demand growth to 2035, and China ad India together 75%

IEA base-case projection for fuel-mix in road Transport over 2012-35



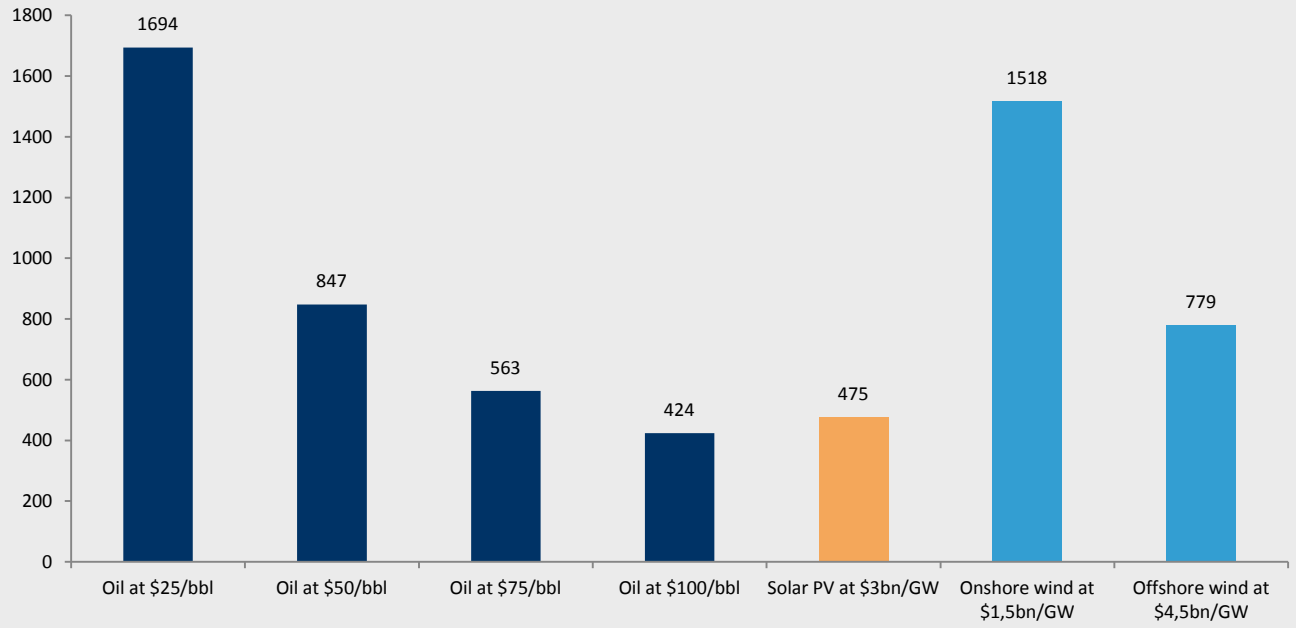
Note: Shares for oil products are calculated on a volumetric basis; the contributions of other fuels are shown as equivalent volumes of the oil product that they displace.

Source: IEA, 2013 World Energy Outlook (© OECD/IEA)

Key points

- Transport acounts for 12mbd out of total projected demand growth of 14mbd by 2035
- However, IEA sees only minimal growth in EVs by 2035, which makes investments made today and over next decade in high-cost, high-carbon oil projects vulnerable to stranding if real oil prices rise and renewable-energy costs continue to fall.

Net EROCI of oil versus solar PV and wind based on today's economics (2014)

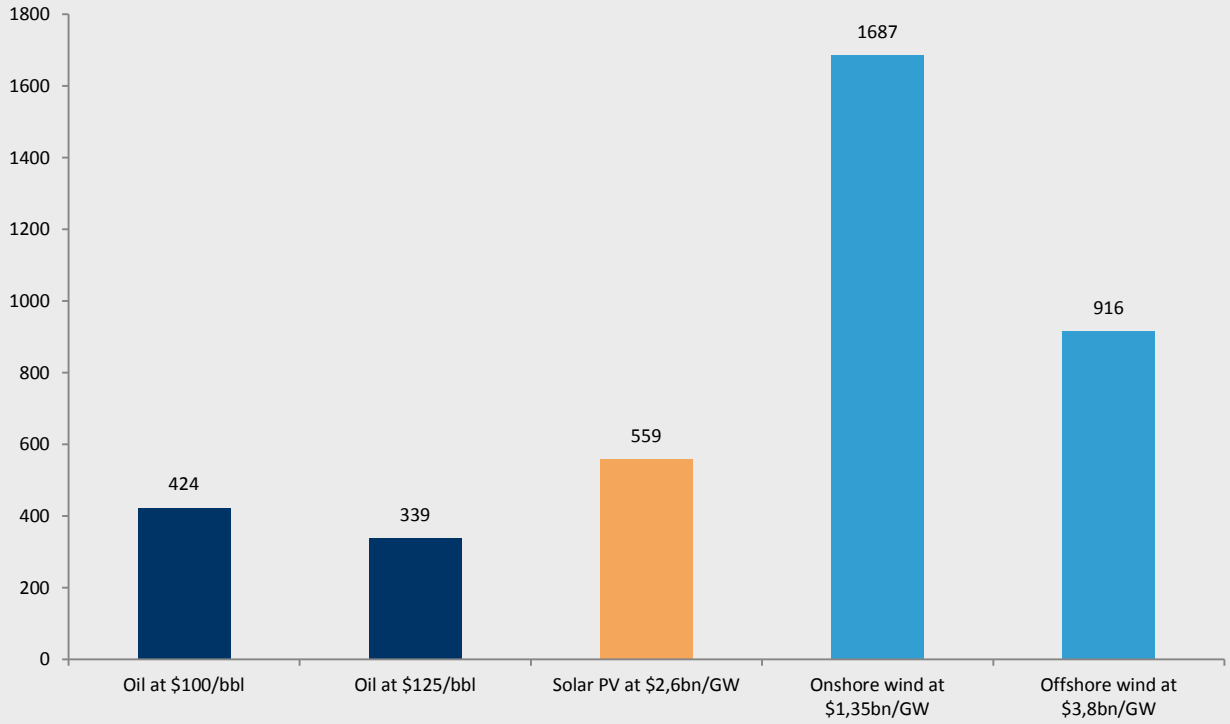


Source: Kepler-Cheuvreux estimates

Key points

- Onshore wind already today almost competitive with oil at $25/bbl for powering EVs versus conventional automobiles
- All renewables more competitive than oil at $100/bbl – renewables have a higher net EROCI today than oil at $100/bbl

Net EROCI of oil versus solar PV and wind based on KC estimates of 2020 economics

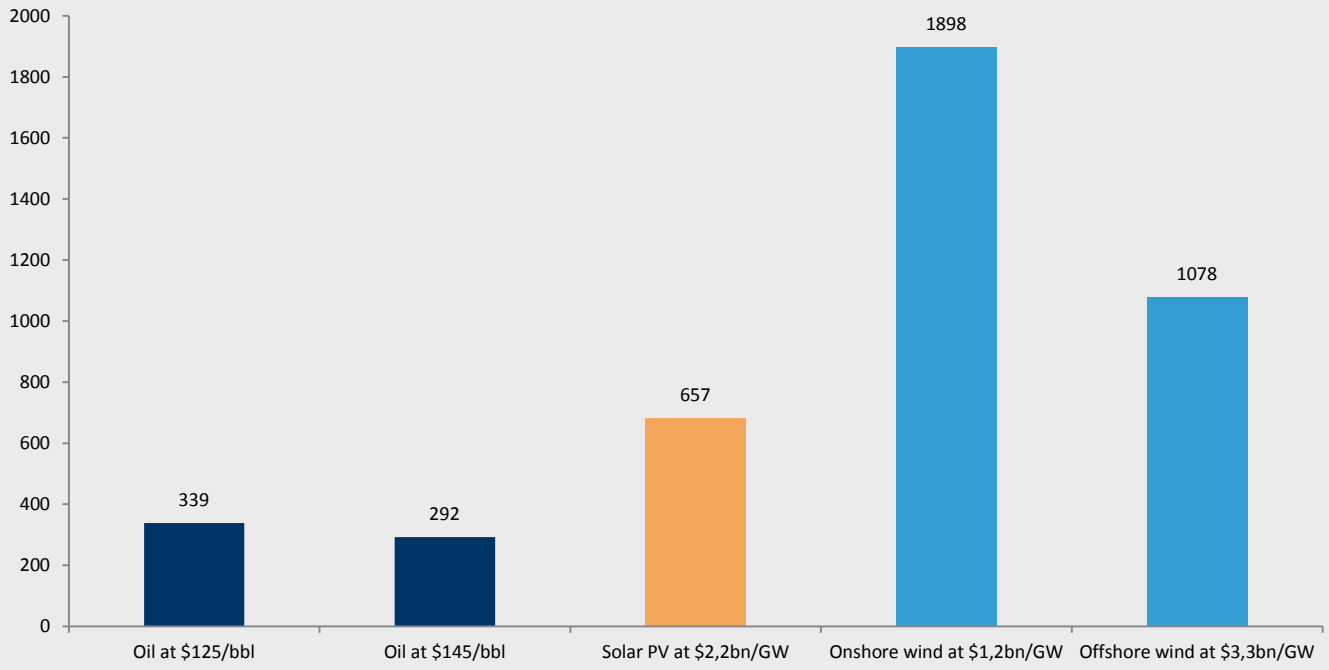


Source: Kepler-Cheuvreux estimates

Key points

- Assuming higher real oil prices of $125/bbl by 2020 (in constant 2012 $), and cost reductions of 10% in real terms for onshore wind and 15% for solar PV and offshore wind.
- All renewables much more competitive than oil at both $100/bbl and $125/bbl.

Net EROCI of oil versus solar PV and wind based on KC estimates of 2035 economics



Source: Kepler-Cheuvreux estimates

Key points

- Assuming higher real oil prices of $145/bbl by 2035 (again, in constant 2012 $), and real-terms cost reductions of a further 10% versus 2020 for onshore wind and 15% for solar PV and offshore wind.
- Net EROCI of all renewables much more competitive than oil at both $125/bbl and $145/bbl.

Disclaimer

This product is not for retail clients or private individuals.

The information contained in this publication was obtained from various publicly available sources believed to be reliable, but has not been independently verified by KEPLER CHEUVREUX. KEPLER CHEUVREUX does not warrant the completeness or accuracy of such information and does not accept any liability with respect to the accuracy or completeness of such information, except to the extent required by applicable law.

This publication is a brief summary and does not purport to contain all available information on the subjects covered. Further information may be available on request. This report may not be reproduced for further publication unless the source is quoted.

This publication is for information purposes only and shall not be construed as an offer or solicitation for the subscription or purchase or sale of any securities, or as an invitation, inducement or intermediation for the sale, subscription or purchase of any securities, or for engaging in any other transaction. This publication is not for private individuals.

Any opinions, projections, forecasts or estimates in this report are those of the author only, who has acted with a high degree of expertise. They reflect only the current views of the author at the date of this report and are subject to change without notice. KEPLER CHEUVREUX has no obligation to update, modify or amend this publication or to otherwise notify a reader or recipient of this publication in the event that any matter, opinion, projection, forecast or estimate contained herein, changes or subsequently becomes inaccurate, or if research on the subject company is withdrawn. The analysis, opinions, projections, forecasts and estimates expressed in this report were in no way affected or influenced by the issuer. The author of this publication benefits financially from the overall success of KEPLER CHEUVREUX.

The investments referred to in this publication may not be suitable for all recipients. Recipients are urged to base their investment decisions upon their own appropriate investigations that they deem necessary. Any loss or other consequence arising from the use of the material contained in this publication shall be the sole and exclusive responsibility of the investor and KEPLER CHEUVREUX accepts no liability for any such loss or consequence. In the event of any doubt about any investment, recipients should contact their own investment, legal and/or tax advisers to seek advice regarding the appropriateness of investing. Some of the investments mentioned in this publication may not be readily liquid investments. Consequently it may be difficult to sell or realise such investments. The past is not necessarily a guide to future performance of an investment. The value of investments and the income derived from them may fall as well as rise and investors may not get back the amount invested. Some investments discussed in this publication may have a high level of volatility. High volatility investments may experience sudden and large falls in their value which may cause losses. International investing includes risks related to political and economic uncertainties of foreign countries, as well as currency risk.

To the extent permitted by applicable law, no liability whatsoever is accepted for any direct or consequential loss, damages, costs or prejudices whatsoever arising from the use of this publication or its contents.

KEPLER CHEUVREUX (and its affiliates) have implemented written procedures designed to identify and manage potential conflicts of interest that arise in connection with its research business, which are available upon request. The KEPLER CHEUVREUX research analysts and other staff involved in issuing and disseminating research reports operate independently of KEPLER CHEUVREUX Investment Banking business. Information barriers and procedures are in place between the research analysts and staff involved in securities trading for the account of KEPLER CHEUVREUX or clients to ensure that price sensitive information is handled according to applicable laws and regulations.

Country and region disclosures

United Kingdom: This document is for persons who are Eligible Counterparties or Professional Clients only and is exempt from the general restriction in section 21 of the Financial Services and Markets Act 2000 on the communication of invitations or inducements to engage in investment activity on the grounds that it is being distributed in the United Kingdom only to persons of a kind described in Articles 19(5) (Investment professionals) and 49(2) (High net worth companies, unincorporated associations, etc.) of the Financial Services and Markets Act 2000 (Financial Promotion) Order 2005 (as amended). It is not intended to be distributed or passed on, directly or indirectly, to any other class of persons. Any investment to which this document relates is available only to such persons, and other classes of person should not rely on this document.

United States: This communication is only intended for, and will only be distributed to, persons residing in any jurisdictions where such distribution or availability would not be contrary to local law or regulation. This communication must not be acted upon or relied on by persons in any jurisdiction other than in accordance with local law or regulation and where such person is an investment professional with the requisite sophistication to understand an investment in such securities of the type communicated and assume the risks associated therewith.

This communication is confidential and is intended solely for the addressee. It is not to be forwarded to any other person or copied without the permission of the sender. This communication is provided for information only. It is not a personal recommendation or an offer to sell or a solicitation to buy the securities mentioned. Investors should obtain independent professional advice before making an investment.

Notice to U.S. Investors: This material is not for distribution in the United States, except to "major US institutional investors" as defined in SEC Rule 15a-6 ("Rule 15a-6"). Kepler Cheuvreux refers to Kepler Capital Markets, Société anonyme (S.A.) ("Kepler Capital Markets SA") and its affiliates, including CA Cheuvreux, Société Anonyme (S.A.). Kepler Capital Markets SA has entered into arrangements with Crédit Agricole Cheuvreux North America, Inc. ("CA Cheuvreux North America") and Kepler Capital Markets, Inc. ("KCM, Inc.") (collectively "US Broker-Dealers"), which enables this report to be furnished to certain U.S. recipients in reliance on Rule 15a-6 through US Broker-Dealers registered under the U.S. Securities Exchange Act of 1934, as amended.

Each U.S. recipient of this report represents and agrees, by virtue of its acceptance thereof, that it is a "major U.S. institutional investor" (as such term is defined in Rule 15a-6) and that it understands the risks involved in executing transactions in such securities. Any U.S. recipient of this report that wishes to discuss or receive additional information regarding any security or issuer mentioned herein, or engage in any transaction to purchase or sell or solicit or offer the purchase or sale of such securities, should contact a registered representative of the US Broker-Dealer that provided the report. Under no circumstance should you direct orders to CA Cheuvreux North America as payment for products or services provided by KCM, Inc. In turn, under no circumstance should you direct orders to KCM, Inc. as payment for products or services provided by CA Cheuvreux North America.

CA Cheuvreux North America is a broker-dealer registered with the Securities and Exchange Commission ("SEC"), a member of the Financial Industry Regulatory Authority ("FINRA") and the Securities Investor Protection Corporation ("SIPC"). You can reach CA Cheuvreux North America at 1301 Avenue of the Americas, 15th floor, New York, NY 10019, phone (212) 492-8800; Equity trading: (212) 492-8825. Further information is also available at www.cheuvreux.com.

KCM, Inc.is a broker-dealer registered with the SEC, a member of FINRA and SIPC. You can reach KCM, Inc. at 600 Lexington Avenue, New York, NY 10022, phone (212) 710-7606; Equity trading: 212-710-7602. Further information is also available at www.keplercapitalmarkets.com.

You may obtain information about SIPC, including the SIPC brochure, by contacting SIPC directly at 202-371-8300; website: http://www.sipc.org.

CA Cheuvreux North America is a wholly owned subsidiary of Crédit Agricole Cheuvreux S.A. which is, in turn, owned by Kepler Capital Markets SA. As part of the ownership of Crédit Agricole Cheuvreux S.A., Kepler Capital Markets SA is entitled to distribute certain financial research produced by Crédit Agricole Cheuvreux S.A.

KCM, Inc. is a wholly owned subsidiary of Kepler Capital Markets SA. Kepler Capital Markets SA, registered on the Paris Register of Companies with the number 413 064 841 (1997 B 10253), whose registered office is located at 112 avenue Kléber, 75016 Paris, is authorised and regulated by both Autorité de Contrôle Prudentiel (ACP) and Autorité des Marchés Financiers (AMF).

The US Broker-Dealers are under common ownership, but operate independently in the US. In this regard, US Broker-Dealers are the distributors of this research publication in the United States. Commissions are not shared between US Broker-Dealers (directly or indirectly).

Amsterdam
Kepler Cheuvreux Benelux
Johannes Vermeerstraat 9
1071 DK Amsterdam
+31 20 573 06 66

Frankfurt
Kepler Cheuvreux Germany
Taunusanlage 19
60325 Frankfurt
+49 69 756 960

Geneva
Kepler Cheuvreux SA
Route de Crassier 11
1262 - Eysins
Switzerland
+41 22 361 5151

London
Kepler Cheuvreux UK
12th Floor, Moorhouse
120 London Wall
London EC2Y 5ET
+44 20 7621 5100

Madrid
Kepler Cheuvreux Espana
Alcala 95
28009 Madrid
+34 914365100

Milan
Kepler Cheuvreux Italia
Corso Europa 2
20122 Milano
+39 02 85507 1

Paris
Kepler Cheuvreux France
112 Avenue Kleber
75016 Paris
+33 1 53 65 35 00

Stockholm
Kepler Cheuvreux Sweden
Regeringsgatan 38
10393 Stockholm
+46 8 723 51 00

Vienna
Kepler Cheuvreux Vienna
Schottenring 16/2
Vienna 1010
+43 1 537 124 147

Zurich
Kepler Cheuvreux Switzerland
Stadelhoferstrasse 22
Postfach
8024 Zurich
+41 43 333 66 66

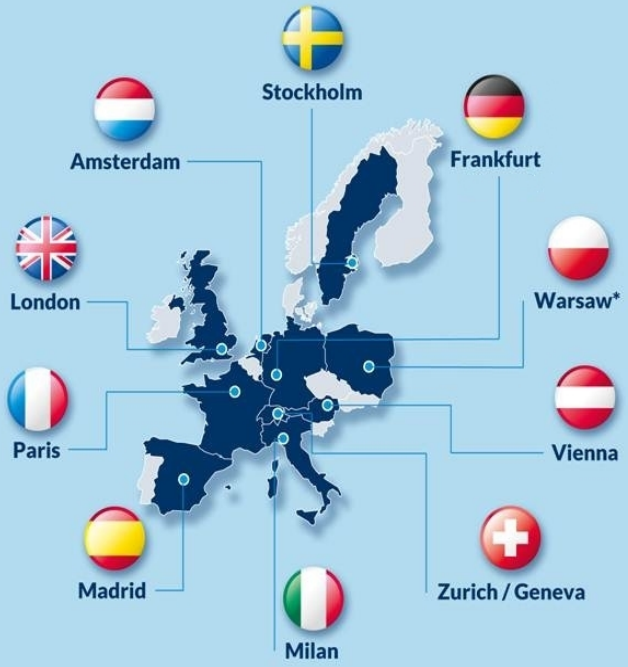
North America

Boston
CA Cheuvreux North America
99 Summer Street Suite 220
Boston MA 02110
+1 617 476 9201

New York
CA Cheuveux North America
1391 Avenue of the Americas, Floor 15
New York, NY 10019
+1 212 492 8800

San Francisco
CA Cheuveux North America
50 California Street Suite 860
San Francisco, CA 94111
+1 415 255 9802

New York
Kepler Capital Markets, Inc
600 Lexington Avenue, Floor 28
10022 New York, NY USA
+1 212 710 7600



* Kepler Cheuvreux has exclusive international distribution rights for UniCredit's CEE product.