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Global Energy (Revised): Drilling Down into the IEA's 2012 WEO

Commodities Special

- The IEA's 2012 World Energy Outlook (WEO) was published earlier this week, and has attracted significant attention for its projection that the United States will pass the Kingdom of Saudi Arabia (KSA) as the world's largest oil producer "by around 2020".
- At the same time, the IEA states that "Iraq makes the largest contribution by far to global oil supply growth" over the time horizon of the WEO, with its output increasing from c.3mbd currently to 6.1mbd by 2020, and 8.3mbd by 2035.
- These new and/or enhanced sources of production are very much required, though, as (i) owing to ongoing natural decline rates in existing fields, and (ii) the projected growth in demand from emerging economies, the world will need to bring on a significant amount of new capacity over the next two decades.
- As far as the decline from fields already producing is concerned, the data in the 2012 WEO leads us to infer that the IEA expects production from existing capacity to decline by c.1.5mbd per year over 2012-20.
- With regard to the outlook for consumption, on a "current-policies" basis, the IEA sees global oil demand rising to 96mbd by 2020 versus 87.4mbd in 2011, while on a "new-policies" basis 2020 demand would be some 2mbd lower at 94.2mbd.
- As a result, we estimate that the "new-policies" scenario set out in the WEO implies a need for some 2.3mbd per year of new capacity over 2012-20 to cover both natural production declines and growing demand.
- On the basis of its supply-and-demand forecasts under the "new-policies" scenario, the IEA derives a projected 2020 oil-price forecast of \$120/bbl by 2020 in real terms (i.e. in constant 2011 \$), and of \$125/bbl in real terms by 2035.
- For our purposes here, we take the WEO's supply projections as given and focus instead on its demand projections, in particular for the Middle East (ME). With the Middle East home to some of the world's most important crude-oil exporters, the demand outlook for this region is crucial to the outlook for global exports over the next two decades.

- And in light of this region's extremely rapid growth in domestic oil consumption over the last decade, we find the projections for ME demand growth over 2012-20 as set out in the 2012 WEO are potentially too modest and in danger of being revised higher. This is for two main reasons: (i) many ME countries have very generous subsidies in domestic oil consumption, and (ii) the region is projected to experience continuing very rapid population growth over the next two decades.
- As a result, if the projections for Middle Eastern demand growth out to 2020 are too light, global exports of crude oil over the next decade will likely be lower than implicitly assumed in the 2012 WEO.
- In short, if subsidies on domestic oil consumption cannot be reined in materially in some of the world's key exporters, then we expect the IEA's real-terms 2020 oil-price forecast of \$120/bbl could prove too low, and perhaps significantly so. And as the IEA itself notes in the 2012 WEO, "cutting subsidies and raising prices is not an easy task".

The 2012 WEO's supply-and-demand forecasts

The 2012 WEO models three scenarios for the oil market out to 2035: (i) the "new-policies" scenario, which is the IEA's central case; (ii) the "current-policies" scenario; and (iii) "the 450 scenario".

As defined in the 2012 WEO (p.34), "*The new-policies scenario 'takes into account broad policy commitments and plans that have already been implemented to address energy-related challenges as well as those that have been announced, even where the specific measures to implement these commitments have yet to be introduced'*".

By contrast, the current-policies scenario models the supply-demand outlook for oil under the existing policy framework worldwide, that is to say taking into account "*only those government policies and measures (...) enacted or adopted by mid-2012*" (Ibid).

As such, it is a cross-check against the new-policies scenario in that it projects what the IEA thinks will happen without any further policy action in the future.

Finally, the 450 scenario is the IEA's attempt to model "a plausible energy pathway (...) consistent with actions having around a 50% chance of meeting the goal of limiting the global increase in average temperature to two degrees Celsius in the long term". Given that current international commitments on climate policy fall far short of what would be required to achieve this pathway, however, this is something of a hypothetical modelling exercise at present, albeit a very useful and illuminating one.

The projections under all three scenarios are modelled in such a way that supply and demand balance exactly, with no change in the level of spare capacity or inventories assumed into the future.

For our purposes here we focus on the new-policies scenario, and Figure 1 sets out the IEA's projection for global oil supply out to 2020 and 2035.

Figure 1: World oil production*, 2011-35, as per the "new-policies" scenario in the 2012 WEO (m bbls)

	2011	2020	2035
Conventional crude oil	68.5	66.9	65.4
Natural-gas liquids	12.0	15.2	18.2
Unconventional oil	3.9	9.7	13.2
World Oil Production	84.5	91.8	96.8
Processing gains	2.1	2.5	2.9
World Oil Supply	86.6	94.2	99.7
Bio-fuels**	1.3	2.4	4.5
World Total Liquids Supply	87.9	96.6	104.2

Source: IEA; *All petroleum liquids; **expressed in energy-equivalent volumes of gasoline and diesel.

The IEA gives three main headline numbers, namely (i) what it calls World Oil Production (comprising conventional crude oil, natural-gas liquids or NGLs, and unconventional oil); (ii) World oil Supply (the first category plus processing gains; and (iii) World Total Liquids Supply (the second category plus bio-fuels).

For reasons explained in our report *Crude Oil: Iceberg Glimpsed Off West Africa* of 2 February 2012 (see in particular pages 20-22), the key number to focus on is the first of these categories, i.e. what the IEA calls "World Oil Production" comprising conventional crude oil plus NGLs plus unconventional oil (essentially tight oil and oil sands).

(And as also explained in *Crude Oil: Iceberg Glimpsed Off West Africa*, in order to derive a like-for-like comparison with the numbers for conventional and unconventional oil, we need to adjust the NGL figures that the IEA gives on a volumetric basis (i.e. in barrels, as shown in Figure 1) to barrels-of-oil equivalent (boe), as at 4.4GJ/bbl and 6.3GJ/bbl respectively, NGLs on average contain only 70% of the energy value of a barrel of crude or unconventional oil.)

Looking at the projection for world oil production out to 2020 and 2035 shown in Figure 1, what is striking is the fact that NGLs and unconventional oil increase their share of overall production significantly over the period relative to conventional crude. Conventional crude oil accounted for 81% of world oil production in 2011 (i.e. 68.6mbd/84.5mbd) but is projected to contribute only 73% and 67% of the total by 2020 and 2035 respectively. This is explained by the very sharp expected increase in production of both NGLs and unconventional oil over the forecast period.

The supply of NGLs is projected to increase by 25% over 2012-15 and by 50% over 2012-35 owing to (i) the increased global production of natural gas itself over the forecast period, especially in the Middle East and North America (this increases the production of the liquids associated with natural gas), and (ii) reduced flaring of natural gas associated with oil in countries like Russia, Nigeria, and Iraq (such associated gas tends to be rich in NGLs).

The supply of unconventional oil is projected to increase so sharply owing mainly to the boom in light tight oil – also commonly referred to as shale oil – in North America, and the continuing rise in the production of Canadian oil sands. Production rises from 3.0mbd in 2011 to 9.7mbd in 2020 and 13.2mbd in 2035, with light tight oil mushrooming from 1mbd in 2011 to 3.8mbd in 2020 before falling back from the middle of the next decade to stand at 3.4mbd in 2035. Canadian oil sands trend upwards at a slower rate than light tight oil up to the middle of the next decade, but remain on an upward trajectory over the entire forecast period: from 1.6mbd in 2011 the IEA projects that output will reach 2.9mbd by 2020, and 4.3mbd by 2035.

With the United States being the source of the overwhelming majority of the increase in light tight oil, as well as seeing a significant increase in its production of NGLs under the IEA's forecasts, the WEO projects that the US will for a time surpass Saudi Arabia as the world's largest oil producer by around 2020.

US production of conventional and unconventional oil plus NGLs is projected to rise from 8.1mbd in 2011 to 11.1mbd in 2020 (the KSA's production is projected to be 10.6mbd in 2020), before falling back to 9.2mbd in 2035 as the production of light tight oil starts to fall back after 2025. Saudi Arabia regains its place as the world's top producer after 2025, and the WEO has the Kingdom's output reaching 12.3mbd in 2035.

In addition to the significant boost to world oil production from light tight oil and NGLs, the IEA expects Iraq to double its production over 2011-20, mostly from increased production of conventional crude oil.

Declining output from existing production

Perhaps the most interesting question raised by the supply projections in Figure 1 above is why the production of conventional crude oil actually declines both to 2020 and 2035 despite the expected large increase from Iraq as well as rising production from Brazil's off-shore fields.

To some extent this is because non-OPEC production of unconventional oil and both non-OPEC and OPEC production of NGLs are expected to increase sharply over the forecast period, giving OPEC a greater degree of discretion over its output of conventional crude.

Much more important, however, is the ongoing decline in the output from existing fields. The IEA estimates that the production of conventional crude oil from fields already producing will fall from 68.5mbd in 2011 to c.58mbd by 2020 and to c.30mbd by 2035.

In other words, the world needs to replace around 10.5mbd and c.40mbd of lost conventional crude output over 2012-20 and 2012-35 respectively just to keep output constant i.e. before accounting for any increase in global demand.

This implies that output from existing conventional fields is expected to decline at a rate of c.1.3mbd per year out to 2020 and by c.1.8mbd per year out to 2035.

If we then assume that output from already existing sources of unconventional oil and NGL production fall at the same respective rates over 2012-20 and 2012-35 as the rates at which the IEA projects output of conventional crude from already existing fields will fall, then this would imply that total world oil production (conventional crude plus NGLs plus unconventional oil) from currently producing fields will fall by 1.5mbd per year over 2012-20 and 2.3mbd per year over 2012-35.

The changing pattern of global demand

In addition to replacing the projected lost output from fields already in production, world oil supply will have to grow in order to meet continuing rising demand in the non-OECD economies, particularly in Asia and the Middle East. Figure 2 shows the IEA's projections for global oil demand out to 2020 and 2035 under the new-policies scenario (note that the numbers for total World Oil Demand shown here in Figure 2 equate to the line "World Oil Supply" in Figure 1 above, i.e. the line "World Oil Production" plus processing gains). Note that the IEA presents the category "Bunkers" separately, i.e. unattributed to individual countries, which is different from BP's approach to the presentation of global demand data over 2000-10 in Figures 3-8 below.

Figure 2: World oil demand* by region, 2011-35, as per the "new-policies" scenario in the 2012 WEO (m bbls)

	2011	2020	2035
OECD	42.1	39.4	33.3
Non-OECD	38.4	47.1	57.1
<i>o/w E. Europe Eurasia</i>	4.8	5.2	5.6
<i>o/w Asia</i>	18.3	23.8	30.9
<i>o/w Middle East</i>	6.8	8.1	9.4
<i>o/w Africa</i>	3.1	3.8	4.5
<i>o/w Latin America</i>	5.5	6.3	6.8
Bunkers	6.9	7.7	9.3
World Oil Demand	87.4	94.2	99.7

Source: IEA; *All petroleum liquids excluding bio-fuels.

Looking at the demand-side projections in Figure 2, the OECD continues the decline in consumption that actually began in 2005, with demand projected to fall from 42.1mbd in 2011 to 39.4mbd in 2020 and 33.3mbd in 2035. By contrast non-OECD demand continues to rise across the entire forecast period, increasing from 38.4mbd in 2011 to 47.1mbd in 2020 and 57.1mbd in 2035.

Unsurprisingly, Asia is the main driver of non-OECD demand growth, with China and India the two most important sources of rising consumption. (together, China and India increase their demand by 4.5mbd over 2011-20, with China's demand increasing by 3.7mbd to 12.7mbd, and India's by 0.9mbd to 4.3mbd). Overall, Asia's compound annual growth rate (CAGR) in demand over 2011-35 is 2.2%.

All the other non-OECD countries also show rising demand across the entire forecast period, with Africa exhibiting a CAGR over 2011-35 of 1.6%, followed by the Middle East (1.4%), Latin America (0.9%), and Eastern Europe/Eurasia (0.6%).

The IEA's 2020 pricing forecasts: \$120bbl in real terms

On the basis of its supply-and-demand forecasts under the "new-policies" scenario, the IEA derives a projected 2020 oil-price forecast of \$120/bbl by 2020 in real terms (i.e. in constant 2011 \$), and of \$125/bbl in real terms by 2035.

IEA Middle-East demand growth looks very low to us

Figures 3-8 show the increase in oil consumption globally over the last decade as given by BP. As can be seen from Figure 4, at 56% the Middle East in fact exhibited the strongest relative growth rate of any region over 2000-10, and as shown in Figure 7, three of the countries in this region (the KSA, Iran, and the UAE) were amongst the 10 countries that registered the largest absolute increases in their domestic oil consumption over this period.

Figure 3: Total global oil* consumption (all petroleum liquids), 2000-10 (kbd)

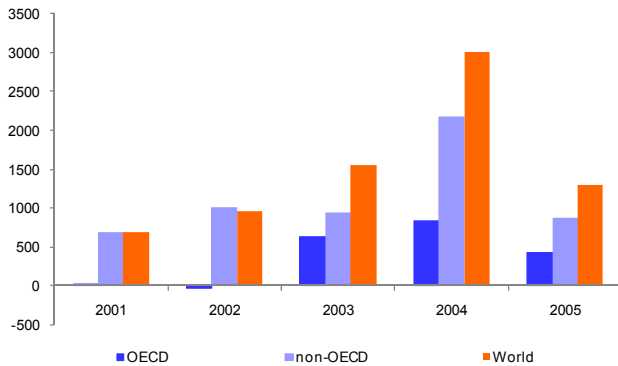
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2010/2000
Total World Consumption*	76,605	77,304	78,268	79,823	82,827	84,126	84,958	86,428	85,999	84,714	87,382	14.1%
o/w OECD	48,128	48,139	48,106	48,734	49,566	49,996	49,794	49,611	48,053	45,963	46,438	-3.5%
o/w Non-OECD	28,477	29,165	30,162	31,090	33,262	34,130	35,164	36,817	37,946	38,751	40,944	43.8%

Source: BP; *All petroleum liquids, unadjusted for their respective energy densities

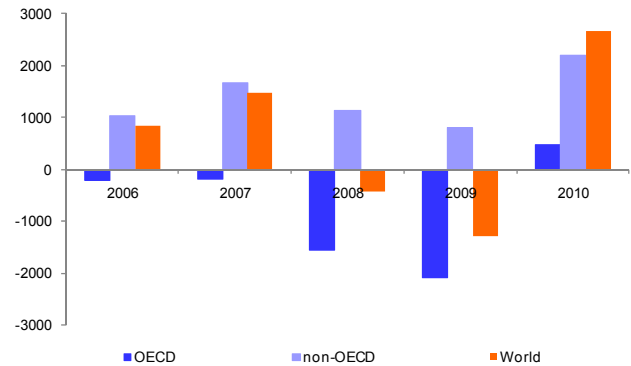
Figure 4: Evolution of global oil* consumption by region ranked by relative increases over 2000-10 (kbd)

	2000	2010	2010/2000	2010/2000
Middle East	5,021	7,821	2,800	55.8%
Africa	2,439	3,291	853	35.0%
Asia Pacific	21,135	27,237	6,103	28.9%
South & Central America	4,855	6,104	1,249	25.7%
Europe and Eurasia	19,582	19,510	-72	-0.4%
North America	23,574	23,418	-155	-0.7%

Source: BP; *All petroleum liquids, unadjusted for their respective energy densities

Figure 5: YoY change in oil* consumption, 2001-05 (kbd)

Source: Deutsche Bank after BP; *All petroleum liquids, unadjusted for their respective energy densities

Figure 6: YoY change in oil* consumption, 2006-10 (kbd)

Source: Deutsche Bank after BP; *All petroleum liquids, unadjusted for their respective energy densities

Figure 7: Evolution of global oil* consumption showing top 10 absolute increases over 2000-10 (kbd)

	2000	2010	2010/2000 (kbd)	2010/2000 (%)
World	76,605	87,382	10,777	14.1%
China	4,766	9,057	4,291	90.0%
Saudi Arabia	1,578	2,812	1,234	78.2%
India	2,261	3,319	1,058	46.8%
Brazil	2,018	2,604	585	29.0%
Singapore	645	1,185	540	83.6%
Russian Federation	2,698	3,199	502	18.6%
Iran	1,304	1,799	495	38.0%
Canada	1,922	2,276	354	18.4%
Thailand	835	1,128	293	35.1%
UAE	396	682	286	72.1%

Source: BP; *All petroleum liquids, unadjusted for their respective energy densities

Figure 8: Breakdown of global oil* consumption increases over 2000-10 between world and OPEC (kbd)

	2000	2010	2010/2000 (kbd)	2010/2000 (%)
World	76,605	87,382	10,777	14.1%
OPEC (nine countries only)**	4,464	7,244	2,780	62.3%

Source: BP; *All petroleum liquids, unadjusted for their respective energy densities; **OPEC members excluding Iraq, Angola, and Nigeri

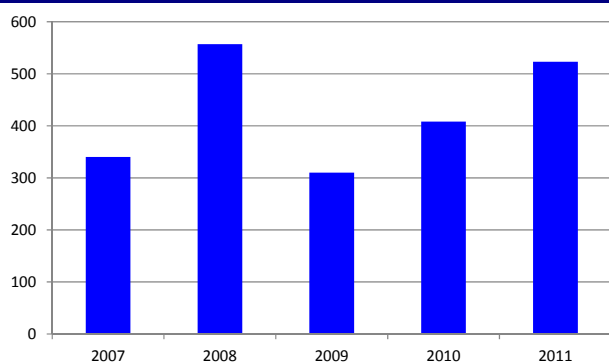
There are two main reasons for this very dramatic increase in Middle Eastern oil demand over the last decade: (i) generous subsidies on domestic oil subsidies, and (ii) strong population growth.

In view of the Middle East's extremely rapid growth in domestic oil consumption over the last decade, we find the projections for the region's demand growth over 2012-20 as set out in the 2012 WEO are very light. This is because we expect both the generous subsidies on domestic oil consumption and rapid population growth to continue out to 2020.

Subsidies and population growth in key ME countries

Figure 9 shows the IEA's estimates of total subsidies on fossil-fuels since 2007. In 2010 the stood at \$408bn, and this increased to \$523bn in 2011.

Figure 9: Global subsidies on fossil fuels (\$ bn)



Source: IEA

As explained in our report *Crude Oil: Iceberg Glimpsed Off West Africa*, Figure 10 then shows the detailed breakdown of the 2010 number between the various fossil fuels, from which it can be seen that direct subsidies on oil accounted for \$192bn out of the total \$408bn, or nearly half the total. If we then add to this the subsidies on electricity – a large proportion of which is on oil-fired power generation – we infer that globally >50% of all subsidies on fossil fuels are on oil.

Figure 10 highlights OPEC countries in blue and other major oil exporters (i.e. those with >100kbd in net crude exports in 2009) in orange.

In terms of the breakdown of total direct subsidies on oil between net exporters and net importers, it can be seen that OPEC countries accounted for \$121bn of the total \$192bn (63%), and other major oil-exporting countries (i.e. those with net crude exports in excess of 100kbd) for a further \$16bn.

This means that the major oil-exporting countries of the world accounted for \$137bn of all direct subsidies on oil in 2010, or 71% of the total \$192bn.

Figure 10: Global fossil-fuel subsidies, 2010 (\$bn)

	Oil	Gas	Coal	Power	TOTAL
Iran	40.9	25.5	0	14.4	80.8
Saudi Arabia	30.6	0	0	13.0	43.5
Russia	0	17.0	0	22.3	39.2
India	16.2	2.2	0	3.9	22.3
China	7.8	0	2.0	11.6	21.3
Egypt	14.0	2.4	0	3.8	20.3
Venezuela	15.7	1.4	0	2.9	20.0
UAE	2.7	10.0	0	5.5	18.2
Indonesia	10.2	0	0	5.8	15.9
Uzbekistan	0.6	9.3	0	2.4	12.2
Iraq	8.9	0	0	2.2	11.3
Algeria	8.5	0	0	2.1	10.6
Mexico	9.3	0	0	0.2	9.5
Thailand	2.1	0.5	0.4	5.4	8.5
Ukraine	0	5.2	0	2.5	7.7
Kuwait	2.8	0.9	0	3.9	7.6
Pakistan	0.1	4.9	0	2.2	7.3
Argentina	0.8	2.5	0	3.2	6.5
Malaysia	3.9	1.0	0	0.8	5.7
Bangladesh	0.3	1.9	0	2.8	5.0
Turkmenistan	0.9	3.6	0	0.6	5.0
Kazakhstan	2.0	0.2	0.4	1.7	4.3
Libya	3.2	0.3	0	0.8	4.2
Qatar	1.2	1.4	0	1.6	4.2
Ecuador	3.7	0	0	0	3.8
Vietnam	0	0.2	0	2.7	2.9
Nigeria	2.4	0	0	0.5	2.9
South Africa	0	0	0	2.1	2.1
Angola	0.9	0	0	0.2	1.1
Philippines	1.1	0	0	0	1.1
Azerbaijan	0.1	0.4	0	0.3	0.8
Taiwan	0.2	0	0	0.3	0.6
Sri Lanka	0.3	0	0	0.2	0.5
Colombia	0.5	0	0	0	0.5
South Korea	0.0	0	0.2	0	0.2
TOTAL	191.9	91.0	3.1	121.6	407.6
o/w OPEC	121.4	39.8	0.0	47.0	208.2
o/w other major oil exporters*	15.8	18.8	0.4	28.0	63.0

Source: IEA, EIA; * countries with net crude exports of >100kbd in 2009

If we then add to this the \$20bn of subsidies we estimate to have been for oil-fired power generators – all of which we assume to be in OPEC countries (mostly Saudi Arabia, Iran, the UAE, and Kuwait) -- we conclude that the major oil exporters accounted for c.\$157bn of the \$210bn in direct and indirect global oil subsidies in 2010, or 75% of the total.

And the important thing to note about oil subsidies, especially in producing countries, is that once in place they are very difficult to remove in this respect the experience of Nigeria earlier this year is very instructive.

As far as the population growth in the Middle East is concerned, Figure 11 shows the trend for selected key countries (those comprising the Gulf Cooperation Council, or GCC) since 2000, with projections to 2020.

Figure 11: GCC population growth and projections (m)

	2000	2010	2020
Saudi Arabia	20.5	26.2	33.3
Kuwait	2.2	3.6	5.2
UAE	3.2	5.6	7.1
Bahrain	0.6	1.2	1.7
Oman	2.4	3.1	3.5
Qatar	0.6	1.8	2.8
Total	29.6	41.5	53.4

Source: Economist Intelligence Unit

The data in Figure 11 are from the Economist Intelligence Unit, who in turn drew on IMF and the relevant countries' projections. The important thing to note about these figures is that the very rapid population growth experienced by these countries over 2000-10 is expected to continue over 2011-20.

Indeed, in absolute terms, the GCC's population is projected to increase by exactly the same amount over 2011-20 as it did over 2000-10, namely 11.9m, with more than half of that growth coming in the world's largest oil producer and exporter, Saudi Arabia.

KSA demand alone could rise by 1.8mbd to 2020

Unless the current very high level of subsidies in key Middle Eastern countries can be reined in dramatically, we think the oil-demand forecasts in the 2012 WEO will prove too low, and perhaps much too low.

Indeed, we would argue that in the absence of a dramatic scaling back of subsidies, Saudi Arabia on its own could experience an increase in domestic oil demand over 2011-20 almost as great as that of the IEA's projection for the entire Middle East region as a whole.

The KSA's oil demand is being driven by two main factors, namely (i) very rapid electricity demand growth (c.60% of the Kingdom's power is generated from oil, and power demand grew at a CAGR of 6.4% over 2001-10); (ii) the growth in consumption associated with transportation and industry.

As far as the use of oil in power generation is concerned, the KSA is currently in the process of adding significant new oil-fired capacity over the next five years to meet the burgeoning demand that is coming from (i) population growth, (ii) the need for more de-salination facilities as pressure on fresh-water supplies increases over time, and (iii) the growth in demand for air-conditioning.

Based on our analysis of various sources, we expect new oil-fired generation capacity of at least 5,000-6,000MW to come on-stream over 2012-17, and taking into account continuing growth in power demand and in the demand for oil as an industrial and transportation fuel we think that the Kingdom's domestic oil consumption could reach 4.6mbd by 2020 compared with the 2.8mbd shown by BP for 2010 in Figure 7 above.

This would represent an absolute increase of 1.8mbd over 2011-20 for the KSA alone, and as such would not be far short of the 2.3mbd increase that the WEO is projecting for the entire Middle East region as a whole over the same period (as per Figure 2 above, the Middle East's consumption rises from 6.8mbd to 9.1mbd over this period).

In the 2012 WEO, the IEA makes reference to this vital question of future Saudi demand, saying (p. 86):

"The New-Policies scenario assumes that the Saudi government reduces oil and gas subsidies to a limited degree, which helps to encourage more efficient energy use and spurs more gas production. But cutting subsidies and raising prices is not an easy task. Although a signatory to the 2009 G-20 call for inefficient fossil-fuel subsidies to be phased out, the Saudi government has not yet announced any plans to raise oil or gas prices, though electricity price rises are planned." (Our emphasis)

If the projections for Middle Eastern demand growth out to 2020 are too light, global exports of crude oil over the next decade will likely be lower than implicitly assumed in the 2012 WEO, with more bullish implications for prices than the IEA is assuming.

Conclusion: subsidies key to pricing assumptions

If subsidies on domestic oil consumption cannot be reined in materially in some of the world's key exporters in the near future, then we expect the IEA's real-terms 2020 oil-price forecast of \$120/bbl could prove too low, and perhaps significantly so. **And as the IEA itself notes in the 2012 WEO, "cutting subsidies and raising prices is not an easy task".**

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Appendix 1

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