The executive summary of the INES in 22 Pdf pages was released towards the end of second week of June 2013. The work was done by Booz & Company under guidance of steering committee established by PMAC “Prime Minister Advisory Council” representing ministries of Oil, Electricity, Planning, Finance, Industry & Mining and Environment. It took 18 months and included 40 workshops and 150 interviews. The recommendations as portrayed in the INES report:

- Describe the current challenges facing Iraq’s energy sector and opportunities presented by its energy resources
- Define vision and set a national policy objectives
- Layout a long-term plan of policy commitments, infrastructure development and institutional reform to achieve the defined vision

The contents of the summary of the INES report are as follows:

I- Introduction
II- Summary of the final report
   1- The upstream oil sector
   2- The downstream oil sector
   3- The natural gas subsector
   4- The power subsector
   5- The linked Industries subsectors
   6- INES Requirements and Results
   7- Institutional Reform
   8- INES Governance

The strategy dimensions were reported to be:

- Energy Security: Meeting domestic energy demand
- Government value maximisation: in energy associated investments
- Economic Diversification
- Employment generation
- Environmental sustainability

The scope of work included major components of the “Energy Sector” as defined by the items 1 to 5 above. It looks however that some main sectors and several subsectors of “Linked Industries” were not included. Since economic diversification was a concern (to increase share of non-oil GPD) more sectors could have been considered. The strategy now can be transformed into Integrated National Development Strategy “INDS” where “missing sectors and subsectors” may be included.

This analysis to follow is based on the summary report ‘SR’ in absence of the detailed study. The coverage of activities and investment in each subsector will be taken as at appears in the SR. Comments on other subsectors or projects within a sector will be made bearing in mind that:
Tremendous effort is believed to have been made to integrate all input data leading to the results contained in the strategy report.

The INES was a must pre-requisite to start the bidding rounds of MoO, an issue that would have:

a. Avoided the uncertainty in the offered PPTs by the bidding IOCs and the eventual scaling down of those PPTs by MoO.

b. Presented other fields choices with higher risk to contract by IOCs and left several known green and brown fields for development by national operators with contribution of international contractors as needed.

c. Have set the bases to plan for exploration, gas, refining and associated industries.

The results of any study depend on the input quality and the technical capabilities of the working team. Comprehensive short, medium and long terms plans would lead to ‘Comprehensive Strategy’ that can be transformed into a National Development Strategy covering all sectors.

The results as portrayed in the SR indicate that the feed from MoO and MoE was the highest compared with the other ministries represented in the steering committee. Few important ministries such as Water Resources, Transport, Telecommunication, Agriculture, Commerce and Education could have been included?

1: The upstream oil sector

1.1: Linkage oil production- GDP: No forecast beyond 2010 was suggested

1.2: Oil Reserves: Reported reserves are in order noting that:

   ▪ The current 143 billion barrel can be increased to 175 billion (Author’s estimate) by improving the Recovery Factors that are believed to be generally law especially in the case of the brown fields.

   ▪ Additional reserves are expected to be announced after completion of seismic data acquisitions in the awarded fields of Bids 1-3. Furthermore, new reserves are expected to be discovered in the four Blocks of Bid-4.

1.3: Alternatives of oil production profiles

1.3.1: The High Production profile

This profile is very unlikely to achieve due to reservoir constraints resulting in risk of short duration at peak PPTs. The scheme requires fast installation of the Mega Water Injection Project “MWIP” (delayed now) that needs immense monitoring believed to be outside the capabilities of the Regional Oil Companies “ROCs” of the awarded fields and would require separate body/contractor. Furthermore, there are no development plans for the many fields under the national operators (SOC, MOC, MidOC and NOC) that may provide a cushion to sustain the PPTs. Contribution to production from Kurdistan is still under evaluation with no steady and reliable forecast in sight.
1.3.2: The Medium Production profile
This profile is possible subject to:

- Proper evaluation of the FDPs (Field Development Plans) of the awarded fields that are believed to be presented to MoO by the end of last year. This should include strict assessment of the expectations of the green reservoirs that are covered by the FDPs.
- Immediate follow up of the integrated MWIP stating a final choice of the source water (Sea Water offshore Fao or saline water from ‘Main Outfall Drain’ followed by completion of the FEED and project construction (5 years?).
- Installation of surface production facilities to handle larger production rates and increasing water cut in the crude oil
- Expansion of storage, transportation and export facilities
- Field electrification is needed to facilitate use of electric submersible pumps “ESPs” to be installed in producing wells in conjunction with water injection

1.3.3: Low Production profile
This is the most likely profile that is line with expected progress in expanding storage, transportation and export facilities plus the completion of the MWIP. This profile will give time to proper reservoir monitoring and management to ensure durable PPT for longer time. It may add up one million b/d that can be part of a surplus capacity to meet fluctuating demand on Iraqi Oil.

The three profiles are comparable with those of the IEA Iraq Energy Outlook of November 2012, shown in the right hand side except for the buildup:
- High case: 11mmb/d in 2035
- Central: 9mmb/d in 2035
- Delayed (Low): 4mmb/d in 2020 and 5.3 in 2035

The IEA report was released after discussion with MoO and many independent specialists.

2: The downstream oil sector
2.1: Crude oil evacuation (Transportation)

The proposed evacuation plan considers three type of crude oil, Kirkuk, Basra Light and South Heavy:

- Basra Medium is not accounted for
- Kurdistan Heavy, Medium and Light are not distinguished and they should not be mixed with Kirkuk type. Separate network by agreement with the federal government is needed.
- The 230,000 b/d production of API 17 heavy crude from the awarded fields of Qaiyara and Najma (planned to tie in with flow of Kirkuk Field) should not be mixed with Kirkuk.
Crude. That with more production from nearby Jawan and Qasab (not awarded) should in the future be mixed with heavy or medium Kurdistan crude oil.

2.1.1: Northern Evacuation System
- The assumed capacity for the two lines of Iraq-Turkish Export Pipeline is in order
- There is big uncertainty about the Syrian option that may have to be substituted by Iraq-Jordan Pipeline
- Iraq-Red Sea pipeline through Jordan may be contracted in two stages of 1-1.25 million B each
- Total capacity of the northern system can reach around 4mmbpd

2.1.2: North South Link
This comprises current and future PS1-K3 links. The total announced capacity of 3.25 mmbpd may be too tight to source both Iraq-Jordan and Iraq-Turkish Pipelines in full capacity. Drug reducers can help pumping extra %20 as tried earlier by NOC along the second line.

2.1.3: Southern Evacuation System
The system is planned to comprise:
- 4 x 0.9 (3.6) mmbpd SBMs in Khor Alamia Oil Terminal KAAOT and 1.6 mmbpd in AlBasra Oil Terminal ABOT
- New 2mmbpd pipeline and terminal facility for evacuation of heavy crude oil
- Total export capacity is around 7mmbpd
The next few years may show if an outlet becomes necessary to replace the Gulf Route or not?

2.2: Refining
Iraq continues to be short of production of white products until 2019. The scope of work of the INES is:
- Upgrade of Dura and Basra Refineries
- Rehabilitation of selected already installed topping plants (Dhi Qar, Najaf, Samawa, Diwaniya and Amara)
- Retirement of some existing refining capacity
- New refineries in Qaiyara, Kerbala, Maisan, Kirkuk and Nasiriya
- Total refining capacity to increase from 800 kbpd to 1400 kbpd in 2019. IEA Energy Outlook anticipates new refineries start coming up in 2019
The following challenges face the INES plan:

Qaiyara Refinery: This complex refinery has been a dream in Iraq for years as the only option to handle heavy crude quality of the four fields of Qaiyara Group (Qaiyara, Najma, Jawan and Qasab) with a total field potential exceeding 400,000 b/d.
Qaiyara and Najma were awarded to Sonangol but the bid contract did not include upgrade of the API in the field. Jawan and Qasab Fields are still under NOC.
Construction of the new complex refinery would require FEED and improved security in Qaiyara region and south of Mosul in general. So far conditions caused delay of field activities starting from seismic data acquisition.

Other refineries: While Kerbala Refinery seems to be going ahead, the fate of the planned Kirkuk refinery is linked to the status of the disputed Kirkuk Governorate. If no agreement is reached between KRG and the Federal Government about Kirkuk the refinery may have to be built in another site such Baiji or Mosul?
Maisan refinery (150,000 b/d) will follow Kerbala Refinery while Nasiriya Refinery is part of a package including development of Nasiriya Field that may require several years to complete.

2.3: Products
Noticeable expansion of distribution facilities is stressed in depots, pipelines, retail services and metering. However no specific plans with scope of work- timing and cost are suggested in the SR.

3: The natural gas subsector
3.1: Alternative production profile

- The analysis will use the following GOR values (scfpb). In absence of design criteria only %75 of the separated gas may be economically feasible to utilize for compression.

<table>
<thead>
<tr>
<th>% Contribution</th>
<th>GOR Total</th>
<th>GOR utilised</th>
</tr>
</thead>
<tbody>
<tr>
<td>S Fields (%75)</td>
<td>800</td>
<td>600</td>
</tr>
<tr>
<td>N Fields (%20)</td>
<td>600</td>
<td>450</td>
</tr>
<tr>
<td>Kurdistan (%5)</td>
<td>200</td>
<td>150</td>
</tr>
</tbody>
</table>

Exhibit ES - 6: Alternative Gas Production Profiles

This report (* in mmbpd) estimates peak associated gas as:

<table>
<thead>
<tr>
<th>Peak</th>
<th>Iraq*</th>
<th>Kurdistan*</th>
<th>IEA Outlook*</th>
<th>bscfd</th>
<th>bscfd INES</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>13</td>
<td>0.65</td>
<td>11</td>
<td>South: 5.85</td>
<td>8.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>North: 1.17</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Kurdistan: 0.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Total: 7.12</td>
<td></td>
</tr>
<tr>
<td>Medium</td>
<td>9</td>
<td>0.400</td>
<td>9</td>
<td>South: 4.05</td>
<td>6.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>North: 0.81</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Kurdistan: 0.06</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Total: 4.92</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>6</td>
<td>0.250</td>
<td>= or &gt;5.3</td>
<td>South: 2.70</td>
<td>4.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>North: 0.54</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Kurdistan: 0.04</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Total: 3.28</td>
<td></td>
</tr>
</tbody>
</table>

The above analysis of the availability of associated gas of the three production profiles (included oil production from Kurdistan ‘not given by INES but estimated in this report’ indicates that INES figures may be high by %25-%20 if the contribution of fields of Bid-3 are excluded.
Furthermore 1.5 bcf/d is assumed as production of non-associated gas noting that the awarded 3 fields of Bid-3 “Akkas, Siba and Mansuria” (including inINES) is only 0.600 bcf/d as contracted. By conclusion the difference of 0.9 bcf/d is likely to be from Kurdistan mostly (unspecified fields).
The main challenges facing the gas strategy plans will be:

- Delays in oil field development will be reflected on gas production. Bearing this in mind the Low profile with upside of %15 is the most likely.
- The year 2015 will see the capture of all produced gas as anticipated by INES is far too optimistic.
- Intensive program is required to prepare and commission a Master Gas Plan leading to construction of complete processing and distribution network that includes the top priority ‘National Gas Pipeline’, LPG and LNG facilities.
- The gas plan is definitely outside the capability of MoO. The role of Basra Gas Company that is now restricted to operate in three fields may have to be revised if National Gas Company is not formed?
- The domestic price to increase diversified economy via downstream and linked industries?
- Accurate assessment of the availability of surplus gas for export that will avoid idle plant capacity

3.2: Export of surplus gas

The availability of gas for export, not clear now, requires revision post 2015 after:

- Progress in development of the awarded fields of Bid-1 and 2
- Progress in the development of Siba and Akas fields (500 mmscfd) is made. Mansuriya Field will have to wait until security in Dyala improves
- Field seismic acquisition in Blocks, 8, 9, 10 and 12 (Bid-4) and perhaps discovery well in each block
- Gas exploration and utilization in Kurdistan is at clearer picture

Import of natural gas from Iran via a pipeline to Baghdad passing near Mansuriya Field, contradicts principle of utilizing Iraqi gas, and is subject to delays and discontinuous operation due to security conditions?

4: The power subsector

The planned expansion of generation capacity according to INES is adding 40 plants (steam & gas turbines) by 2016 increasing the current 9000 MW to 22000 MW. The feed will be either gas or oil while Combined Cycle Gas Turbines will come into service after 2016. Two GW renewable power generation are planned by 2030. Import of Electricity is said to stop by 2016?

Earlier this year MoE announced its 5-year plan shown on the right handside. The main challenges facing the strategy are:

- Definite uncertainty regarding gas availability for the 14 planned stations by 2015 and absence of distribution network
• Shortage of water for the steam turbine driven stations, noting that the MWR was not represented in the steering committee. Shortage of water was a cause for power cut in at least two stations in summer of 2012? Many experts think that the two Iraq’s rivers will be dry by 2040?
• The record of achievements of MoE in the last ten years shows that project constructions are slow.

5: The linked Industries subsectors

• Each of the mentioned industries provides foundation for multiple secondary industries that are undefined under each type.
• Items 5.1 and 5.2 below require gas as feed, the amount – timing of which is not defined.
• Such industries should either be privatised, run by the ‘mixed sector’ (partially or totally), or left to the State? No analysis of the ownership issue was made.

5.1- Petrochemicals
Iraq is importing 188,000 tonnes per year at a cost of $275 million. The INES proposes that 15.6 million tonnes will be available by 2030. Assessment of the practicality of that can’t be made:
  • No project scope of work-time table is shown
  • No gas feed forecast is given
  • Does the plan include renovation and expansion of the present PC1 and re-activation of PC3 Mol ex-project that covered noticeable progress including the completion of the FEED and much of the civil work?

5.2- Fertilizers
Iraq imports %50 of its needs at cost of $100 million per year. The INES proposes increase of the production from the three existing plants (Al Qaim, Baiji & Khor Elzubair) of 300,000 tonnes to 6.3 million tonne per year by 2030:
  • Feed is natural gas but no forecast is presented
  • No project scope of work-time schedule is shown
  • Any renovation and expansion of the existing plants?
  • Urea required for fertilizers manufacturing in Al Qaim Phosphate plant is gas dependent. In absence of its local production in1987, it had to be transported from Baiji plant.

5.3- Steel
Iraq imports 2 million tonnes per year at a cost of $1.2 billion. The strategy proposes production of 10.2 MTPA by 2030. No details are mentioned and no plan for renovation and expansion of the existing plant in Khor Elzubair is suggested.

Flow lines for connecting oil wells to gathering-production network are extensively used in in Iraq. There will be at least 1000 wells to be drilled in the awarded fields that requires 4”-8” flow lines. Taking an average of 1.5km per well, the need is at least 1500 km of pipe that can be manufactured in a plant near Basra. Mol in the late 80s was negotiating purchase of know how to set up a Pipe Manufacturing Plant in in Khor ElZubair.

5.4- Aluminium
Under the INES plan the capacity will increase from zero to 1 MTPA (million tonne) in 3030.
A Smelter project requires huge energy supply, was under consideration by MoI in about 1987.

5.5- Cement
The current import cost is $780 million. Meeting domestic demand by 2014 does look possible. No projects and time table is presented to judge the validity of the suggested target.

5.6- Bricks
Proposed plan looks sound but no links with growth of population and residential & industrial requirements (Ministry of Planning?) to check. Also no substitute (alternative or choice of technology) to replace fertile soil being used for manufacturing the brick, is defined?

Brick and cement plants are to be in diversified locations in Iraq to meet local needs however no detail was given.

Petrochemicals, Fertilizers, Steel and Aluminium plants are to be gathered in a complex near Basra on route to export and to provide space for further related downstream industries. Know how, gas supply and power are needed, however no necessary details of the complex are given?

Price of gas supplied to local industry must be an incentive to achieve increased diversified economy.

5.7- Missing Industries and sectors

5.7.1- Mining
Sulfur: Possible renovation and expansion of existing plant in Mishraq?
The sulfur is extracted by using hot water at 170 F (requires electricity):
- Renovation involves working over blocked wells due to freezing of Sulfur because of hot water supply interruptions in the past.
- Eastern part of the mine is believed to be across the Tigress located in a ‘Disputed Area’ with KRG?

Bentonite: State or private exploitation for drilling mud to source drilling requirements of over 1000 new wells planned by TCS Operators. Successful trial of the ore from W Desert was made in drilling two wells in Kirkuk and Zubair Fields by IDC in 1991.

Kaolin and others: Reference to Geological Survey and Mining Investigation work plan would have helped.

5.7.2: Other industries
To diversify economy, improvement of other industries that were part of MoI program for years is worth looking at. Incentives may be granted to the private sector to take care of the industries to the following:
- Textiles Industries: Current cotton and wool industries
- Rubber Industries: Renovation and expansion of Diwaniya and Najaf plants
- Parts for Assembly Industries (إنتاج وسائل الإنتاج): Detailed study of 1988 available with MoI?
5.7.3: Other Sectors
Other sectors that can be part of the INS or INDP and related 5-yr plans:

**Water Resources:**
- Secure more water for domestic, industrial use and for agriculture (to ensure national food security)
- Construction of more irrigation projects
  - Over 100 sites of dams are available with MWR several of which are under study; some can be for multiple use including generation of hydroelectric power
  - Serious consideration of implementing Iraq Green Belt (Independent study by Dr Hasan AlJanabi is available)
- More water wells with allocation of electricity supply
- Modernise irrigation policy adopting water conservation

**Transport:** Highways and roads to include those in the countryside, railways and ports especially Great Fao Port.

**Agriculture:** Basic issues to take care of; to replace import of Wheat, Rice, food products, vegetable and fruit.

**Communication & Telecommunication:** Renovation and expansion of Land telephone exchanges and cross-country telecommunication

**Health and Education:** Require intensive plan to ensure healthy and educated society who can enjoy the benefits of the oil wealth

6: NES Requirements and Results

6.1: INES Costing
$620 billion in total (530 CAPEX and 90 OPEX) including all payments to TSC Operators. Private investments will contribute %15 primarily in refining and linked industries.

a. %60 of the expenditure will go to TSC Operators of MoO
b. %15 of the expenditure for production and handling of the natural gas
c. %15 of the expenditure for renovation and expansion of the power system
d. Net present value over span of strategy assuming $110 per barrel for Brent is $5 trillion with +%,- one trillion for a change of $20 per barrel

Comment: No projects scope of work and timing to assess assumption. Furthermore, cost of many sectors and sub-sectors that are not included in the INES will definitely have a share in the assumed budget.
7: Institutional Reform
   e. Capability development
   f. Institutional design
   g. Private sector involvement
   h. Pricing

Comment: Prime factor in the success of any national development plan, requiring detailed ST, MT and LT plans.

8: INES Governance
This is the second prime factor in the success of the strategy and plans; who is the top responsible body to guide the studies, the plans and the monitoring? No options were presented by the study.

Analysis prepared by Dr Thamir Uqaili on 20th June 2013

*) Summery received from Thamir Ghadban HPMAC (Head of PM Advisory Commission) on 14th June 2013.
1- I have been following the news of INES during the last two years.

2-While I was in Iraq during Dec2012 – Jan 2013, I knew that the study was completed and it will be discussed in special conference that I will be invited to.

3-Following an interview on Iraqia Channel, with the HPMAC and the Deputy oil Minister on 13th June; I wrote requesting information concerning the study. The summery of INES was sent to me and many other ex-MoO experts.

4-After careful study of the summery this analysis was sent to HPMAC on the 8th of July but unfortunately a conference was already held in Baghdad on the 12 of June where INES was discussed. The result of the conference was not announced.

**) O&G Consultant