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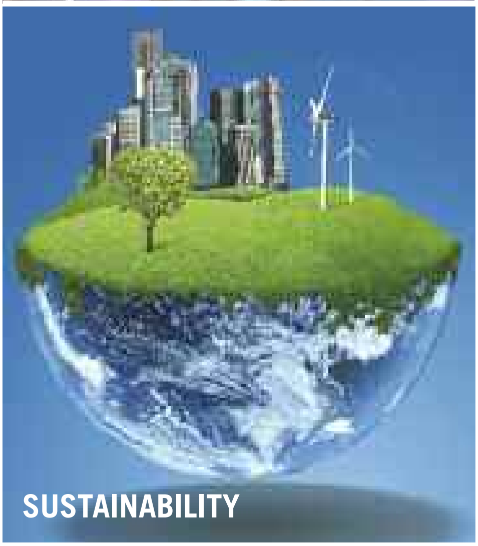

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TECHNICAL BULLETIN 3 / 2010

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October 2010

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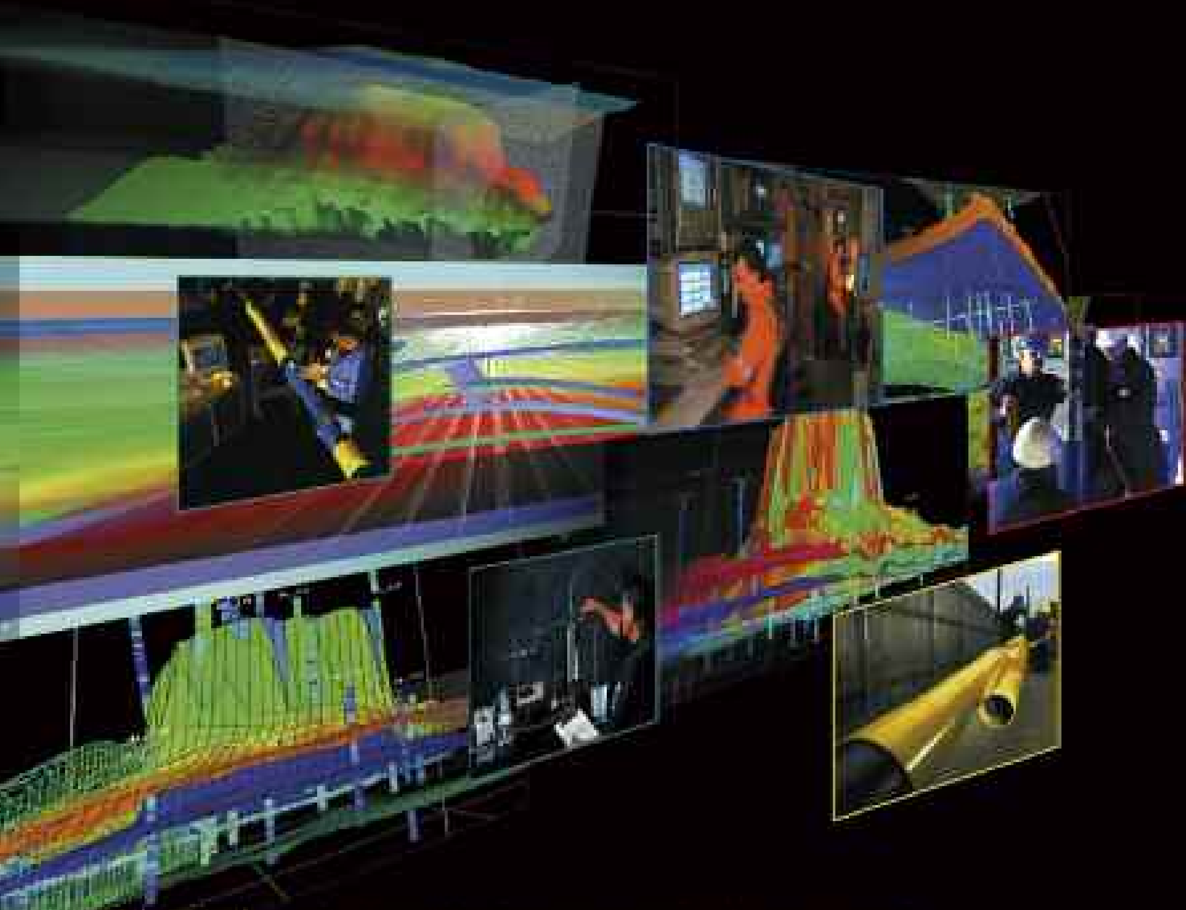

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Challenges to face increasing demand of crude oil

by Maurizio Rampoldi - SPE Italian Section Chairman

Recent projections confirm that the balance between the global supply and demand for crude oil is becoming progressively tighter, and show that the gap will grow to about 20 millions barrels/day by 2030. The main challenges the petroleum industry is facing to keep up with the increasing demand are three:

- development of skilled workforce,
- development and rapid deployment of leading-edge technologies mainly those required to access unconventional resources,
- communication to the public about the role of our industry

Since these are global and complex challenges, we must incorporate the concept of sustainability in our operation framework. In particular, if sustainability can be defined as "meeting the needs of the present without compromising the ability of future generations to meet their own needs", it requires that the following mission statements become reality as soon as possible:

- a long term vision of industry and life,
- people in the centre of every decision,
- public and social responsibility of industry
- a strong leadership to shape the future
- an intensive and effective "public education" about O&G industry

The challenges require a type of professionals often very different with respect to the past and current generation which still mostly considers the sustainability only an extra cost without perceiving the global value of it. Since our industry must and wants to be an important and effective partner in the present world where petroleum business create value for the present and for the future of the whole human society, the engineers of tomorrow must adopt elements of sustainability to develop adequate social, cultural and economic grounding, and to understand their role in shaping the future.

SPE spends a lot of effort to pursue these objectives of sustainability, consistently with its core value of innovation and social responsibility. Some examples:

YP program is well progressing and focused to create favourable conditions for the growth in leadership and excellence of young professionals with new vision of the future, able to capture in the game as much players as possible.

Several educational initiatives have taken place based on the fact that education is an excellent way to influence the "forma mentis" of both trainees and trainers. One over the others is Energy4me focused to capture and disseminate technical information for public benefit.

A Committee of Sustainability is going to be established to provide a platform for discussion, in line with other professional associations (eg. ASME, ASCE, AIChE, IEEE).

At the level of Italian Section, we have the possibility to benefit of these international programs but also the challenge to improve


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them with customized solutions as the success of the Teachers Workshop held on the 22nd September during the ATCE in Florence with the collaboration of the Museum of Sciences and Technologies "Leonardo Da Vinci" of Milan has clearly demonstrated.
A description of this event is given in the article "ATCE 2010 – Overview and Italian Section Contribution" at page 17.

The 2010/2011 program will be focused to pursue these objectives in parallel to the usual activities organized by the Section.

To conclude, I would like to update you with some SPE membership demographics:

- 2010 (as of 31st December 2009)
- 68627 professional members, 17438 of those are YP
- 23546 student members

More than 115 countries are represented

Regions with the largest number of new members:

- Middle East (1790)
- Gulf Coast North America (1272)
- Canada (1063)
- Northern Asia Pacific (983)
- North Sea (785)

Regions with the highest percentage of overall growth (retention and new members):

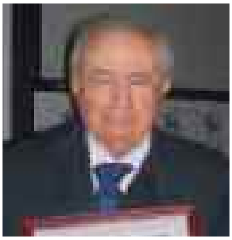
- Canada (20,5%)
- Russia and Caspian (19,2%)
- Northern Asia Pacific (10,5%)
- South Central and Eastern Europe (10,3%)
- Middle East (8,2%)

Projected 2,5% growth in total professional membership in 2011

- Goal = 70343
- Current number (as of 31th August) = 66700
- Need 3643 members to renew or join before the end of the year

Need for potential new members:

- Non-engineers (eg. IT, Human Resources, legal, geologists)
- Recent graduates



How the BP Gulf of Mexico blow out could influence the E&P in the world

by Francesco Guidi

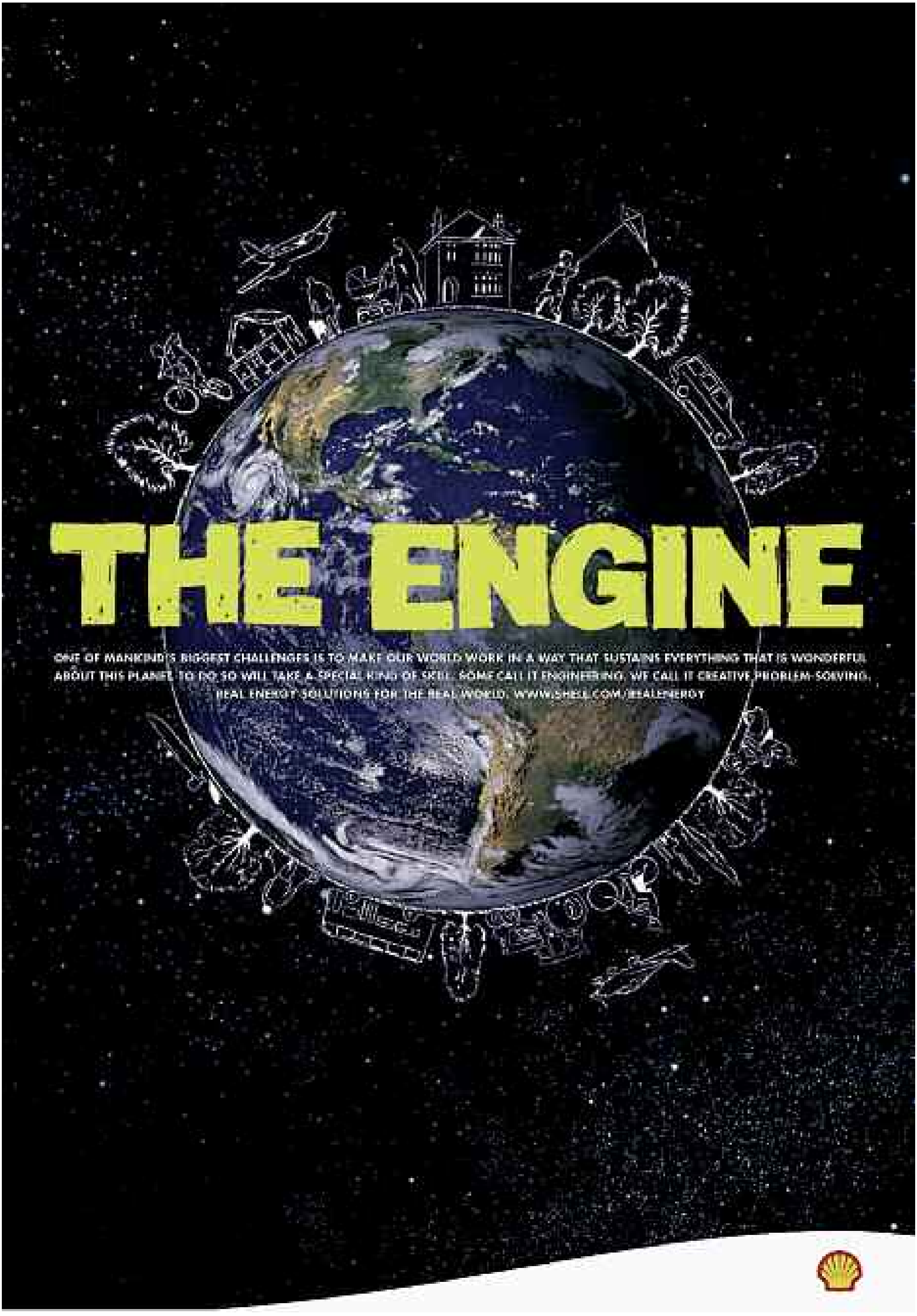
On April 20, 2010, the Transocean Deepwater Horizon rig, that was working for BP in Louisiana waters (water depth 1,500 m) in the Gulf of Mexico, exploded, killing 11 workers and commencing months of unrestrained oil leaking to the sea.
The blow out threatened Louisiana coasts, Gulf of Mexico fisheries and Gulf of Mexico ecosystems. Efforts to manage the spill with controlled burning dispersants and plugging the leak were unsuccessful until BP capped the well in mid July, temporarily halting the flow of oil into the Gulf.
The well was then successfully plugged and declared *effectively dead* on September 19.
The total oil spilt to the sea is estimated in about 4.1 million barrels.
This oil spill has obtained the dubious distinction of being the worst oil spill in US history, surpassing the damage done by Exxon Valdez in Alaska in 1989.

The US reaction

A drilling moratorium was declared immediately after the blow out in the Gulf of Mexico for waters deeper than 500 feet in order to check the situation.
The White House said the moratorium was necessary to give regulators and oil companies time to figure out how to prevent other oil spills in the area.
On October 12, the moratorium was lifted. The Interior Secretary Ken Salazar, in a statement, said drilling could resume as long as rig operators could demonstrate they comply with new safety regulations imposed since the April 20 Deepwater Horizon oil rig explosion.
Among the new conditions on deep water drilling, the chief executive officers of rig operator companies must certify to the Government that they comply with all safety regulations and demonstrate that they have the equipment necessary to contain a deep water blow out.
The Interior Department reiterated in its statement that it intends to institute more rules aimed at preventing deep waters blow outs. Some industry officials said that the new rules could sharply escalate the costs in US waters drilling operations.

EU decided against deep water drilling ban

On October 13, the day after the US decision to remove the moratorium, the European Union decided against deep water drilling ban. Gunther Oettinger, the EU's Commissioner for Energy, had called for a temporary ban of offshore drilling in sensitive area until the causes of the Gulf of Mexico oil disaster had been fully investigated. But the idea was dismissed by U.K., which argued its domestic oil and gas industry has one of the most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robust safety and regulatory regimes in the world.
Therefore, instead of a ban, the European Commission, the EU's executive arm, recommended on October 13 *a single new piece of specific legislation for offshore oil and gas activities,* including criteria for granting drilling permits and control of rigs. *Safety is not negotiable*, Mr. Oettinger said. *We have to make sure that a disaster similar to the one in the Gulf of Mexico will never happen in European waters. This is why we propose that best practices already existing in Europe will become standard throughout the European Union.*
The Wall Street Journal Europe of October 14 comments: *Under the measures being put forward, member states issuing drilling licences would ensure that oil companies may key EU requirements, had contingency plans in place and the financial means available to pay for any environmental damage caused by accidents.*
In the event of a spill, companies would also be responsible for cleaning up damage to 200 nautical miles from the coast.
Such measures could have repercussion for the European oil industry. Most oil exploration is carried out in relatively shallow waters, but oil companies are increasingly moving into deep offshore areas.

The reactions in Italy

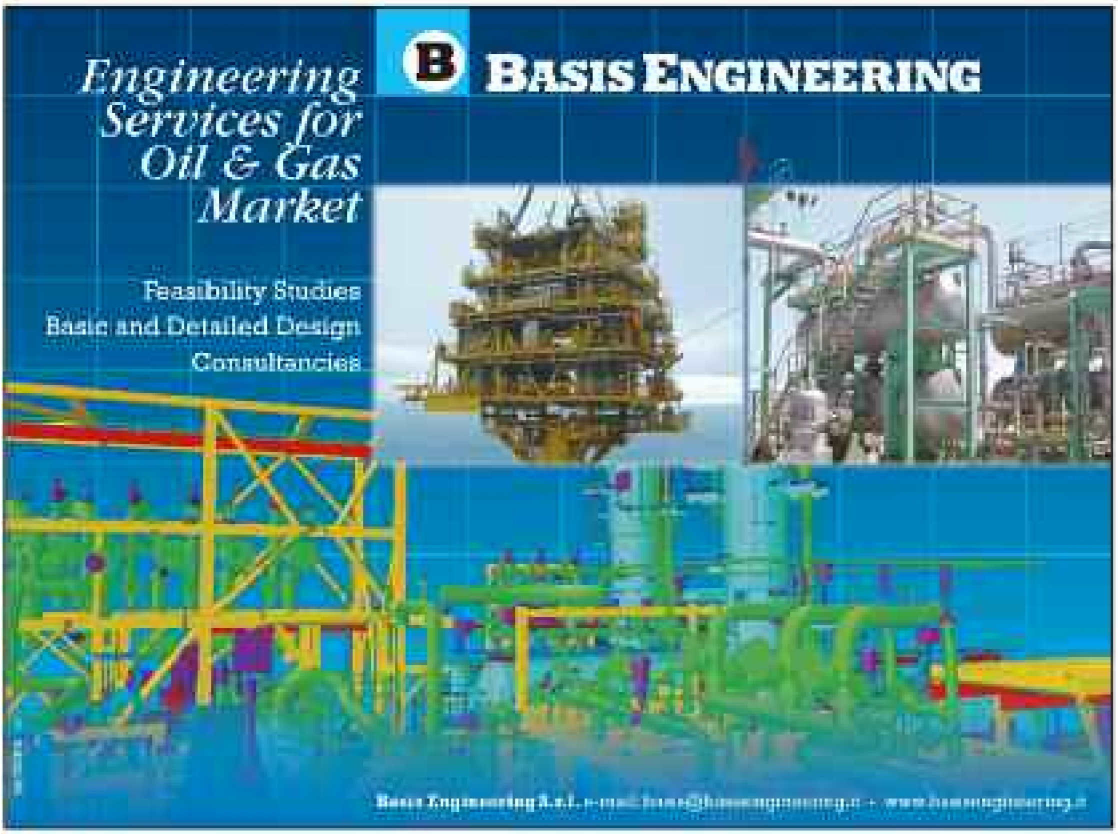
Assomineraria issued, at the end of April, a Position Paper in which it stressed the peculiarities of the activities in the Italian offshore with respect to the operative conditions in which the Gulf of Mexico incident happened. They are:

- in Italy no drilling of exploratory wells in ultradeep waters takes place;

offshore hydrocarbon production is for 92% constituted by gas;

- a very large geomineral knowledge of the areas where the E&P activity occurs has been acquired, which forms the base of any activity project and control;
- advanced technologies and safety standard have been adopted, so that no accidents have occurred in the last 15 years, during which more than 300 offshore wells and about 400 onshore wells have been successfully drilled.

All the same, at the end of June 2010, the Ministry of the Economic Development announced a Decree that bans oil and gas exploration and production, not only in protected offshore and coastal areas, but also in a ray of twelve nautical miles from the external perimeter of these areas.
Furthermore, for liquid hydrocarbons, there is a ban of activities in the strip of five nautical miles from the base line of the territorial waters along the entire national coastal perimeter.
The Decree became effective on August 26.
There was an immediate and strong reaction of Assomineraria that said this ban could have a heavy negative impact on all oil and gas activities in Italy; therefore, it asked the abrogation of the law; in accordance to what has been decided in the European Union or, at least, some modifications for which Assomineraria advanced some proposals, such as the institution of a consultation table with the participation of the competent Ministries to discuss all the problems.



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The Birth of Opec - 50 years ago

by Riccardo Varvelli - Politecnico di Torino

The spark was set off at the beginning of 1959 by British Petroleum (B.P.); the company unilaterally decided to reduce the official crude oil price by 18 cents a barrel (i.e. by 10%).

Such a decision stemmed from the British oil company's concern about the fierce competition from the USSR (at that particular time, the USSR was in the process of negotiating on Italian oil supplies with Enrico Mattei), which would imply reduced profits, impacting not only British Petroleum but also the countries where British Petroleum operated and with whom they had signed the commercial agreement referred to as "fifty-fifty".

"Fifty-fifty" was an agreement between the country that "owned" the oilfields and the company that "produced" the oil. This agreement allowed the "owner" to earn 50% of the revenue of the "producer" that was derived from selling the extracted oil.

Thus, reducing the price of oil meant reducing profits and letting half of this reduction rest on the books of the "owner".

The first person who vehemently reacted to this decision was Venezuelan Mining and Hydrocarbons Minister Juan Pablo Perez Alfonzo; the second was Saudi Arabia General Manager of the Directorate of Oil and Mining Affairs Abdullah Tariki.

Both of them were furious as this decision could easily lead other international oil companies to imitate B.P. (and in fact that is what happened). Since the income of the countries they represented was greatly dependent on oil trade, the damages caused by this decision would have been enormous.

In April 1959, a congress on oil was held in Cairo and all Arab countries participated. One of the players at this event was Tariki. Perez Alfonzo was invited only as an observer. But the two met several times and shared not only their discontent but also their eagerness for revenge. In their last meeting at the Maadi Yacht Club (Maadi was one of Cairo's suburbs), Alfonzo showed up with a "gentlemen's agreement" where he proposed some ideas to constructively oppose Western oil companies' policies. In addition to the Saudi representative, this agreement was signed by the representatives of Iran, Kuwait and Iraq.

On August 9, 1960 the Board of Directors of Standard Oil of New Jersey (currently Exxon) also decided to reduce the price of oil by 14 cents a barrel, followed by Shell shortly thereafter.
On September 10, 1960 (50 years ago), the official representatives of Saudi Arabia, Venezuela, Kuwait, Iraq and Iran met in Baghdad. At that time, oil exports from these five countries accounted for 80% of all exported oil worldwide.

1. The official birth of OPEC

On September 14, 1960 the Organization of Petroleum Exporting Countries (OPEC) was founded. Its main objective was the protection of the member countries' interests through the support of oil prices and its condition was to be

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consulted on any decision regarding the price between oil companies and "owner" countries. The founding document also proposed an international crude oil production regulation system and a commitment to support the other members of the organization in case oil companies attempted to impose a sanction on OPEC members. In the following years OPEC membership grew to ten, as Libya, Nigeria, the United Arab Emirates, Qatar and Indonesia were added to the five founding countries.

The two original promoters of OPEC were short-lived within the organization. In 1962 Tariki was dismissed by Saudi Arabia's King Feisal and replaced by Ahmed Zaki Yamani. Alfonzo resigned in 1963 out of disappointment with OPEC's policies. Rivalries arose rapidly within the organization of the exporting countries especially due to political or religious issues: Iraq vs. Kuwait (the former with an ultra-revolutionary-, the latter with an ultra-conservative government), Sunnite Saudi Arabia vs. Shiite Iran, Western-minded Venezuela vs. Eastern-minded Persian Gulf countries.

For about a decade OPEC's actions were low-key and indecisive. OPEC was unable to affect the Seven Sisters' overbearing tendencies (and sometimes their actual abuse of power).

2. The Seven Sisters and Mattei

The Seven Sisters were Exxon, Mobil, Texaco, Chevron, Gulf, Shell and B.P.. Moreover, OPEC did not want (or was unable) to catch the wave of opportunity it was offered by Enrico Mattei. In the fall of 1957 Mattei negotiated an unprecedented agreement with Iran that voided the "fifty-fifty" commercial agreements and replaced them with a "seventy five-twenty five" agreement. Thanks to this new agreement Sirip, an Italian-Iranian corporation, was founded with Eni owning 50% and NIOC (National Iranian Oil Company) owning the remaining 50%.

According to this proposal by Mattei, where the "fifty-fifty" criteria was confirmed according to profits, in a 50% Iranian-owned company, Iran would earn 50% in royalties plus 50% of the remaining 50% as a shareholder; so Iran would be entitled to 75% of the profits and Eni to the remaining 25%.

Not even the Six-Day War against Israel, caused by the then "Rais" of Egypt, Gamal Abdel Nasser with the block of the Gulf of Aqaba, which Jordan, Syria and Iraq supported, gave strength to OPEC. Started on June 5, 1967, the war was over six days later with the total defeat of the Arab forces and with OPEC's silence. OPEC was in fact divided internally: Saudi Arabia and Iran were against and Iraq was for the attack.

The OPEC was not even responsible for outweighing the "fifty-fifty" criteria as indicated in its deed of association. Persia's Shah is to take credit for that: in November 1970 and based on the Sirip's system that had been proposed thirteen years earlier by Mattei, he obtained 55% from the foreign oil companies that were operating as a consortium in Iran.
He thus outweighed the "fifty-fifty" and created a "fifty five-forty five" agreement. During that time, OPEC merely confirmed the new equilibrium as a "minimum percentage for the royalties' sharing of the member countries".

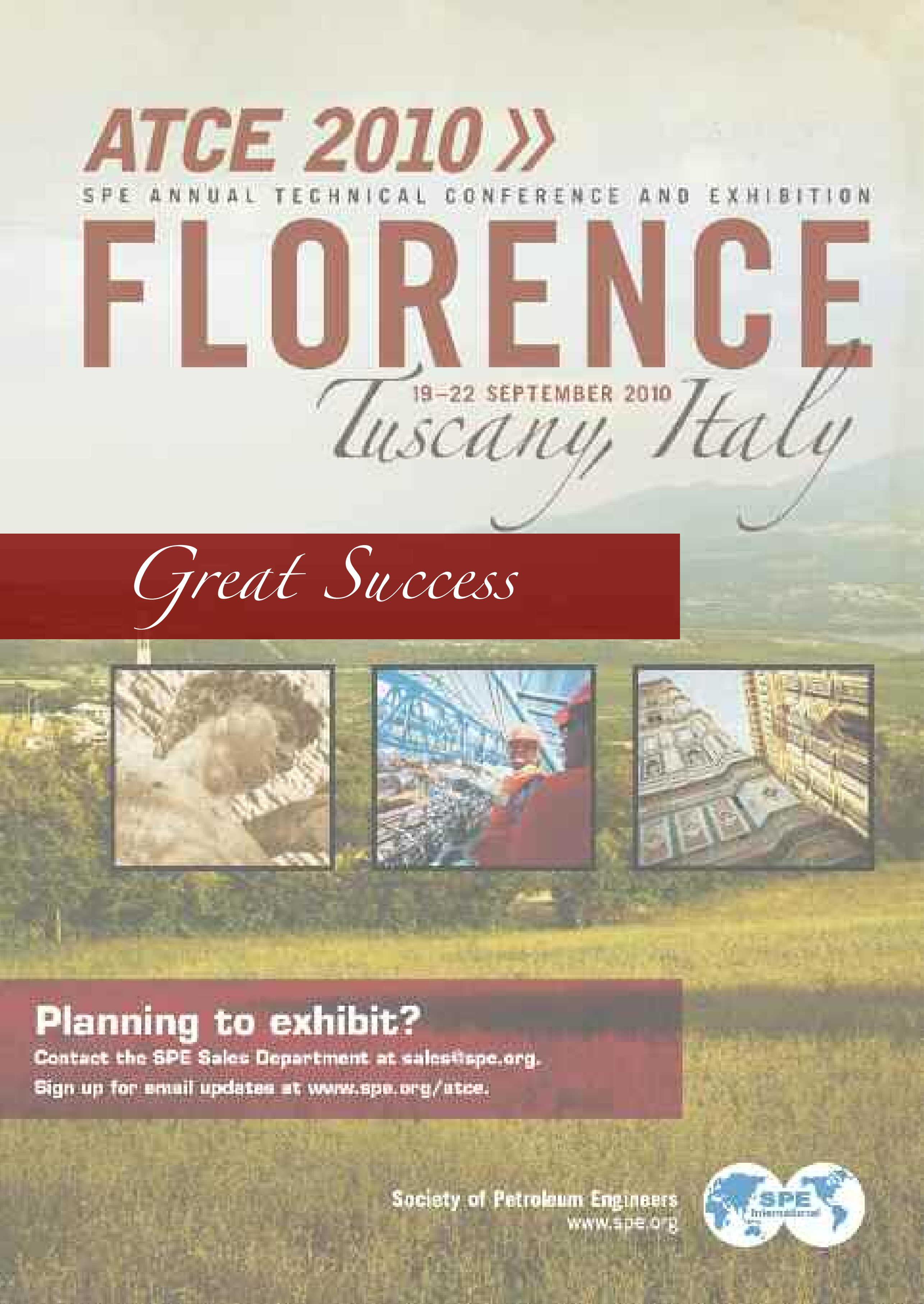
After this event, OPEC gained more importance thanks to the oil companies that decided not to negotiate oil prices with each individual country but only with the Organization of the Exporting countries, i.e. OPEC.

3. Oil crises and oil prices

OPEC's chance to finally get off the ground as the negotiating counterpart of oil companies in establishing oil prices and to actually affect the negotiation process was given to OPEC by the Yom Kippur War (October 1973) and later by the Iran and Iraq War (1979-1980). In the first case, OPEC operated as executioner to punish the Western world because of its support to Israel in initiating the oil embargo. When OPEC's member countries realized that they were not going to earn even a single dollar in royalties, they decided to replace the embargo with an increase in oil prices. Within a few months oil soared from $3 to $11 a barrel, generating an unprecedented inflation effect on oil importing countries. In the second case - the Iran and Iraq War - a production decrease of about 5 million barrels a day occurred as a result of the fact that some member countries were engaged in war issues. Despite being able to increase its production to make up for the drop in supply, OPEC decided not to do so and instead let the price of oil skyrocket to $34 a barrel (on the "spot" market it exceeded $40 a barrel). The going price would be $100. In doing this, OPEC took an undeserved economic advantage because of its impudicity in triggering an economic shock to the worldwide balance.

Since then, thanks to the return of the typical supply and demand mechanism, OPEC, the main world player in setting oil prices, has merely operated as a market controller. OPEC missed the opportunity to take control in 1986 when exceeding production caused oil prices to slump to $12 a barrel and in 2008 when, as a result of speculative manoeuvres and a sudden increase in demand from China, oil prices reached $140 a barrel.

Today OPEC, while having lost one of its members (Indonesia) and having acquired two new members (Angola and Ecuador), accounts for about 40% of the worldwide oil production and 60% of the worldwide reserves. It, therefore, is a sufficiently reliable partner and the world can expect it to be the one moderating influence on the price of oil.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Overview of ATCE 2010 in Florence and Italian Section contribution

by M. Rampoldi - SPE Italian Section Chairman

This year's Annual Technical Conference and Exhibition, held in Florence from 20th to 22nd September 2010, has been a great success and attracted about 5000 participants (40% US and 60% internationals) coming from 75 countries, much more than the last edition in New Orleans, where 55 countries were represented. It took place at the "Firenze Fiera Congress and Exhibition Center" named "Fortezza da Basso".

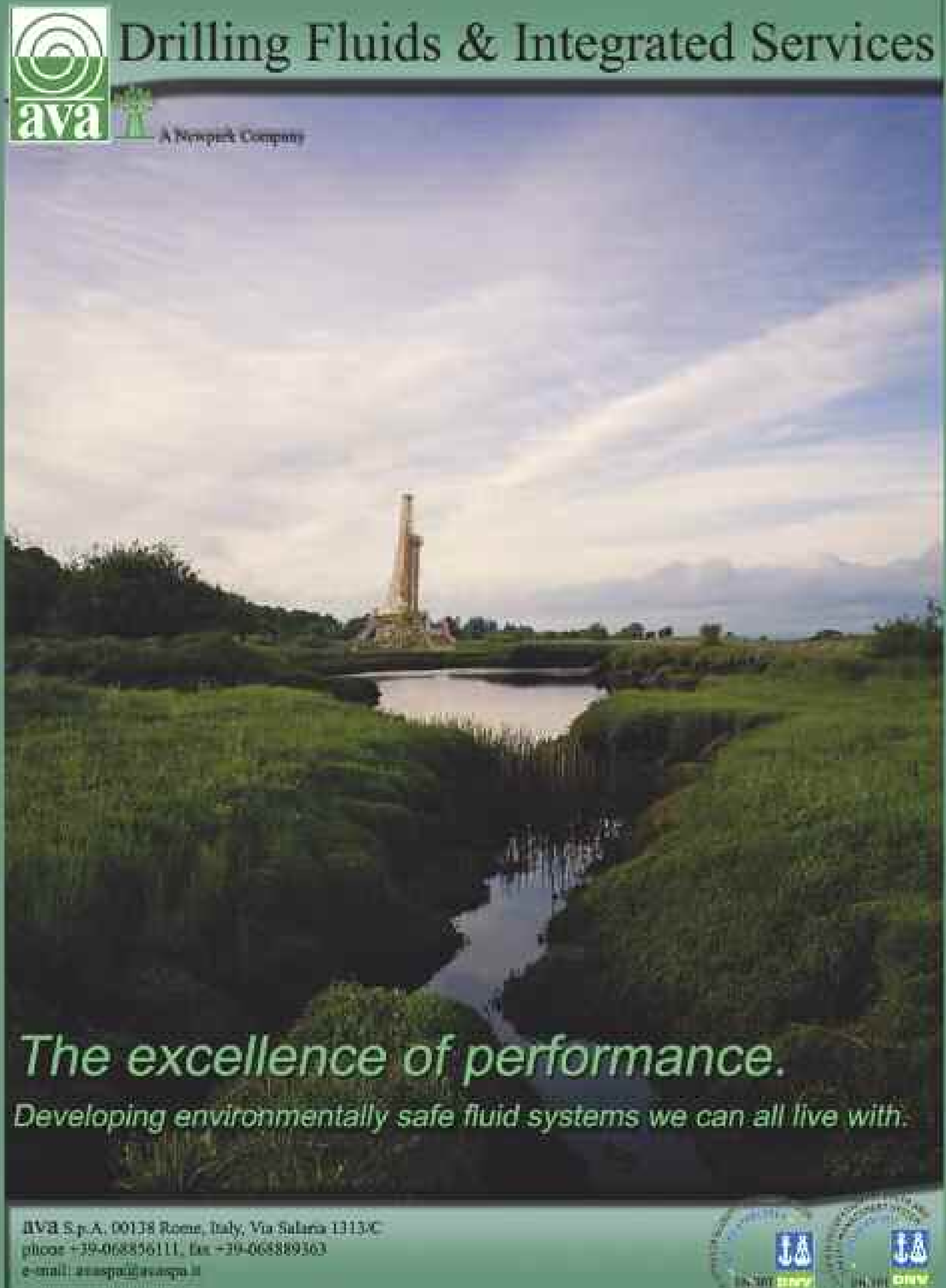
The Italian Section and all its members were well represented and proud of the contribution given to its organization and success.
About 1,800 technical paper proposal submissions were received, the largest number ever submitted for an SPE event.
More than 25 out of the 400 selected for presentation, were prepared by professionals operating in Italy.

More than 250 exhibiting companies from 17 countries, utilizing approximately 4,000 sq meters of exhibit space, featured the latest products and services in the E&P industry.

All the major oil companies, service and integrated services companies operating in Italy were present in the exhibit area.

ATCE program started on Monday morning 20th September with Opening General Session: Matteo Renzi, the Mayor of Florence (figure 1), welcomed participants and sponsors while Claudio Descalzi, Chief Operating Officer for eni e&p division, introduced the major subject of the conference.

Figure 1 – Opening General Session: Matteo Renzi, the Mayor of Florence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The General Session continued in the morning with the panel "Gas Market Variables in the Global Energy Equation" during which panellists discussed how worldwide demand for natural gas likely will continue to soar, but the oil and gas industry faces challenges in meeting that demand. Moderator Andrew Gould, Chief Executive Officer of Schlumberger, noted the growth of liquefied natural gas (LNG) and the rise of unconventional resources spurred by drilling and completion innovations.

A diverse group of panelists:

- Sara Ortwein, President, ExxonMobil Upstream Research Company
- Michael Stoppard, Managing Director, IHS CERA
- Yan Cunzhang, President, PetroChina Company Ltd.
- Howard Paver, Senior Vice President, Global New Business Development, Hess Corporation (figure 2)

provided examples of how their companies have been involved in unconventional gas developments and clean technologies to support future demand. They provided also a comprehensive view of the gas market prospective, needs and problems to be faced over the next 30 years, such as:

- Energy demand is increasing more in the non-OECD countries than in the OECD countries. Energy production is sourced 32% by oil, 32% by coal, 23% by gas and 13% by nuclear, hydro and renewables.

Figure 2 – General Session: Opening Panel Discussion

- World gas demand is growing at a rate of 1,6% each year and will achieve about 4,2 Tcm in 2030. Some countries are self sufficient for what concerns gas demand, such as USA, Brazil and India.
- Most of gas reserves are located in Russia (47 Tcm), Iran (31 Tcm) and Qatar (28 Tcm), but Turkmenistan and China are the countries with the most important growth in gas reserves, 3,7 Tcm and 2,9 Tcm, respectively.
- Unconventional Gas developments are significantly increasing with respect to conventional gas. LNG, gas shale and coal bed methane demand are increasing while gas hydrates is still considered an immature type of resource.
- There is a need to lower emissions, but it is foreseen CO_2 emissions to be stable in the OECD countries while increasing in the non-OECD countries.
- Statistics indicate that gas is an energy source considered clean or dirty depending on the local combination of a number of cultural, industrial, social and political issues; therefore, strong efforts have to be made to enhance its acceptance. Key drivers to facilitate the acceptance and the success of unconventional gas developments are the public awareness, the application of integrated solutions for sustainable developments and strong investments in people.

Also on Monday at the ATCE Chairman's Luncheon, Claudio Descalzi shared his insights on how operators must refocus on improving competencies, relationships with producing countries, and corporate culture in order to succeed in the future. He noted that, with global demand predicted to soar, international and national oil companies must become smarter, more effective, and more efficient in their production operations (figure 3).

Figure 3 – Chairman's Luncheon, Claudio Descalzi.

ATCE's time-honoured events included the Annual Awards Banquet, which recognized individuals for their significant contributions to the oil and gas industry, and the President's Luncheon, which offered the "State of the Society" address from 2010 SPE President Behrooz Fattahi, who passed the presidential gavel to 2011 SPE President Alain Labastie. Some of Italian Section most representative members were recognized with important awards.

First of all, **Cesare Colamasi** received the SPE Honorary Membership at the SPE Annual Banquet that took place in the spectacular "Salone dei Cinquecento" of "Palazzo Vecchio". AIME President Deann Craig and SPE President Behrooz Fattahi gave him this prestigious award. Honorary Membership is

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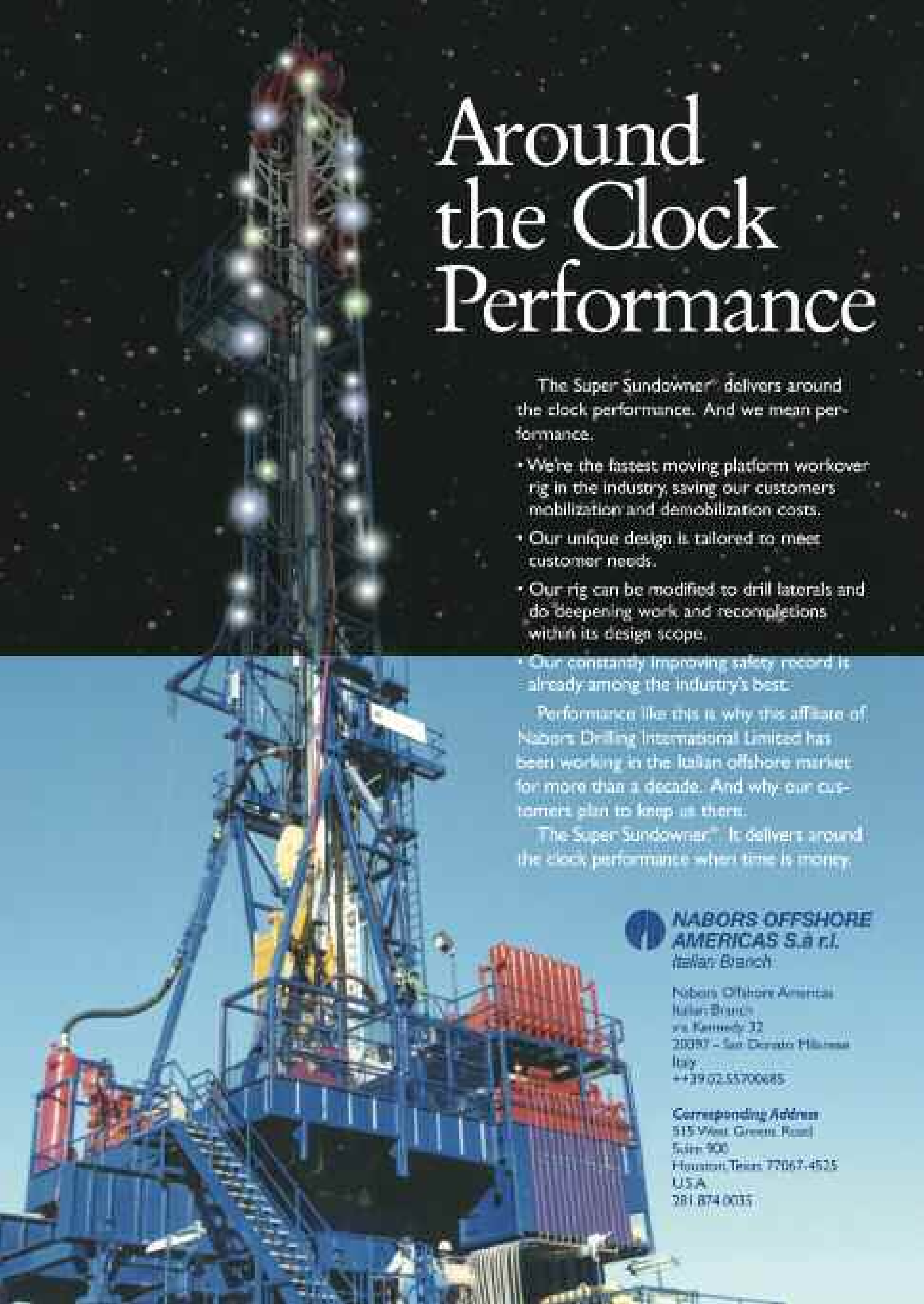
the highest honour that SPE presents to an individual. It is limited to 0.1% of the SPE total membership. This elite group represents those individuals who have given outstanding service to SPE and/or who have demonstrated distinguished scientific or engineering achievements in the fields within the technical scope of SPE. Colamasi is being recognized as a pioneer in promoting and developing SPE in Continental Europe creating the Adriatic Section in the 80's, for his service to the Italian Section and as an SPE board member (figures 4-5).

Figure 4 - Salone dei Cinquecento: Banquet

Figure 5 - Award to Cesare Colamasi



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Second, **Giambattista De Ghetto** and **Thomas Lockhart** received the SPE Honorary Membership at the President's Luncheon for their continuous and precious contribution to SPE activities, to technology and knowledge improvement and dissemination (figures 6, 7).

Third, Italian Section received the SPE President Award for implementing one of the Most Innovative 2010 New Program for its Webinar Series to connect members in several locations across Italy. This award category honours sections for having developed a unique, successful program, which in this case should help engage members outside of Milan and continue to expand membership growth across Italy and other sections in the European region. Maurizio Rampoldi received the award at the President's Luncheon on behalf of the Section (figure 8).

Figure 6 - Award to Giambattista De Ghetto.

Figure 7 - Award to Thomas Lockhart.

Figure 8 - Award to Maurizio Rampoldi.


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In addition, **F. Gonzales** and **L.G.P. Bertoldi** won the 2010 Young Professional Paper Contest for the paper "A Fully Compositional Integrated Asset Model for the Karachaganak Field".

A special mention must be given to our young professionals for their excellent work and contribution to Petrobowl, a stimulating networking competition between 30 Student Chapters that took place all the day of Monday 20th September. Detailed description is given in the STYPED Bulletin.

Between the several technical sessions, I would like to mention a special panel session named "**Back to Basics! Old School vs New School**" leaded by Loris Tealdi, eni e&p, and R. Hoff, Esso Norge. A very crowded, lively and interesting debate took place during the panel with industry experts. The panel explored different approaches to reservoir engineering and modelling studies where the "old school" contrasted with the "new school." A recent survey of SPE young professionals pointed out that only approximately 50% of the new generation of engineers fully understands the physics behind the modern reservoir tools they use. A panel of distinguished professionals including A. Gringarten (Imperial College), T. Blasingame (Texas A&M University), B. Rossen (Delft University of Technology), A. Lara (Petrobras) and R. Al-Hussainy (Hess) discussed the current trend of reservoir engineering and modelling. Their debate offered interesting insights and comparison about the different approaches to find solution of technical problems between the new population of reservoir engineers and the one of 20 years ago. After presenting some statistics and trends of the SPE young professionals population on this subjects, the Session Chairperson Loris Tealdi opened the panel asking to the 5 distinguished panellists this provocative question: "Are we really passing from Reservoir Engineering, pencil and deeper thinking on a conceptual model … to PowerPoint Engineering and fancy "black box" numerical modelling? ….". A specific article on this interesting subject will be presented in the next Bulletin.

Figure 9 - Teacher Workshop: Maurizio Rampoldi

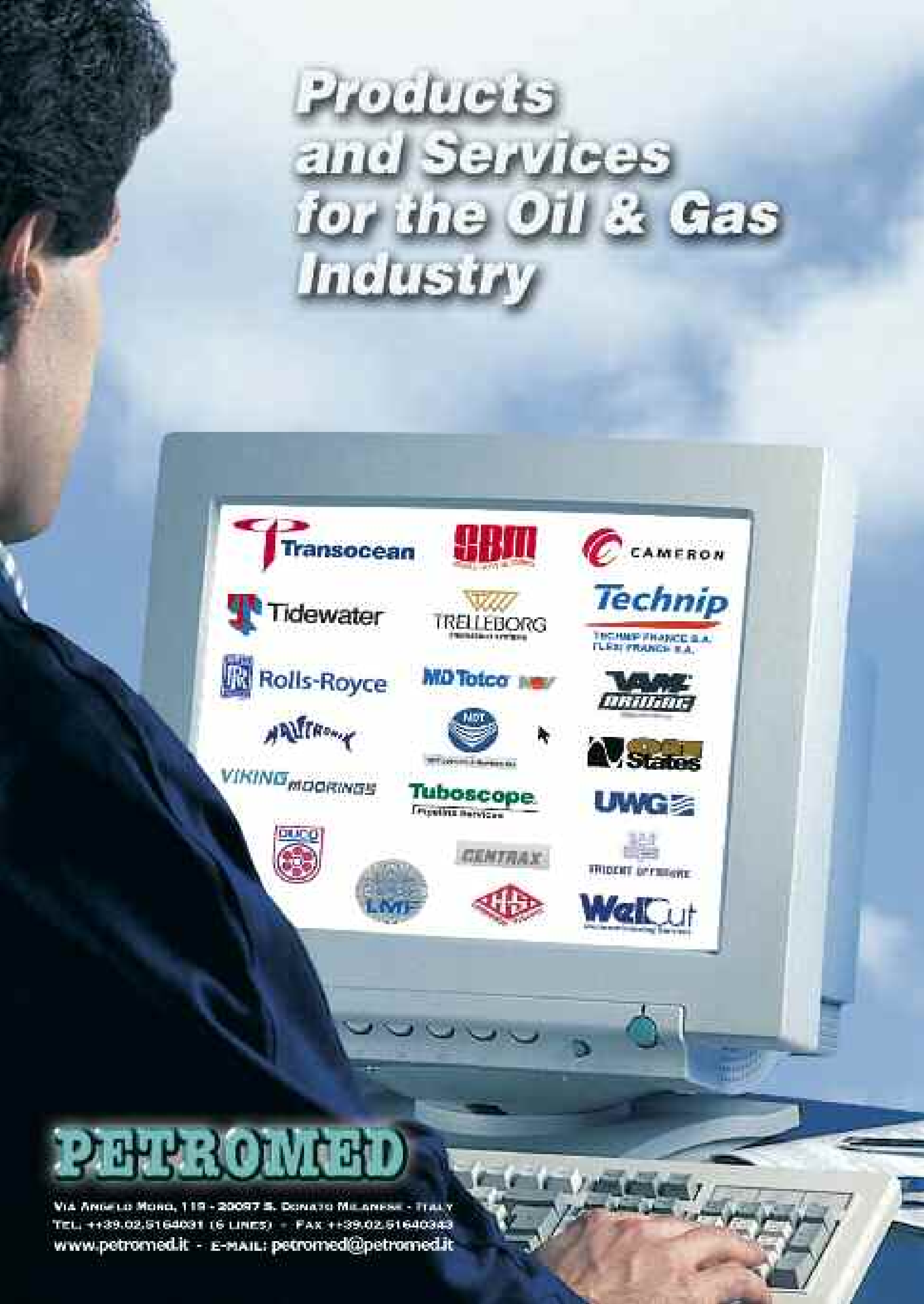
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Figure 10 - Teacher workshop: Giambattista De Ghetto, Maurizio Rampoldi and Ganesh Thakur

On side of the main technical and social programs of ATCE, there were several events related to the strategic programs of SPE.

I would like to talk about the **Teacher Workshop** which took place on Wednesday 22nd September with the fundamental contribution of our Section. 50 Tuscany-area science teachers participated in a unique workshop presented by SPE and the National Museum of Science and Technology "Leonardo da Vinci" of Milan. Teachers received comprehensive, objective information about the scientific concepts of energy and its importance, while discovering the world of oil and natural gas exploration and production. This workshop is one component of SPE's energy education program, Energy4me. Energy4me is a public outreach program and web resource designed to help students and adults become more educated consumers of energy.

Workshop started in the morning: Maurizio Rampoldi, SPE Italian Section chairperson welcomed teachers, Ganesh Thakur, 2012 SPE President introduced the day and highlighted the importance given by industry and SPE to such type of education program which was sponsored by ExxonMobil represented for the occasion by Sujata Bhatia. Then, Giambattista De Ghetto, Senior Vice President of eni e&p, presented to teachers and discussed an overview of energy with specific reference to the petroleum industry. (Figure 9, 10 and 11)

Figure 11 - Teacher workshop: Giambattist De Ghetto and Ganesh Thakur

Well Recaps:

#26, #75 and #140

Grand slam:

ULTRADEEP GOM WELLS SET SPEED RECORDS, REDUCE WASTE AND EXPOSURE, PREVENT FLUID LOSSES

Back-to-back wells, incorporating the ULTRADRIL* system in water depths of 8,957 and 9,101 ft (2,730 and 2,774 m) respectively, reached TD faster than other wells drilled in 7,000+ ft (2,134+ m) of water in the Gulf of Mexico. The water-base ULTRADRIL system also eliminated the haul-off and disposal expenses for 4,000 bbl of cuttings, reduced the operator's environmental exposure, and prevented fluid losses while crews ran and cemented casing. "The ULTRADRIL system helped us achieve record results in ultra deepwater."

One down, six to go:

SUCCESS IN GERMANY LEADS TO SIX MORE WELLS

The operator had been drilling with oil-base mud in offset wells because of shale problems but switched to the ULTRADRIL system. After successfully drilling 7,148 ft (2,179 m) through two intervals, the fluid was stored for six weeks and used on a subsequent well. "The performance of the ULTRADRIL system was excellent. We will use it on our next six wells."

Making the first move:

OPERATOR OFFSHORE ITALY EVALUATES ULTRADRIL SYSTEM TO REPLACE OBM

Looking ahead to more stringent environmental regulations in the Adriatic, an operator tested the ULTRADRIL high-performance, water-base drilling fluid as a replacement for invert systems. The results were very promising — shale inhibition and drilling performance similar to OBM, low dilution rates, high ROP and good resistance to cement contamination. "The ULTRADRIL system makes operators a lot less vulnerable to regulatory changes that could adversely affect drilling numbers."

Teachers worked in groups and trainers provided by the Museum conducted the education activities supported by some volunteers of the Italian Section (figures 12, 13 and 14).

Figures 12, 13 and 14 - Teacher, Workshop: activities.

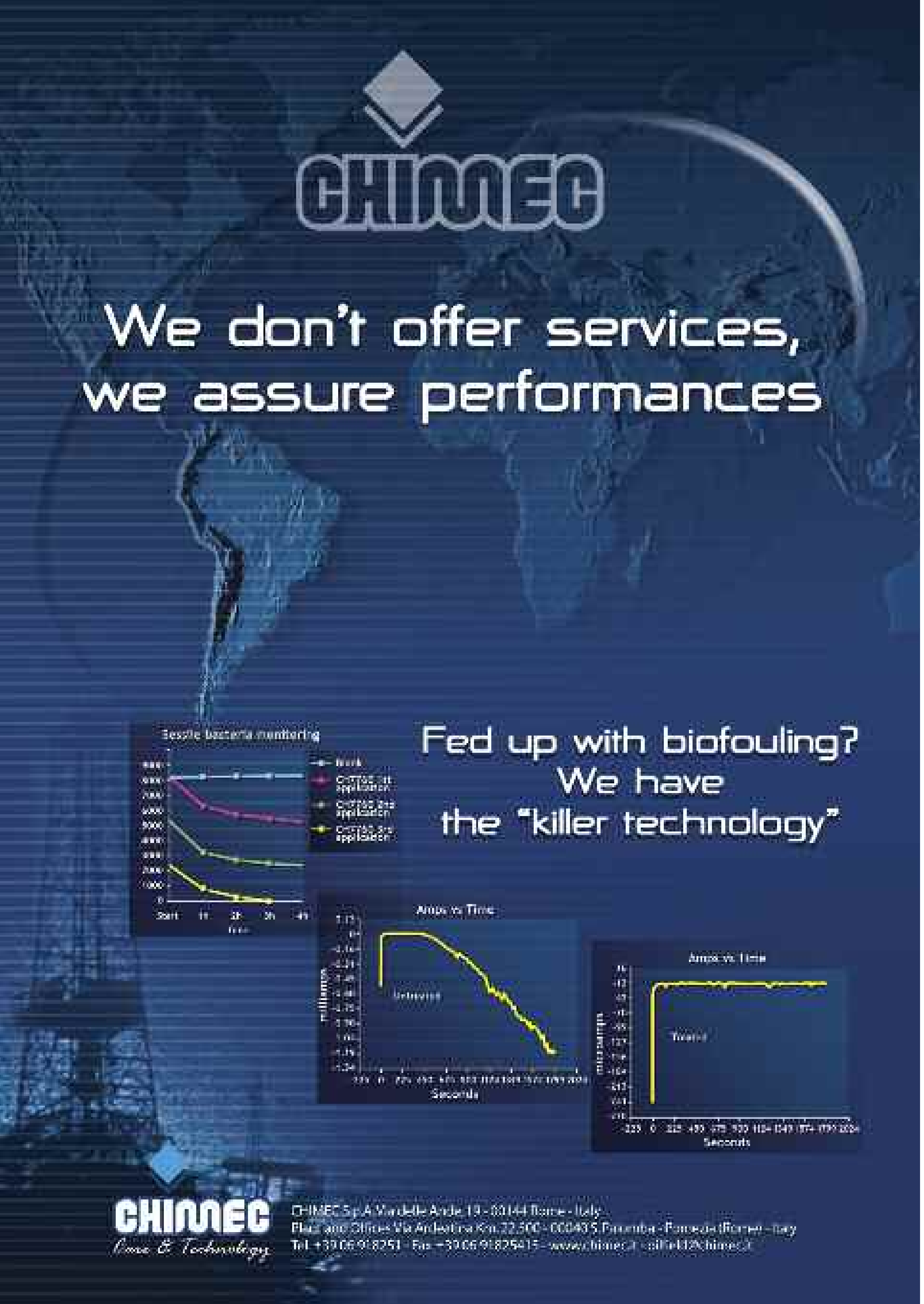
Figure 15 - Teacher workshop Tour Roderi

The workshop included an interesting tour through the exhibition stands and was concluded successfully with a final discussion in the late afternoon (figure 15).

To conclude this overview of ATCE activities, where our members gave their contribution, it must be noted that a one a half day meeting of the SPE Distinguished Lecturer (DL) Selection Committee took place with the participation of Osvaldo Pascolini and Alberto di Lullo. In this occasion 16 candidates and their proposed lectures were analysed for the next 2010-2011 season of Distinguished Lectures program that will celebrate its 50th anniversary in 2011. For this special occasion the Italian Section had the pleasure to host a dinner for the DL committee members and their guests.

The DL program started in 1961 with 3 lectures and became very popular over the last years. During last 2009-2010 season, 39 lecturers visited more than 170 Sections in six continents providing 540 distinguished lectures. The DL Committee is formed by senior oil & gas professionals with international reputation, coming from Academia, industry operators and providers, and consultancy firms. It has the duty to review the quality, timeliness and relevance of the proposed lectures presentations (figure 16).


Figure 16 - DL Committee.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Press Release for SPE 2010 Honorary Membership

Contact: Tom Whipple, SPE Awards, awards@spe.org or +1.972.952.9452

Cesare Colamasi Receives Honorary Membership

from Society of Petroleum Engineers

Richardson, TX (30 September 2010) – The Society of Petroleum Engineers (SPE) recently honored Cesare Colamasi with the Honorary Membership at SPE's Annual Technical Conference and Exhibition held 20-22 September in Florence, Italy. Colamasi is a Chairman at Petren.

Honorary Membership is the highest honor that SPE presents to an individual. It is limited to 0.1% of the SPE total membership. This elite group represents those individuals who have given outstanding service to SPE and/or who have demonstrated distinguished scientific or engineering achievements in the fields within the technical scope of SPE. Colamasi is being recognized as a pioneer in promoting and developing SPE in Continental Europe, for his service to the Italian Section and as an SPE board member.

SPE serves more than 92,000 members worldwide, sharing technical knowledge for the benefit of our industry. Each year, SPE presents awards that recognize members whose efforts have advanced petroleum technology, as well as their professional achievements and contributions to the industry and the society.

"These individuals have been nominated by their colleagues and selected by a committee of peers for their outstanding contributions. They represent the pinnacle of achievement in the oil and gas industry. We congratulate Cesare Colamasi for receiving this prestigious international award from SPE," said Behrooz Fattahi, 2010 SPE President.

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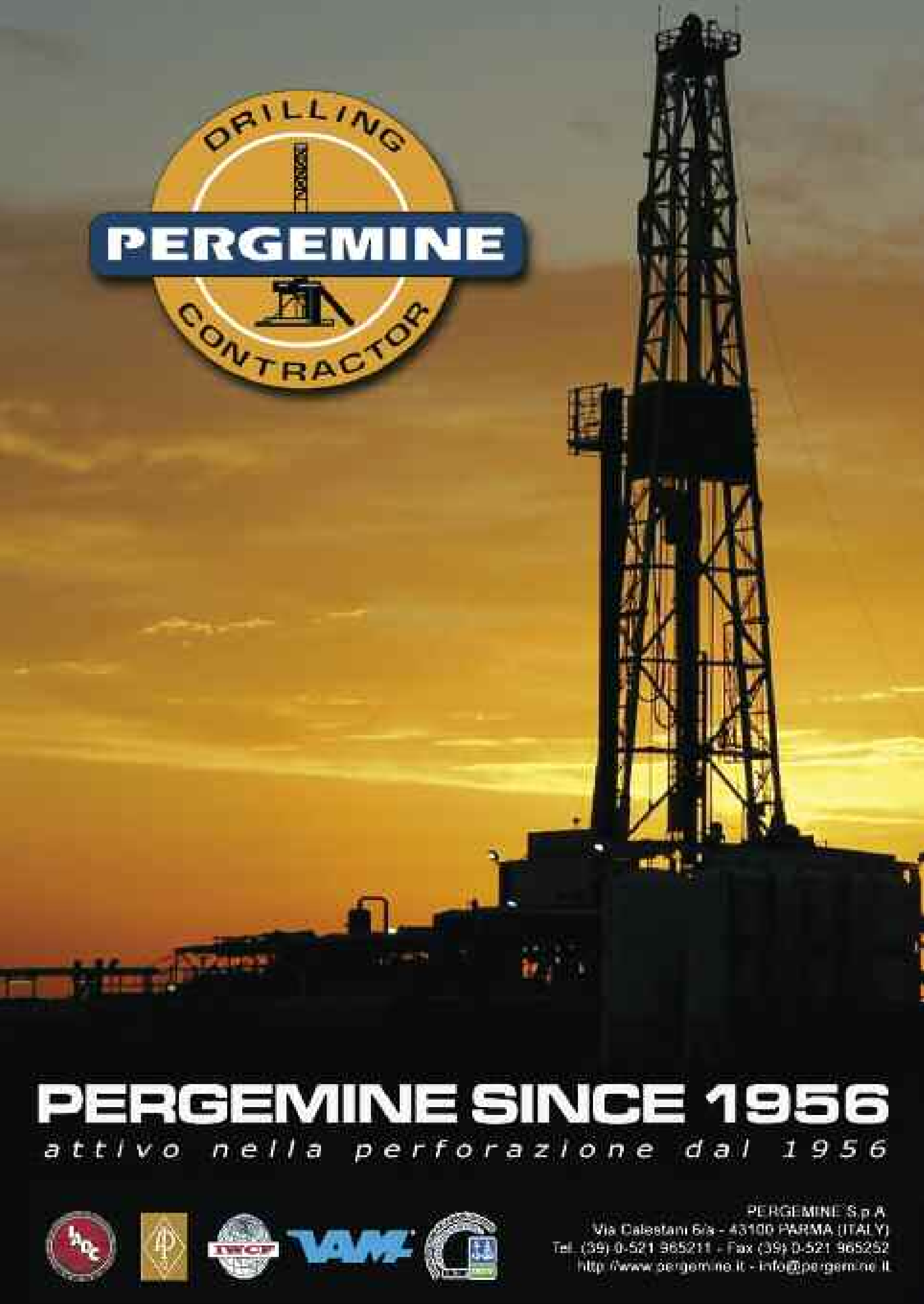
About SPE

The Society of Petroleum Engineers (SPE) is a not-for-profit professional association whose members are engaged in energy resources development and production. SPE serves 92,000-plus members from more than 116 countries worldwide. SPE is a key resource for technical knowledge related to the oil and gas exploration and production industry and provides services through its publications, conferences, workshops, forums, and website at www.spe.org.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Shale Gas: will the North-American unconventional gas "revolution" expand worldwide?

by Aldo Napolitano - eni e&p division

In the last decades of the eighteenth century the will of independence together with new and unconventional ideas, tenaciously defended, brought most of the North-American states to become independent and a united nation; these ideas expanded then back again to Europe where a revolutionary period caused radical and permanent changes that still pervade our cultural background and way to conceive a civil society.
The parallelism is certainly outsized, forgive me, but no doubt in the first decade of this century and particularly in the last three to five years a sort of revolution occurred in the natural gas of US as a consequence of tenacious attempts to get production directly from impervious source rocks, causing as a result unexpected modifications on the world gas market mechanisms. In just 3 years time, in fact, shale gas will comprise 35% of US gas supply and its current production has already displaced most of the LNG imports that have been redirected to European and Asian markets.
At the same time shale gas has unexpectedly recently become a common subject of public debate on newspapers and media of several parts of the world, notably inter alia in Europe, China and India, all aspiring to reduce their dependency from energy imports.

But let us have a look first of all at what the shale gas is and then to the role of the key technologies (mainly horizontal drilling and hydraulic fracturing) that enable their development.

Shale: mudstone would be a better definition - the geology point of view.

With shale gas it is meant to indicate continuous accumulations of gas contained within the source rock itself *(figure 1)*, that become economically producible once hydraulically fractured. The continuous nature of the accumulation means that traditional geological elements like traps and ceiling formations and factors like buoyancy effect are no more the target of the exploration activity. Rather, a combination of geochemical, geomechanical and, secondarily, geometrical parameters become the subject of the research.
A gas shale is such when it is characterized by a high organic content of the right quality (usually of marine origin) together with a high maturity level, but having been subject to limited expulsion. It should also have a mixed mineralogical nature (from quartzitic to carbonatic mudstone) in the right percentages. These latter parameters and the diagenetic history determine the geomechanical characteristics of the rocks and in particular

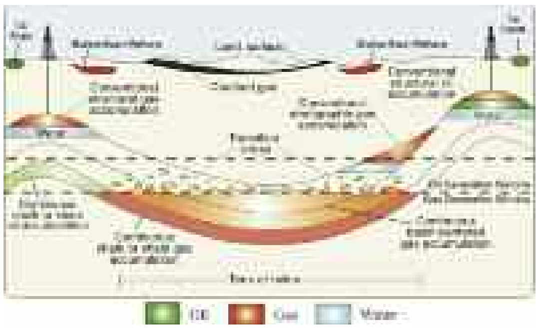


Figure 1 – Unconventionals – shale gas is represented by the unexpelled gas within the source rock.

their brittleness, i.e. their reactivity to hydraulic fracturing. In addition, the so-called shale has to have sufficient thickness and lateral continuity, while the basin in which it is contained should have a relatively simple present geometry, with non-excessive stress anisotropy. The depth of the shaly formation ideally should also be relatively shallow (typically 1500 to 3000 m, but goes up to 4500 m in particular conditions), to allow for cheap drilling, but pressure gradients and depth can greatly affect the gas content, its distribution and producibility. As you can see this is a complex combination of geological factors that, however, gives as a result, surprisingly, a large variety of gas shale qualities that the recent advances in applied technologies have opened up to production. The prize of this unconventional exploration will be the identification of the area with the best combination and resulting production performance, the so-called "sweet spot", rather than the "discovery" we are all used to think about.

Well Production and Pressure Decline: the reservoir engineering point of view.

The unconventional nature of the shale can be described by its peculiar three porosity system consisting of free gas in the primary porosity (usually from 3 to 10 p.u.), of free gas within the natural micro-fractures and the adsorbed gas within the organic matter *(figure 2)*, while permeabilities are usually measured in nano-darcies. These factors, function also of depth and pressure regime, give as a result a typical well production profile with an initial peak, a very rapid initial decline and a very long production tail (even tens of years) supported by the slowly released desorbed gas *(figure 3)*. The production rates per well are quite low when compared to conventional standards and the recovery per well is limited by the area and volume interested by the induced micro-fracture system, i.e. by the shape of the well and by the efficiency of the hydraulic fracturing job. As a consequence the most effective and practical method used to forecast the ultimate recovery per well and to estimate the overall recoverable reserves is the once old-fashioned production and pressure decline analysis, but with the introduction of quite unconventional parameters, e.g. super-hyperbolic decline with factor b>1 to match the transient phase switching then to an exponential decline to simulate the ultimate depletion. As a consequence of the limited recovery per well, the definition of the optimal spacing between wells (typically 500 to 1000 ft) becomes a critical factor to maximize the gas recovery while ensuring the best economical return.

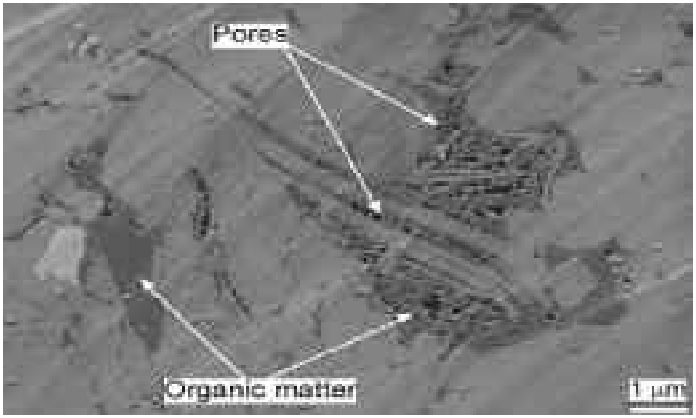


Figure 2 – Example of nanopores and organic matter at the scanning electron microscope in the Barnett shales (Texas, US).

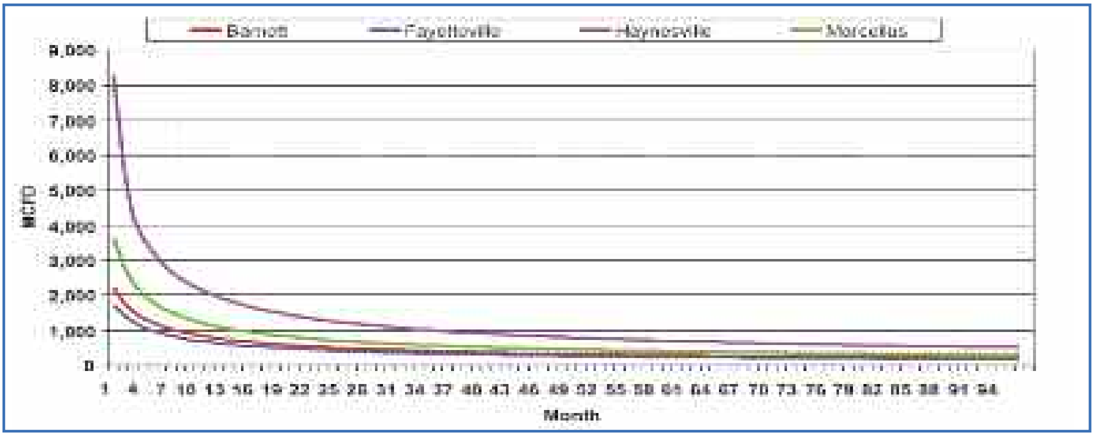


Figure 3 – Examples of typical production profiles in US gas shales

Horizontal drilling and hydraulic fracturing: the key to success.

In order to maximize the rock surface to be fractured, horizontal drilling is usually employed together with multi-fracturing techniques that evolved rapidly in the recent years. In order to minimize the surface impact, the wells are drilled in clusters from common pads *(figure 4)*.

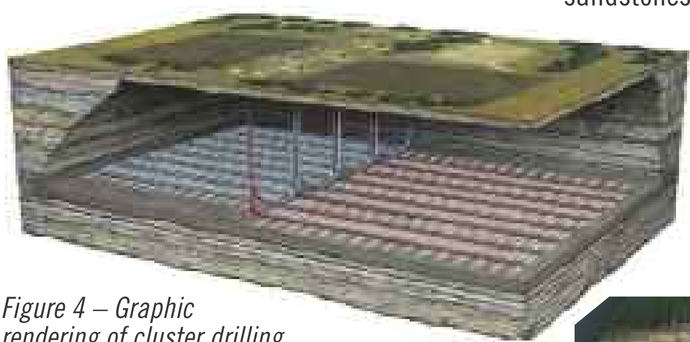


Figure 4 – Graphic rendering of cluster drilling maximizing fracturing efficiency and minimizing surface impact (source: Statoil)

The utilized rigs are usually skid-mounted and semi-automated. The drilling design is simplified as much as possible and the services minimized; drilling and completions are two separate stages and executed in batches *(figure 5)*. All operations are, in other words, aimed at getting the result at the minimum possible cost with the maximum efficiency in order to keep a profit margin at the low production rates per well. The repeatability of the operations leads to a "manufacturing" style, quite typical in other industries or in the mining sector, but not conventional in the oil sector.

The behavior and response to fracturing of the shales is quite different to that of tight sandstones because fractures usually propagate in a complex network rather than in specific directions. Hydraulic fracturing is furthermore achieved in most cases by use of simple fluids like slick water, even though in large quantities, with low volumes and

Figure 5 – Example of fracturing operations, aerial view

concentrations of proppants and chemicals. The multistage fracking ***techniques*** usually consist of a pumping down gun and bridge plugs ***technique*** or so-called “plug and perf” in cased and cemented lateral holes; in particular cases, it is becoming common however a multistage fracturing assembly system with isolation packers that is deployed in open hole laterals. Lateral holes of more than 6000 ft and up to more than 20 stages have become common in several situations. The induced fractures need to be effective and not to propagate to aquifers or to fractures/faults connected to aquifers; these latter aspects can be controlled in part using 3D seismic, while the efficiency of the frac jobs can be verified by recording micro-seismic surveys, i.e. by passive seismic recording of induced cracks using geophones on surface or in observation wells. Micro-seismic is also fundamental to identify the optimal spacing between wells.

Other success factors: geology and engineering are not enough.

In order to keep the overall required efficiency all along the gas chain, from the initial drilling down to the sale to the market, also the surface facilities engineers need to apply unconventional thinking to ensure simple, low cost, modular and progressive gathering, treatment, compression and delivery systems. Logistic parameters and the vicinity to a gas transmission network play, however, an important role on final economics. In general, we can say that both the availability of an interconnected free gas market and of an exceptionally well developed and competitive materials and services market have determined the success of the US case. Additional factors being the peculiar incentives represented by the private ownership of the land in many States and the wide acceptance of the oil industry by cultural tradition in most onshore US. In those areas where more sensitive is the environment, e.g. the Appalachians, the public debate on the impact of this drilling and water intensive activity is, however, quite intense; a correct management, not only of the hazards, but also of the communication and information, is essential. As it always happens, it is in those same areas that the technologies, e.g. for water recycling, are rapidly developing to make gas shale extraction more easily environmentally compatible. These considerations lead us back to the initial question: will the North-American unconventional gas “revolution” expand worldwide? It will probably take some time, but in a selective way.

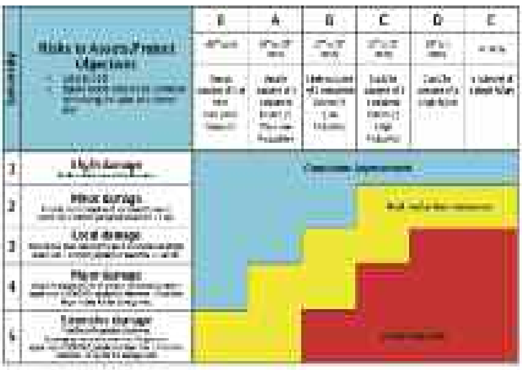
I will not enter here into the analysis of worldwide prospectivity, i.e. the geological differences or similarities between US or Canadian basins and other basins in the world. The US model, however, cannot be immediately replicated elsewhere due to the different, at various degrees, access to and conditions of gas sale markets and pricing mechanisms that will require, in several cases, the definition of appropriate incentives. The lack of a highly developed market for rigs, materials and services, together with limited availability of specialized human resources and the need for new organizational models will be an additional limiting factor. Not surprisingly, however, during the last year the attention, particularly of the American companies and of the majors, has been attracted by regions where some of the above mentioned factors exists or are under evolution, joined to the strong will of these countries to create the conditions to emancipate themselves from the current level of energy import (e.g. East Europe, China). As a conclusion the will of “revolution” could, therefore, be more decisive in determining the gas shale international success than the “optimal” geology.

Asset Integrity: an HSE challenge

by Luciano Scataglini - eni e&p division

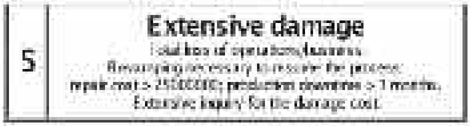
Integrity of assets is more and more a focus area for the oil business today. Extension of life of mature assets, optimization of their production capabi-lities, assurance that they are still meeting the design and operation goals, all these aspects concur to create or confirm value of the so called "brownfields".

But what about safety? The older an asset, the higher its associated risk! As a matter of fact, if a Company wants to prolong the revenue period of its plants, it should be fully aware that in case of major accident, such plants may be lost. Definitely. This is the reason why, when talking about Asset Integrity we, as HSE people, prefer to adopt the OGP(1) definition: "Asset integrity is defined as prevention of major hazards", where "major" means: a hazard that can severely impact on workers, since it may potentially result in severe injuries or disabilities. We have defined a "tolerability" matrix that clearly identifies this kind of hazards and correlates the threat to workers to the extension of damage that is expected on facilities in order to generate such a threat. The matrix is herewith displayed:



Notes: 1. OGP = Oil & Gas Producers
2. NPV = Net Present Value

When looking at row "5" that, in terms of threat to workers, implies "severe impact", it also implies, in terms of damage to assets, the following:



Events like these are never tolerated (they never lie in the light blue area), even though their probability is less than 1 in 1 million in anyone year. If their probability of occurrence is below 1 in 10 thousands in anyone year, they fall in the yellow area; in this case, they require risk mitigation actions, both structural (hardware) and operational (software). All risk mitigation actions, in this case, must be implemented, unless their cost is disproportionate to the benefit or, ultimately, exceeds the NPV(2) of the asset itself and, for this reason, are not viable. Should the "row 5" event impact people outside the plant fence, it is absolutely intolerable, unless the areas outside are of industrial or agricultural nature. This, in few words, the theory. What does it imply in practice?
Several implications. Let's try to list them.

- Routinary activities around plant facilities should be carried out by small teams (let's say, up to 5 people, more or less 1 per discipline).
- Areas where people can meet or manage emergencies (a Control Room, an office building, a lifeboat station, etc.) should be protected from accidental events like explosions, toxic dispersions and fires.
- An escape, emergency and rescue plan shall always be available and tested when dealing with sour gas. It may require the installation of Temporary Refuges able to survive in case of emergency and protect people inside until safely rescued.
- All safety barriers against risk scenarios shall be fit for purpose, that means: able to perform their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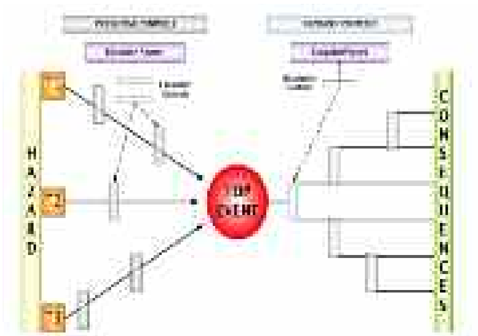
function when requested; compliant with well defined performance standards; regularly tested; inde-pendent from any other barrier; able to neutralize the risk they are expected to face.

- Risks associated with utilities or service equipments shall not be underestimated. Pumps, compres-sors and water treatment plants may be more hazardous than wells, vessels and tanks.
- We have developed a tool that enables us to identify all these things. It is based on the "bow-tie" concept, as here below depicted:

where a top event (major hazard) may only be realized if barriers against the hazards (preventive controls) fail, and may escalate,

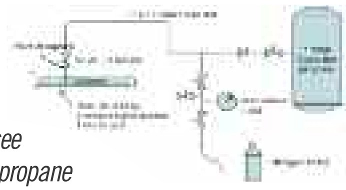


once realized, only if barriers against consequences (reco-very controls) fail in turn.

When barriers are serial (when, for example, the hazard factor T1 is realized), then the top event occur only if the two serial controls have a "common" weak point. Suppose, for instance, that T1 is a human error (an operator opens a valve in error and a gas leak occurs). Which barriers can we put to prevent T1? If the operator is experienced, safety is a matter of attitude, and he is a barrier by definition. But, since it is not sure that his experience is compatible with that particular plant, an operating manual – duly updated – is a further barrier.

Then, despite attitude and knowledge, it is not granted that the operator is safe in behaviour – a number of experienced people is victim of an accident because of over-confidence! – so, a training on how to manage safety issues is mandatory. Are those three barriers independent? Is a risk to have common failures prevented?

In principle, yes, since training can compensate a gap in experience and procedures a gap in training. How can we manage all these in practice? Look at this event:



A leak test for the 1" line from inlet of propane condenser (see picture above) to the propane receiver was carried out; the ¾" valve was leaking propane inside the 1" line since when the line was installed. Metal debris inside the 1" line probably caused ignition when nitrogen was flowing in the line. A high speed "flash back" fire occurred, causing the ¾" valve to be displaced; when hitting the pipe shell in the opposite side made a hole in it from where propane escaped and the mixture was ignited.

When this event is seen from a safety perspective, it is easy to conclude that a procedure for a safe purging and leak testing was not available or, if available, not properly followed; covering these gaps seem to be enough to prevent recurrence. Right! But just recurrence of an event like this, not occurrence of different event scenarios! When considering the event from an asset integrity point of view, on the contrary, it is clear that, in this case, experience, procedures and training were missing at the same time, such that an human error would have been unavoidable. For this reason, additional mechanical and operating barriers are needed, such as double block and bleed valves instead of the ¾" valve and a permit to work, always requested when working in close vicinity of a live plant.

These barriers, when adopted all over the plant and focused not only on normal running but on commissioning and start-up conditions, are able to prevent a large number of events (not only this particular occurrence) and, for this reason, have the potential for reducing the overall risk of a plant by an order of magnitude at least.

The "real" value of a plant, no matter how old it is, strictly depends upon the number of barriers it can provide against those risks that can result in a loss that is so high that a replacement of damaged facilities may become no more practicable.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Environmental, Social and Health Impact Assessment: a new integrated standard

by S. Mortara, F. Uberti, S. Sandri, M. Mollicone, C. Carbone - eni e&p division

Introduction

Eni e&p has recently issued a new standard for conducting integrated Environmental, Social and Health Impact Assessments (ESHIA) with the main purposes to:

1) Improve the decision – making process
2) Facilitate the local authorities approval of the operational projects, according to national legal or other requirements
3) Ensure support from other affected stakeholders.

The process designed in the standard:

a) provides benefits deriving from a single impact assessment approach integrating environmental, social and health components, using a multidisciplinary team;
b) integrates ESHIA into current business processes at the earliest possible stage ensuring that environmental, social and health considerations become an integral part of planned activities and allowing these issues to be addressed in a timely and cost-effective way throughout the overall project's lifecycle from exploration through to decommissioning phases.

Integrated Approach

The approach of environmental, social and health authorities is evolving though a higher concern about the potential effects of industrial activities on the local environment and the population surrounding the premises of drilling sites of operating fields. International organizations are pushing for an integration of the assessment in order to maximize the attention to people, environment and ecosystems and are discussing in several conferences and congresses the best methodology on how to integrate the peculiarity of each sector in a useful and protective tool. The standard identifies several areas of interest on environment social and health and maps then issues and relations according the scheme illustrated in figure 1.

Figure 1 – Key environmental, social and health issues and their inter-relationships

The integrated approach to the impacts identification and assessment and an effective stakeholder engagement, in the different phases of ESHIA process provided in this standard, are tools to better manage relationships with local communities. Therefore, the "non technical" risks for the company, which are often related to unmet expectations and needs of the local population affected by our projects, can be avoided or mitigated.

ESHIA process

The ESHIA process, its phases and relative activities might vary, depending on the requirements of the host country and the project. Nevertheless, a common structure including several key steps can be defined as shown in Figure 2.
ESHIA process, its key phases and relative activities are described together with results of its implementation in several eni e&p business areas. Reference is also made to the stakeholder engagement process, including information disclosure and consultation with local communities, which runs all along the process and helps to improve project design and management. Furthermore the content of a well structure monitoring programme and its importance is explained.

Screening is a high level preliminary assessment to determine whether a proposed project may cause significant environmental, social and health impacts.

Once the Screening phase has been completed, the *Scoping* phase should be undertaken to define the most important issues to be addressed in the ESHIA.

Baseline and field survey(s) will probably be needed to collect data and information to establish the environmental, social and health conditions of the project areas, before any work starts, and to supplement existing data sources as appropriate.

Any project can generate a wide range of *potential impacts*, some of which will be direct, other indirect, cumulated and perceived, whilst others will be more complex and difficult to be identified.

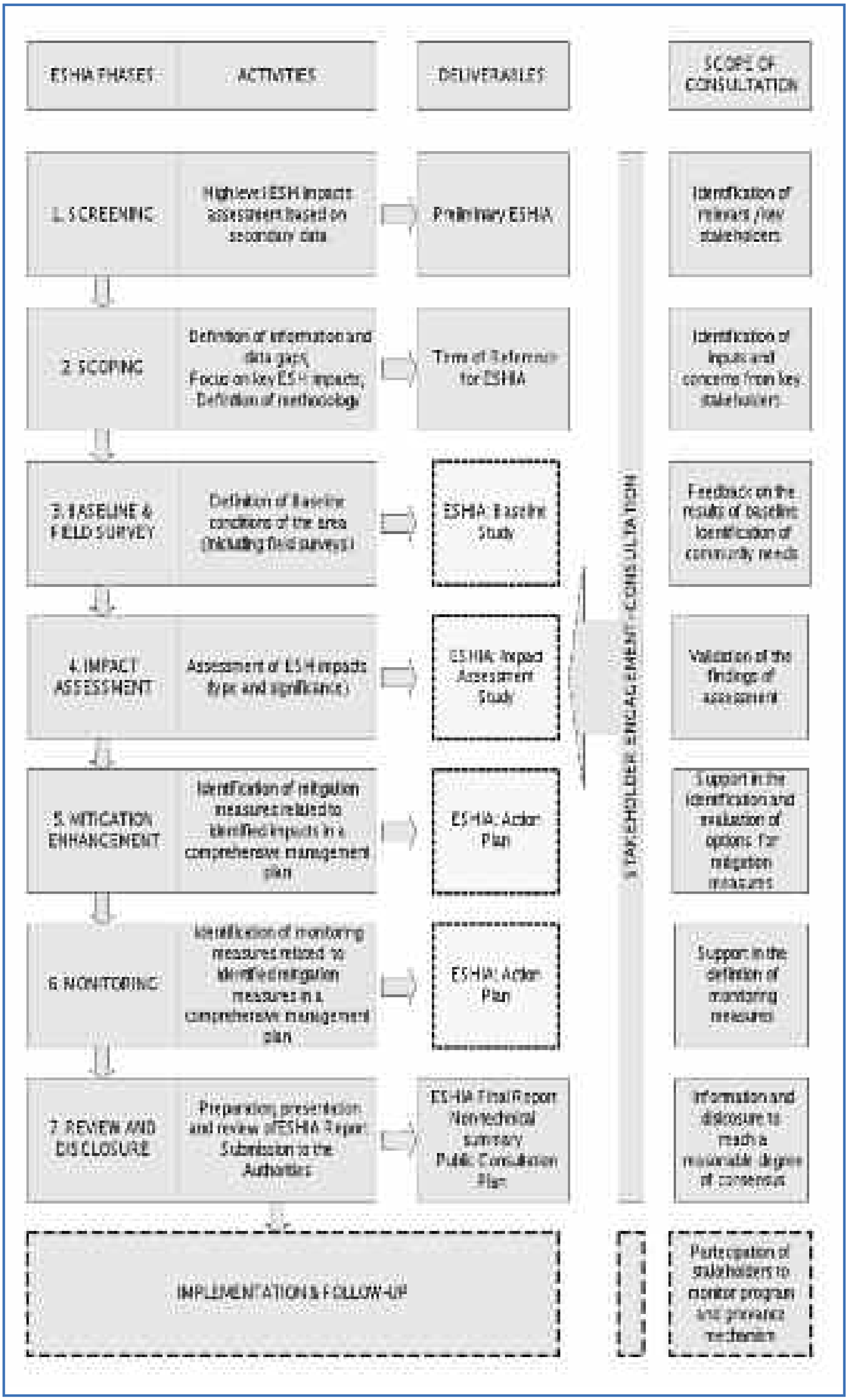
Mitigation/enhancement is a critical phase of ESHIA process: when potential impacts have been identified, the aim of this is to avoid or minimize as much as reasonably practicable the negative ones, while enhancing those that are positive.

The implementation of mitigation/enhancement measures should be monitored throughout the lifecycle of the project in order to *evaluate their effectiveness*. As individual environmental, social and health circumstances often change over the course of a project, the mitigation/enhancement measures will need periodic review. Hence monitoring is a key component of the ESHIA process and is an integral part of the project Health Safety and Environmental Integration Management System.

Conclusion

A proper management of ESHIA process will benefit health& social protection and promotion programmes for population surrounding the facilities, the safeguard of the environment the ecosystem and the biodiversity.
The outcomes of an effective ESHIA and the management of the findings have the potential to strengthen Company's social license to operate, access new resources, promote sustainable development and enhance Company reputation.

Figure 2 – The basic ESHIA phases, activities and related deliverables



News from the World

by Francesco Guidi

Eni enters in Congo Kinshasa and in Togo

- Eni entered in Democratic Republic of Congo (Congo Kinshasa), acquiring 55% share and operatorship of the onshore Ndunda Bloc, in the Bassin Cotier, a not very much explored region, in the prolific basin of the Lower Congo. The other partners are: Surestream Rdc (30%), Coydro (8%) and Ibos (7%).
- Eni entered in the Togo offshore, in two concessions, that are very promising, because they are not far from the Jubilee oil field in Ghana, that has reserves of 500 million bbl of oil. Eni is the operator with a share of 100%.

With these two acquisitions in Congo Kinshasa and in Togo, Eni will be present in eight Sub-Saharan countries. The other six are: Angola, Congo Brazzaville, Ghana, Gabon, Mozambique and Nigeria.

Eni oil discovery in Angola

Eni made another oil discovery in the 15/06 Block in the Angola offshore (1,000 m water depth). The well Mpingi 1, located 120 km from the coast, was drilled down to 2,300 m, where it found oil. At the test, the well gave a production of 6,000 bbl/d. Mpungi 1 is the 7th oil discovery in the block. Eni is the operator with a share of 35%.
The other partners are: SSI Fifteen 20%, Sonangol 15%, Total 15%, Falcon Oil 5%, Petrobras 5%, Statoil 5%.
Eni is in Angola since 1980 and its current equity production is 130,000 barrels of oil equivalent per day.

Eni put in production another gas field in Egypt

On July 19, Eni put on stream the offshore gas field of Tuna, in the Temshah concession, which is located in the Mediterranean Sea in Egyptian waters. The production rate is 4.5 million cubic meters of gas per day.
Eni equity production in Egypt is 170,000 bbl/d of oil equivalent per day.

Eni and MIT, new technologies against blow outs

The CEO of Eni, Paolo Scaroni, and the Chairman of the Massachusetts Institute of Technology (MIT), Susan Hockfield, met in Cambridge (Massachusetts) to make a balance of the ongoing joint venture projects. They announced new agreements for the development of new technologies to face the problem of well blow outs.

Saipem won new contracts in Africa

Saipem won in September contracts for 500 million dollars in Algeria, Congo (Brazzaville) and Nigeria:

- in Algeria a contract has been assigned by Sonatrach: it is a gas/oil separation plant and flow lines for 140 km in Hassi Messaoud;
- in Congo (Brazzaville) a contract has been assigned by the Pointe Noire Port: reconstruction and extension of a terminal for containers;
- in Nigeria a contract has been assigned by Chevron: it is the rehabilitation of the oil field Olero Creek, near Port Harcourt;

Carbon Capture & Storage

Oil companies and contractors continue to pay a lot of attention to the theme of Carbon Capture & Storage (CCS), whose objective is the containment of the CO_2 produced during hydrocarbon activities, through its use for different field applications.
On January 26, 2011, the Second Annual Summit on CCS will be held in Brussels. Following the success of the last year first edition, this Second Summit will explain in details the importance of CCS utilizations. We remind that CO_2 represents 2/3rd of the world GHG emissions. As a matter of fact, carbon dioxide is released to the atmosphere when fossil fuels are burnt. The Carbon Capture & Storage (CCS) is today the only technology capable to ensure in the short-medium term a drastic reduction of GHG emissions from fossil sources.

One interesting use of CO_2 is to enhance oil recovery. A study, performed by the Durham University, shows that using carbon dioxide (CO_2) to enhance the recovery from the North Sea oil fields could yield an extra 3 billion barrels of oil over the next 20 years.
Another interesting application of CO_2, which is under study, is its use in gas storage operations as cushion gas; in this way, carbon dioxide will replace the hydrocarbons normally used as cushion gas, thus making possible their commercialization.

Launch of Total E&P Italia web site

Total E&P Italia launched its web site at the address: www.it.total.com. It is dedicated to the Total Oil Exploration and Production activities in Italy, with particular attention given to the field of Tempa Rossa. Since January 1st of this year, Total E&P Italia, once a division of Total Italia, became a separate company. The realization of this web site, with a strong focus on Tempa Rossa field located in Basilicata, was shown to the public in Potenza, Basilicata, clear signal of Total willingness to dialogue with the territory. In such a way, everybody now has the possibility to know the Total oil activities in Italy and the status of the development of the Tempa Rossa project.

The preparation of OMC 2011

The Offshore Mediterranean Conference (OMC) 2011 will be held in Ravenna from 23 to 25 March 2011. Its preparation is underway. The main items of the Conference will be:

- exploration of frontier areas and access to new reserves;
- drilling and completion;
- reservoir;
- offshore and deepwater technology;
- enhanced recovery;
- production optimization;
- health, safety & environment;
- sustainable development;
- chain of the gas values, from reservoir to the market;
- not conventional resources, with particular emphasis given to the topic of shale gas.

Twenty First Century: A Natural Gas Economy

by Francesco Guidi - francesco.guidi@eni.it, Franco di Cesare - franco.dicesare@alice.it

The Authors are indebted to Riccardo Coen, formerly Exploration Manager with Agip Petroleum in Houston (Texas), for his insightful suggestions and revisions.

The Authors, are former executives of the E&P industry with over one century of active managerial experience in the oil & gas technical and business environment. The following brief article describes the evolution of the oil industry and proposes a possible future of the worldwide energy scenario which might be dominated by natural gas just as oil dominated the energy needs of the last century.

During the last Century, the world economy scene was dominated by the oil industry. Oil Companies built and shaped their own growth and strategic expansion around a strong technical core: their efforts were devoted to enhancing their capabilities to improve the ratio between the number of successful wells vs the number of drilled wells.

The search of hydrocarbons was primarily aimed at defining and high grading oil prone (sedimentary) basins.
If, in spite of extensive preliminary geologic and technical studies, natural gas was discovered instead of oil, this was considered an economic failure. Such a reality was related to the fact that gas was so difficult to produce economically in order to be delivered to the consumers/markets as they were far and difficult.

This was the general global perception of the O&G industry with a few exceptions, such as Italy's Po Valley where large gas fields were discovered and produced during and after WWII because of the foresight of Agip's President, Enrico Mattei (1906-1962), This

gas production has been instrumental in stimulating the post war industry development of Italy.
There is no doubt that the oil industry originated and developed in the USA because the country's geology was endowed with many oil prone basins and the existence of massive energy consuming industries as well as a favourable political climate. The oil companies soon looked beyond the USA domestic oil potential with an aggressive proactive process that led to assessing oil reserves internationally: the trend resulted in an international E&P expansion being the Middle East region their primary focus.

A BRIEF HISTORY OF OIL CONTRACTS

The exploration and production of oil in a host country was initially regulated by a simple contract where an operating Company would bear all costs associated to exploration and development and, in the event of a commercial discovery, royalties and profit taxes would be paid on the amounts of oil produced. The contractual terms produced hefty economic returns for the oil Companies so that it was very common for the host country to demand and modify the contractual formula: Agip's President Enrico Mattei was the first in the oil and gas industry to propose and introduce new contractual conditions which were more favourable to the host countries.

Some sources believe that these innovative contract changes, more favourable to host countries, might have been related to his sudden and tragic loss of life. The new terms generated a contractual model called PSA (Production Sharing Agreement) whereby essentially the State (foreign country) was considered the First Party, or owner of the licence, and the Oil Companies were defined as Second Parties which were entrusted to perform works on a sole risk basis on behalf of First Party. In the event of a commercial discovery and subsequent oil production, all costs were to be reimbursed and a profit would be granted.

The PSA contractual clauses related to oil were well articulated and defined clearly the exploration to production obligations and rewards: all clauses relevant to gas were instead not clearly defined. Therefore, in case of a gas discovery, PSA clauses were subject to revision and in renegotiations and, in some cases they were never applicable. In other cases a gas discovery would allow the Second Party to withdraw from the PSA contractual obligations.

The last international oil contract was adopted by the Iraqi Government to grant oil production rights in already discovered oil fields. The Iraqi adopted a Service Contract model and accordingly the Government receives a commitment from the Oil Companies to produce oil reserves in giant oil fields in exchange for a fee for each barrel (an example would be a $ 1.90/barrel of oil produced during the first 5 year contract granted to ExxonMobil & Royal Dutch Shell for the production of the West Qurna Stage, more than 20 billion barrels of reserves).
During the last decade and in recent years the energy market has been dominated by the energy producers: such a market ended up boosting the strategic power of countries

holding large oil reserves. Their contractual power was a determining factor which triggered the escalation of the oil price to a level of $ 190/barrel. This high price has been certainly a critical component of the 2009 economic crisis.

In the meantime Russian Federation, holding 44.38 trillion cubic meters of gas reserves (25% of the world reserves i.e. 187 trillion *BP Statistical Review of World Energy, June 2010*) flooded the European market with its gas and this without taking into account the Yamal Peninsula which is a region of Gazprom's strategic interests.

THE GAS BUBBLE

The above economic situation induced oil companies to pay more attention to gas which had been considered the "poor" relative of the hydrocarbon family.

Globally, there are abundant supplies of natural gas, much of which can be developed at relatively low cost. The current mean projection of remaining recoverable resource is 16,200 Trillion cubic feet, Tcf, (454 Trillion cubic meters, Tcm), 150 times current annual global gas consumption, with low and high projections of 12,400 Tcf (347 Tcm) and 20,800 Tcf (582 Tcm), respectively. Of the mean projection, approximately 9,000 Tcf (252 Tcm) could be economically developed with a gas price at or below $ 4/Million British thermal units (equivalent to 145 $/Mm^3 di gas) at the export point. ***The Future of Natural Gas. An Interdisciplinary MIT Study, Interim Report 26 June 2010***

Commercial development of Yamal's fields will increase local gas production to 310-360 billion cubic meters per annum by 2030. Accessing the Yamal is very important for ensuring domestic gas production growth. 11 gas and 15 oil, gas and condensate fields with approx 16 trillion cubic meters of explored and preliminary estimated gas reserves (ABC1+C2) and nearly 22 trillion cubic meters of in-place and forecast gas reserves (C3-D3) have been discovered on the Yamal Peninsula and in its adjacent offshore areas. Condensate (ABC1) and oil reserves are estimated at 230.7 and 291.8 million tons, respectively. The Bovanenkovo field is the most significant field on Yamal in terms of gas reserves, with up to 4.9 trillion cubic meters. (*Energy-Pedia, May 2010)*

Gazprom Map

The presence of many important gas projects (Nabucco pipeline, South Stream pipeline) to Europe, in addition to gas pipeline coming from Algeria, and Libya, reduces price of this commodity to the client.

NABUCCO PIPELINE

The significance of the Nabucco pipeline for European gas supply cannot be stressed enough. It will serve as the final link to the Caspian corridor by connecting Turkey to Western Europe, securing access to over 60 000 billion cubic meters of Caspian and Middle-Eastern gas reserves. This amount far exceeds the EU's indigenous reserves, and is only somewhat comparable to Russia's reserves. The Nabucco pipeline will therefore significantly increase diversity and security of supply for Europe in the longer term. (*Nabucco-Pipeline.com*).

Nabucco is expected to transit up to 31 billion cubic meters of natural gas a year from these sources to Austria from 2014 (compare with 2009 Spain consumption of 34.6 billion cubic meters, *BP Statistical Review of World Energy, June 2010).*

South Stream and Nabucco, the two competing gas pipeline projects supported by Russia and the EU respectively, should combine efforts in a joint cost-cutting drive, according to Eni, an Italian oil company with a stake in South Stream. Paolo Scaroni, chief executive officer of Eni SpA, said the move to combine the planned pipelines was "what bankers call a strategic fit," Bloomberg reported Scaroni as saying at a Cambridge Energy Research Associates conference in Houston. (**Euroactiv** 11 March 2010).

The name of the pipeline, Nabucco, alludes to the Verdi opera, whose theme is freedom from bondage, reputedly a reference to Russia's domination over Central Asian gas supplies.

SOUTH STREAM PIPELINE

This project, which was signed by Gazprom and Eni on June 2007, can be summarized as follows (Compare with 2009 Italy consumption of 71.6 billion cubic meters. *BP Statistical Review of World Energy, June 2010*):

- 63 billion cubic meters per annum – pipeline's design capacity
- 900 km – total length of the pipeline's offshore section.
- 2,000 m – maximum depth of the pipeline laying in the Black Sea

Intergovernmental agreements have been signed between Russia and:

- Bulgaria – January 18, 2008
- Serbia – January 25, 2008
- Hungary – February 28, 2008
- Greece – April 29, 2008
- Slovenia – November 14, 2009.

The South Stream is scheduled to be finalized before the end of 2015. *(South-Stream.info)*

SHALE GAS

USA, being the major consumer of natural gas (646.6 billion cubic meters in 2009, compared to 6.93 trillion cubic meter reserves as per ***BP Statistical Review of World Energy, June 2010***), developed a very aggressive domestic policy aimed at finding other gas products, such as *shale gas* and **Coal Bed Methane.**

Especially rewarding has been the search for shale gas. Among the many prospective areas in the USA, the Appalachian Basin

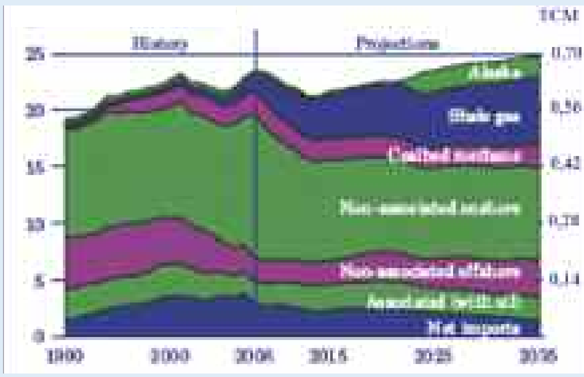
holds the Marcellus Shale formation which yields economically producible gas; the estimated recoverable gas reserves range from 500 to 1,000 trillion cubic feet (14-28 trillion cubic meters).

Due to new large shale gas discoveries, the USA (one of the major natural gas importers) has now lowered the demand for importing foreign gas.

Shale gas drives growth in natural gas production, offsetting declines in other sources

The growth in shale gas production in recent years is one of the most dynamic stories in U.S. energy markets. A few years ago, most analysts foresaw a growing U.S. reliance on imported sources of natural gas, and significant investments were being made in regasification facilities for imports of liquefied natural gas (LNG). Today, the biggest questions are the size of the shale gas resource base (which by most estimates is vast), the price level required to sustain its development, and whether there are technical or environmental factors that might dampen its development. Beyond those questions, the level of future domestic natural gas production will also depend on the level of natural gas demand in key consuming sectors, which will be shaped by prices, economic growth, and policies affecting fuel choice. In the Reference case, total domestic natural gas production grows from 20.6 trillion cubic feet in 2008 to 23.3 trillion cubic feet in 2035. With technology improvements and rising natural gas prices, natural gas production from shale formations grows to 6 trillion cubic feet in 2035, more than offsetting declines in other production. In 2035, shale gas provides 24 percent of the natural gas consumed in the United States, up from 6 percent in 2008 (Figure 3).

Figure 3 – U.S. natural gas supply, 1990-2035 (trillion cubic feet).



EIA/DOE Annual Energy Outlook 2010 , delivered on May 11, 2010.
http://www.eia.doe.gov/oiaf/aeo/pdf/execsummary.pdf

It is worth noting that the present political situation in Iran (30 trillion cubic meters reserves *BP Statistical Review of World Energy June 2010*), prevents this producer to open its tap.

The abundant availability of the product in a world wide economic crisis scenario, has produced a depressed price which, in turn has obliged the Companies either to request the State producer a revision of the ***take or pay*** formula, or to delay projects already defined.

In April 2010 Algeria, one of the most important gas exporters, presented to the members of the Gas Exporting Countries Forum (GECF) a proposal to curtail gas supplies to the global spot market in a move to support price (*MEES, March 2010*).

An example of the gas bubble is represented by the status of the Akkas gas field in Iraq, where the Government has offered the field for development to the industry with the rather disappointing result that no company has shown interest in the project. Several other gas fields are also available on a farm-out basis and they hardly attract attention from Oil and Gas Companies

Recently (MEES 25 October), Iraq has awarded on October 20, the Akkas field development to a TOTAL/TPAO (50/50) Joint Venture.

GAS HYDRATES

Another important unconventional Energy Sources are the so called Gas Hydrates.
A gas hydrate is a crystalline solid; its building blocks consist of a gas molecule surrounded by a cage of water molecules. Thus it is *similar to ice*, except that the crystalline structure is stabilized by the guest gas molecule within the cage of water molecules. Many gases have molecular sizes suitable to form hydrate, including such naturally occurring gases as carbon dioxide, hydrogen sulfide, and several low-carbon-number hydrocarbons, but most marine gas hydrates that have been analyzed are methane hydrates.
(***United States Geological Survey, USGS).***

Recent mapping conducted by the USGS off North Carolina and South Carolina shows large accumulations of methane hydrates.

A pair of relatively small areas, each about the size of the State of Rhode Island, shows intense concentrations of gas hydrates. USGS scientists estimate that these areas contain more than 1,300 trillion cubic feet of methane gas, an amount representing more than 70 times the 1989 gas consumption of the United States. Some of the gas was formed by bacteria in the sediments, but some may be derived from deep strata of the Carolina Trough. The Carolina Trough is a significant offshore oil and gas frontier area where no wells have been drilled.
It is a very large basin, about the size of the State of South Carolina, that has accumulated a great thickness of sediment, perhaps more than 13 kilometers. Salt diapirs, reefs, and faults, in addition to hydrate gas, may provide greater potential for conventional oil and gas traps than is present in other east coast basins.

(Energy and Marine Geology)

The production of gas from hydrates is a challenge to the current level of drilling and production technology, even though some initial experimental testing has proved to be successful. Nowadays no information is available on wether oil companies have capability of such production technology.

Most likely the problem should be addressed in the same fashion that was adopted by the USA during WWII with natural rubber, after Japan conquered the Far East, taking over the natural rubber production. At that time the USA issued a challenge to the major domestic industries and universities to study and develop a material to replace natural rubber (i.e. synthetic rubber already discovered in Germany at the beginning of the 20th century). The gas hydrate problem could be addressed following the same rationale.

SHORT CONCLUSION

Following the current market situation, we see the focus of the gas market is shifting from production to distribution/marketing of the gas commodity: the purchasing price is related to the market share. With such an assumption, oil & gas companies should consider setting up robust joint ventures with national entities (Government and/or national gas companies), which, de facto, enter the energy sector of the importing nations.

There is a concern that (in some extreme cases), oil and gas companies could change their actual mission in the industrial environment, possibly divesting their petroleum assets, altering their original culture, reducing their functions to mere financial companies.

ADDENDUM 1

The history of the discovery and production of synthetic rubber is an important episode of the WWII and it is worth to reproduce here an excerpt from the article **The Century of Enrico Mattei** *by Francesco Guidi and Franco di Cesare* published in SPE Technical Bulletin 3/2005

On December 7, 1941 the USA entered the War, and three months after the attack on Pearl Harbour the Japanese invaded Malaysia and the Dutch East Indies: this gave them the control of over 95% of world rubber supplies, plunging USA into a crisis. The response of Washington was rapid and dramatic. Four days after Pearl Harbour attack (7 December 1941) the use of rubber in any product which was not essential was banned. The speed limit on US highways fell to 35 miles (56 km/hour) per hour, in order to reduce tires wear.
The USA survival depended on the capacity to produce over 800,000 tons a year.
At this moment the *American Synthetic Rubber Research Program* began and the chemical companies were given two years to reach this target. Along with the major rubber producing companies, 14 Universities joined international companies such as Esso Standard Oil of New Jersey, Gulf Oil Company, Texas Oil Company, Phillips Petroleum Company, Shell Development, Firestone Tire and Rubber Company, Good Year, Tire and Rubber Company, Union Carbide, General Tire, Dead Olea.

Malaysia 1970, Rubber plantation, FdC

The war was even won with this extremely important contribution. Immediately after WWII, Enrico Mattei realized the importance of the synthetic rubber and the potential synergy of petroleum refining to generate components necessary for its production and he decided to enter this area. He attempted to acquire rights to the patent for synthetic rubber (Buna-S type rubber) but no Company was willing to licence their know-how. Eventually he was able to conclude a commercial agreement with Phillips Petroleum Company (P.P.Co. now ConocoPhillips) from Bartlesville (Oklahoma). This Company during 1950's and early 1960's became a leader in fundamental research for polymer production and patented the styrene+butadiene process which became the main commercial process for production of styrenic black copolymers. It also developed carbon black. Enrico Mattei reached an agreement with P.P.Co. to build a 50/50 joint venture facility for production of carbon black in Ravenna in 1959. So Eni started production of chemical products and in few years ANIC became one chemical leader in the Western world. The cooperation with P.P.Co. in chemical activity developed even in oil upstream and this explains the good relationships between the two Companies which in early Sixties had signed many joint ventures such as in Nigeria, Iran, UK, Norway, Abu Dhabi, Saudi Arabia, Columbia…

Addendum 2
The Eni strength in the gas field

The Eni name is strictly tied to the gas. The following is a list of some of the major gas fields discoveries more than 8 billion cubic meters each (282 billion cubic feet) made by Agip/Eni, since the first one, Caviaga (Milan), in Italy, in 1944.

Caviaga 12 billion cubic meters (424 billion cubic feet), that opens the list, is an historical discovery because, it has been the first one in Western Europe.

Enrico Mattei, Agip and Eni Chairman, understood the gas importance, since then, expanding its production/consumption in Italy with at least 20 years in advance of the other European countries, when in the late Sixties there were the big gas discoveries in the North Sea.

Very important had been the discoveries of Abu Madi (1967, the first one in Egypt) and Bahr Essalam, (1977, the first one in Libya). Thanks to them, Egypt and Libya are now two important gas exporters.

18 July 2010

	Country	Field/Reservoir name	Fluid Type	Operator	Discovery (Year)
1	ITALY	CAVIAGA	wet gas	ENI E & P	1944
2	ITALY	CORTEMAGGIORE	dry gas	ENI E & P	1948
3	ITALY	MINERBIO	dry gas	ENI E & P	1956
4	ITALY	SAN SALVO - CUPELLO	dry gas	ENI E & P	1956
5	ITALY	SPILAMBERTO	wet gas	ENI E & P	1956
6	ITALY	FERRANDINA	dry gas	ENI E & P	1959
7	ITALY	GAGLIANO	gas condensate	ENI MEDITERRANEA IDROCARBURI	1960
8	ITALY	P.TO CORSINI	dry gas	ENI E & P	1961
9	ITALY	CERVIA-ARIANNA	dry gas	ENI E & P	1963
10	EGYPT	ABU MADI - EL QARA	wet gas	PETROBEL	1967
11	ITALY	AMELIA	dry gas	ENI E & P	1968
12	ITALY	P.TO GARIBALDI AGOSTINO	dry gas	ENI E & P	1968
13	ITALY	BARBARA	dry gas	ENI E & P	1971
14	ITALY	EMMA	dry gas	ENI E & P	1971
15	ITALY	LUNA - HERA LACINIA - LINDA	dry gas	ENI E & P	1971
16	CROATIA	IVANA	dry gas	INAGIP d.o.o.	1973
17	ITALY	MALOSSA	gas condensate	ENI E & P	1973
18	EGYPT	TEMSAH	gas condensate	PETROBEL	1977
19	LIBYA	BAHR ESSALAM	gas condensate	AGIP(N.A.M.E) Ltd. - Libyan Branch	1977
20	EGYPT	PORT FOUAD	gas condensate	PETROBEL	1982
21	ITALY	DARIA	dry gas	ENI E & P	1985
22	ITALY	DONATELLA	dry gas	ENI E & P	1990
23	EGYPT	BALTIM	gas condensate	PETROBEL	1993
24	EGYPT	DARFEEL	dry gas	PETROBEL	1996
25	EGYPT	DENISE	wet gas	PETROBEL	1996
26	EGYPT	TUNA	dry gas	PETROBEL	1996
27	UNITED STATES	LONGHORN	dry gas	ENI PETROLEUM	2006

2010-2011 Lecture & Events Program

by A. Di Lullo - SPE Italian Section Program Chairperson

Dear Members, as customary, I draw your attention on the future initiatives.
First of all, you find below the agenda of the next planned initiatives.

Date		Affiliation	Title
Tue Nov 16, 2010	11:00 AM	Sebastiano Correra	**Technology Innovation: creativity, scouting and cross-fertilization**
Tue 15 Dec, 2010	03:00 PM 08:00 PM	**"Gustavo Sclocchi" Theses Award 2010 (SPE, EAGE, Assomineraria)** **2010 SPE Christmas Dinner**	
Mon Jan 17, 2011	11:00 AM	DL: David Handwerger	**Core analysis conducted on wells drilled in Anatarctica**
Thu Mar 17, 2011	11:00 AM	DL: Jennifer L. Miskimins	**Adopting a Different Viewpoint - How Unconventional Reservoirs Have Changed Our Perspectives on Hydraulic Fracturing**
Thu May 19, 2011	01:00 PM	DL: Younes Jalali	**Engineering the Reservoir One Well at a Time!**

Note that the date of the last two Distinguished Lecturers (in italic) will be confirmed later (travel plans always may have some variability). The other dates are definitive!

We are now planning other initiatives, also on the trail of the successful Teachers' Workshop held during the ATCE in Florence. Of course, we are completely open to suggestions and proposals: just contact the Program Chair at alberto.dilullo@eni.com.

We all look forward to see you (either personally or on webcast) at the next event!

Alberto Di Lullo

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