

Sul P&G 2030

SOUTH OIL&GAS 2030

Um Observatório para Governança de Riscos, Industrialização e
Mudança Tecnológica

A web-based Observatory for participatory risk governance and opportunities for boosting industry

Proposta para uma iniciativa de estímulo a novas dinâmicas de inovação e a indústrias sustentáveis de
Petróleo e Gás no Atlântico Sul e na África Subsariana

New innovation dynamics and the sustainable Oil&Gas industries in South Atlantic and Sub-Saharan Africa

Uma iniciativa promovida através do *International Risk Governance Council, IRGC-Portugal*

<http://www.irgc-portugal.org/>

Novembro 2013

Sumário

Pretende-se criar, desenvolver e promover um *Observatório de Governança de Riscos, Industrialização e Mudança Tecnológica, "Sul P&G 2030"*, para estimular novas dinâmicas de inovação e indústrias sustentáveis de Petróleo e Gás no Atlântico Sul e na África Subsariana.

A identificação dos vastos recursos de hidrocarbonetos no pré-sal brasileiro e, potencialmente, no pré-sal africano, assim como as inovações tecnológicas que levaram ao rápido aumento de recursos não convencionais de hidrocarbonetos nos EUA estão a reformular a geopolítica de energia. As recentes descobertas de gás em Moçambique podem ajudar neste processo e estão na base dos fundamentos para a criação deste Observatório.

O aumento do abastecimento de hidrocarbonetos no Atlântico Norte (EUA, Canadá e potencialmente no México) e no Atlântico Sul (Brasil, África Ocidental e, potencialmente, Venezuela) diminuirá os riscos económicos de potenciais rupturas no fornecimento de petróleo do Médio Oriente para as regiões do Atlântico. Adicionalmente, a expansão do Canal do Panamá (como esperado em 2015) em tempos de maior incerteza nos mercados de energia e da produção potencial de gás não convencional em todo o mundo, pode fomentar novos riscos sistémicos a surgir no Atlântico, especialmente no Atlântico sul. Isso provavelmente ocorrerá em conjunto com o tráfego e as principais rotas marítimas comerciais, que será significativamente melhorada com o surgimento de novas indústrias em várias partes da costa atlântica, incluindo a África Oriental e Ocidental e o Norte do Brasil.

Essas mudanças podem causar impacto nos cenários gerais para a segurança energética a um nível global, que necessitam de ser abordados e discutidos em detalhe. Adicionalmente, muitas zonas portuárias da América Latina (por exemplo, Rio de Janeiro e Santos no Sudeste do Brasil, Bahia e Pecém, no Nordeste do Brasil) e do Sul da Europa (incluindo Sines, Lisboa e Leixões, em Portugal, Valencia no sudeste da Espanha, Las Palmas em Canarias, Algeciras), bem como no norte da Europa (por exemplo, Rotterdam, na Holanda), vão competir para a promoção de entrada / saída de mercadorias, facilitando novas oportunidades para o eventual desenvolvimento dessas regiões, mas acrescentando novos riscos. O Observatório deverá incidir sobre estas mudanças em termos tecnológicos e sistémicos, valorizando a análise histórica e perspectivando estudos prospectivos.

Os efeitos deste novo contexto não são totalmente compreendidos e, com certeza, mal medidos ainda. Dados recentes sugerem que um processo de reindustrialização está a emergir na América do Norte e que o processo de industrialização no Atlântico Sul está a ganhar força. Se assim acontece, o comércio entre as nações do Atlântico é provável que decole com óbvio impacto sobre o comércio entre o Pacífico e as Nações do Atlântico.

Em qualquer circunstância, os crescentes recursos de hidrocarbonetos dos países de língua portuguesa (Brasil, Moçambique e Angola, em particular) irá desempenhar um papel importante na reformulação da geopolítica da energia. O Observatório tem a intenção de explorar esse papel e ajudar a aprofundar o nosso entendimento dos riscos e oportunidades emergentes. Tem como objetivo identificar a percepção atual de académicos, reguladores e operadores de petróleo de Angola, Brasil, Portugal e Moçambique sobre esta questão e definir uma nova agenda de pesquisa.

Um primeiro workshop foi organizado no Porto, Portugal, a 29 de outubro de 2013, por ocasião da XV Conferência sobre Gestão Ibero Latino-Americano de Tecnologia - ALTEC 2013, <http://www.altec2013.org/>. Permitiu lançar o debate para futuros trabalhos, reunir diferentes especialistas e partes interessadas e definir um plano de trabalho. Será seguido por um segundo

Workshop a ser realizado no Rio de Janeiro até o final de Fevereiro de 2014 e um terceiro Workshop em Luanda em Maio de 2014.

Fórum N3: Novos Negócios, Novas Tecnologias e Novos Empregos para as Industrias Off-Shore

O Observatório de Governança de Riscos, Industrialização e Mudança Tecnológica, "Sul P&G 2030", será dinamizado juntamente com um conjunto de workshops destinados a discutir o desenvolvimento e implementação de roteiros estratégicos para novos negócios, novas tecnologias e novas oportunidades de emprego, com destaque para as novas condições geopolíticas do Atlântico e do hemisfério Sul. Mais uma vez, um primeiro "Fórum N3: Novos Negócios, Novas Tecnologias e Novos Empregos para as Industrias Off-Shore" foi organizado no Porto, Portugal, a 30 de outubro de 2013, por ocasião da XV Conferência sobre Gestão Ibero Latino-Americano de Tecnologia - ALTEC 2013, <http://www.altec2013.org/>. Permitiu lançar o debate para futuros trabalhos.

A ênfase inicial estará no pré-sal brasileiro e, eventualmente nas perspectivas para o pré-sal Africano, com o objectivo final de discutir oportunidades novas e emergentes em três áreas principais: i) **tecnologias submarinas** e novos negócios relacionados; ii) **capacidade naval, embarcações e plataformas especializadas**, incluindo as oportunidades para a construção de novas plataformas navais, de médio porte e âmbito especializado, para apoiar a exploração de petróleo no Atlântico sul; e iii) **sistemas de governança de riscos**. Desenvolvimentos recentes na região do Rio de Janeiro serão avaliados e discutidos de forma a promover novas iniciativas e ações cooperativas. O debate será centrado nos seguintes aspectos.

- **tecnologias submarinas** e novos negócios relacionados:
 - Sistemas de Produção Submarina independentes do apoio de plataformas na superfície do mar;
 - Sistemas de geração e distribuição de energia elétrica em ambiente submarino (geração e distribuição de energia a partir de correntes marinhas, diferenças de temperatura e pressão, geotermia e nuclear, entre outras);
 - sistemas de inspeção e manutenção de equipamentos submarinos.
- **capacidade naval e plataformas off-shore:**
 - capacitação da frota naval, incluindo "barcos de apoio especializados" ("Plataform Support Vessels", designadamente barcos de apoio especializados, como os lançadores de tubulações);
 - outras plataformas especializadas de apoio à exploração off-shore.
- **sistemas de governança de riscos:**
 - Sistemas de prevenção de riscos ambientais;
 - monitoração, combate e remediação de acidentes ambientais e suas consequências;
 - Sistemas de governo e discussão pública.

Avaliações comparativas com a Noruega e no Mar do Norte serão estabelecidas e parcerias estratégicas de cooperação com o Brasil serão discutidas. Mas os workshops serão orientados para a criação de novos empregos, novas empresas e indústrias resilientes sustentáveis ao longo de toda a cadeia de valor do petróleo e gás e áreas relacionadas. O objectivo é facilitar a valorização tecnológica, social e económica da acumulação de capacidades científicas e tecnológicas em muitas regiões. A discussão incidirá ainda sobre o papel das novas indústrias de base tecnológica e do seu efeito estruturante nas economias, devendo ser dado destaque para as oportunidades em industriais emergentes para responder a riscos sistémicos no Atlântico.

As empresas de base tecnológica que emergem no Rio de Janeiro em associação com **tecnologias submarinas** irão formar um caso de estudo inicial a ser discutido, incluindo o papel do Parque Tecnológico da Universidade Federal do Rio de Janeiro, UFRJ, na "Ilha do Fundão".

Executive Summary (in English)

The ultimate goal of this initiative is to promote a consortium in the form of an *Observatory for Risk Governance, Industrialization and Technological change*, "SOUTH Oil&Gas 2030", to stimulate sustainable offshore Oil&Gas related businesses. It is aimed to help improving our understanding of new innovation dynamics and the sustainable Oil&Gas industries in South Atlantic and Sub-Saharan Africa.

The identification of vast hydrocarbons resources in the Brazilian pre-salt and, eventually, in the African pre-salt, as well as the technological innovations that led to the rapid increase of unconventional hydrocarbons resources in the USA both are reshaping the energy geopolitics. The recent gas discoveries in Mozambique may help in this process. Together, they have driven the rationale behind "SOUTH Oil&Gas 2030".

The increase supply of hydrocarbons in the North Atlantic (USA, Canada and potentially Mexico) and in the South Atlantic (Brazil, West Africa and potentially Venezuela) diminishes the economic risks of the disruptions in the Middle East oil supply for the Atlantic nations. In addition, the expansion of the Panama Canal (as expected in 2015) in times of increased uncertainty in the energy markets and potential production of unconventional gas worldwide, may foster new systemic risks to emerge in the Atlantic, particularly in the South Atlantic. This will probably occur together with traffic and major commercial sea routes, which will be significantly enhanced with the emergence of new industries in several parts of the Atlantic coast, including East and West Africa and Northern Brazil.

These changes may impact the overall scenarios for energy security at a global level, which require to be addressed and discussed in detail. In addition, many port zones in Latin America (e.g., Rio de Janeiro and Santos in Southeastern Brazil; Bahia and Pecém in Northeastern Brazil) and Southern and Atlantic Europe (including Sines, Lisbon and Leixões in Portugal, Valencia in Southeastern Spain, Las Palmas in Canarias, Algeciras), as well as in northern Europe (e.g., Rotterdam, in the Netherlands), will compete for promoting entry/exit gates of merchandise, thus leaden to opportunities to develop, and adding new risks to those regions. This initiative should focus on those changes in terms of technological and systemic risks.

The effects of this new context are not fully understood and, certainly, poorly measured as yet. Recent data suggests that a process of reindustrialization is emerging in North America and that the industrialization process in the South Atlantic is gaining momentum. If so happens, trade among Atlantic nations is likely to take off with obvious impact on trade between Pacific and Atlantic nations.

In any circumstance, the hydrocarbons resources of the Portuguese speaking countries (in particular, Brazil, Mozambique and Angola) will play a significant role in the reshaping of the geopolitics of energy. This initiative intends to explore this role and to help deepening our understanding of emerging risks and opportunities. It aims to identify the current perception of academics, regulators, government officials and oil operators of Angola, Brazil, Portugal and Mozambique on this issue and to set a new research agenda.

An initial workshop was organized in Porto, Portugal, on Tuesday, the 29th of October 2013, by the time of the XV Conference on Latin Ibero-American Management of Technology - ALTEC 2013, <http://www.altec2013.org/>. It was used to set the agenda for new research, to bring together different experts and stakeholders and define a plan of work. It will be followed by a second workshop to be held in Rio de Janeiro by the end of February 2014 and a third workshop to be held in Luanda in May 2014.

Fórum N3: New Business Ventures, New Technologies and New Job Opportunities for the Off-Shore Industries

New ways for international companies soft-landing will be studied for generating knowledge flows in technology based companies. This will be achieved together with the organization of a “**Forum N3: New Businesses, New Technologies and New Jobs for the oil and gas Industries**”. Again, an initial event was organized in Porto, Portugal, on Wednesday, the 30th of October 2013, by the time of the XV Conference on Latin Ibero-American Management of Technology - ALTEC 2013, <http://www.altec2013.org/>. It will be continued in the years to come.

Pilot case studies will be performed in terms of emerging opportunities for oil and gas supply chains, including *subsea technologies* (submarine drilling and energy supply; submarine robotics, submarine processing units, among others), the construction of new and *specialized platforms support vessels* (including *and integration of* renewable off-shore energy sources), the development of *reliable onshore gas exploration processes* as well as strategies designed to minimize health, safety and environmental risks across all elements of the these systems.

This initiative is aimed to help developing and implementing strategic roadmaps for new technology-based business ventures, job opportunities and demand-side policy measures with the objective to increase the market uptake of innovations in offshore-related industries and sectors, with emphasis on the new geopolitical conditions for the Atlantic. Emphasis will be on the Brazilian pre-salt and the ultimate goal is to discuss new and emerging opportunities in three major areas: i) subsea technologies and related business ventures; and ii) Platform Support Vessels and other off-shore platforms, including the opportunities for building and developing new, medium-size, support vessels to support oil exploration in the south Atlantic; and iii) Risk governance. Recent developments in the region of Rio de Janeiro will be assessed and discussed in a way to foster joint cooperative ventures.

- **Subsea technologies:**
 - Independent subsea production systems;
 - Subsea energy production and distribution systems;
 - Inspection and maintenance of subsea systems.
- **Specialized Platform Support Vessels and off-shore platforms:**
 - Development of specialized Platforms and Support Vessels;
 - Emerging developments in specialized naval engineering to support offshore oil exploration.
- **Risk governance:**
 - Prevention of environmental risks;
 - Monitoring and remediation of risks.
 - Governing risks and public participation.

Comparative assessments with Norway and the North Sea will be established and strategic cooperative partnerships with Brazil will be discussed. But the workshop will be oriented towards the creation of new employment, new enterprises and resilient industries in sustainable offshore O&G related areas, making use of the unique accumulation of scientific and technological capabilities in Portugal and in Europe. It will focus on the role of new technology-based industries and firms have for structuring effect on the economy and will be launched with emphasis on the emerging industrial opportunities and systemic risks in the Atlantic.

Emerging technology-based firms in Rio de Janeiro will form an initial case study to be discussed, including the role of the “Science Park of Rio de Janeiro” of the Federal University of Rio de Janeiro, UFRJ, at “Ilha do Fundão”, which has become specialized on oil & gas industry with international

recognition and involving a unique set of knowledge networks, government agencies and oil related companies.

Resercah Focus

The following themes will be the focus of the analysis in the short term:

- **Application of information technologies to O&G industry:**
 - innovation potential in digital oil fields software
- **Subsea technologies:**
 - Independent subsea production systems, energy production and distribution systems;
 - Inspection and maintenance of subsea systems.
- **Specialized Platform Support Vessels and off-shore platforms:**
 - Development of specialized Platforms and Support Vessels;
 - Emerging developments in specialized platform support vessels for oil exploration.
- **Reliable onshore gas exploration processes**
- **Risk governance:**
 - Prevention of environmental risks; Monitoring and remediation of risks.
 - Governing risks and public participation.
- **New Businesses, New Technologies and New Jobs for the offshore and onshore Industries: ports, technology parks and emerging urban contexts**
 - Monitoring new opportunities and promoting new technology-based companies in international cooperation.
 - Promoting the commercialization of science and technology and the incubation of new industries.

Potential Partners and Associate Partners (Potential; to be confirmed)

Name	Type	Country	Contact person
Regulators and Government agencies:			
ANP	Brazilian national regulator	Brasil	Elias de Souza
Angola Oil Ministry (Ministério de Petróleos de Angola)	Oil Ministry	Angola	Artur Alvaro Pimenta
Industry Associations and Oil & Gas Companies:			
ONIP	Industry Association	Brasil	Carlos Camerini
GALP ENERGIA	O&G Operator	Portugal	Manuel Ferreira de Oliveira, CEO Carlos Pina, member of the Board António Sousa Nunes, R&D Director Ruben Eiras, ruben.eiras@galpenergia.com Rui Baptista, ruibaptista@galpenergia.com
PARTEX Oil & Gas	O&G Operator	Portugal	António Costa e Silva, CEO Fernando Barata Alves Teresa Ribeiro Luis Guerreiro
Sonangol	O&G Operator	Angola	Fernando Roberto
ENH, Empresa Nacional de Hidrocarbonetos	O&G Operator	Mozambique	Nelson Ocuane Júlia Dias
Technip/Lusotechnip	Oil Field Services	Portugal/ France	Franz Josef Kaltner; FJKaltner@technip.com Victor Duarte; VDuarte@technip.com Dominique PERREAU-SAUSSINE; dperreausaussine@technip.com
Schlumberger Brasil	Oil Field Services	Brazil	Cecília Gurgel; cgurgel@slb.com Kamel Bennacer; bennaceur1@slb.com José G. Gonzalez; Gonzalez67@slb.com
Research and Technology Centers; Academic Partners:			
Center for Innovation Technology and Policy Research, IN+, at IST, Lisbon	University	Portugal	Manuel Heitor, Director, mheitor@ist.utl.pt Paulo Ferrão Miguel Amaral, PhD Joana Mendonça, PhD <i>Others to be identified</i>
INESC PORTO	Private R&D services	Portugal	Jose M Mendonça Vladimir Miranda <i>Others to be identified</i>
UFRJ-IE; PPED	University	Brasil	Adilson Oliveira Renata Lèbre La Rovere Ana Célia Castro

UFRJ – Parque tecnológico	University Technology Park	Brasil	Mauricio Guedes Leonardo Mello Filipe Martins
PUC-Rio, Inst. Energia	University	Brasil	Alfred Renault
WAVEC, Offshore Renewables	Private R&D services	Portugal	António Sarmento, Director Teresa Simas, R&D manager; teresa@wavec.org
CEIIA	Private R&D services	Portugal	Jose Rui Felizardo Artur Costa Others to be identified
ISQ	Private R&D services	Portugal	Manuel Cruz Eduardo Dias Lopes
BGI: Building Global Innovators; MIT-Portugal Program (AUDAX/ISCTE)	Private R&D services	Portugal	
SINTEF BRASIL	Private R&D services	Brazil	Antonio Caldeira Pires
CEBRI, BRAZILIAN CENTER FOR INTERNATIONAL RELATIONS - CEBRI	Think Thank. Private Association	Brasil	Henrique Rzezinski
IHC, FCSH-UNL	University	Portugal	Fernanda Rollo
Univ. Eduardo Mondlane	University	Mozambique	Jorge Nhambiu, School of Engineering
Univ. Lúrio	University	Mozambique	Jorge Ferrão, Rector
Univ Zambeze, UniZambeze	University	Mozambique	Bhangy Cassy, Rector Alexandra Rodrigues, Directora
CMU, EPP	University	USA	Granger Morgan Michael Griffin Paul Fischbeck Inês Lima Azevedo Others to be identified
Ecole Polytechnique Fédérale Lausanne (EPFL)	University	Swiss	Matthias Finger
EU-VRi / Steinbeis Advanced Risk technologies Group	Private Foundation	Germany	Aleksandar Jovanovic
IRGC, International Risk Governance	Private Foundation	Swiss	Marie Valentine

Council			
IRGC-Portugal, International Risk Governance Council-Portugal	Resercah Network	Portugal	Joana Medonça

Proposed plan of activities

The foreseen activities will consider five dimensions, as described briefly in the following paragraphs.

1. Research, Innovation and Graduate Education Plan (see Annex 1)

This project considers new research and collaboration activities aimed to continuously inform and assist the development of a new web-based Observatory, "SOUTH Oil&Gas 2030" to provide information on new opportunities for enterprises, resilient industries and skilled employment and encourage the stakeholders involvement in risk governance practices.

A research platform will be set up with academic, regulatory and business partners from Brazil, Portugal, Angola, Mozambique, US and Norway, as a preliminary stage towards desining the Observatory. The focus will be on the Brazilian, Angola, Mozambique and Southern European regions to identify industrialization and specialization pathways through comparative studies of knowledge networks, supply chains, and industrial geographies with the north of Europe and the US.

It is foreseen that the existing Doctoral Program on "Engineering and Public Policy, EPP", with dual degrees at IST-Lisbon (Technical University of Lisbon), Faculdade de Engenharia da Universidade do Porto (FEUP-Porto) and Carnegie Mellon University, as well s the PPED Programa at UFRJ, may act as one of the "vehicles" to foster doctoral research in the areas of this Initiative.

We aim therefore at fostering an international Doctoral Consortium in order to bring together a few selected Doctoral programs focused on Technology Policy into a network of cooperation and exchange of students and academic staff. An annual meeting of the Doctoral Consortium, involving Universities from both developed and developing countries, should help addressing common issues, attracting participation from developing countries and providing a wider international educational environment for students.

Potential schedule: starting in 2014.

Expected approach and schedule: a team of post-doctoral and doctoral researchers, together with a technical secretariat, with locations in Rio, Lisbon, Luanda amd Maputo. It should start with about 3 to 5 post-doctoral researchers in Brazil and 2 to 3 post-doctoral researchers in Lisbon, together 4 to 5 new students per year (4 to 5 years grants), starting in 2015, with first public announcement late 2014.

2. Advanced Studies Workshops

It considers an annual event, two weeks long, for advanced, on job training, of high-level officials, politicians, university and science and technology leaders from developing countries. It is aimed to guarantee the involvement and networking of recognized competences, bringing together scholars, as well as other experts and politicians from leading universities, intergovernmental organizations and other competence centers worldwide. Practical work will include the identification and discussion of case studies and diversified experiences leading to new opportunities for enterprises, resilient industries and skilled employment and encourage the stakeholders involvement in risk governance practices.

The venue for the Workshops should rotate among main institutions involved.

Potential schedule: starting in July 2014 in Rio de Janeiro.

3. Policy Fellowship Program

It considers a program of fellowships for field work in Brazil and Africa, oriented towards the preparation of policy briefs about selected and specialized themes on new opportunities for enterprises, resilient industries and skilled employment and encourage the stakeholders involvement in risk governance practices.

The ultimate goal is to involve graduate and post-graduate students worldwide in short and medium term research periods (2 to 9 months), with themes and people to be competitively selected at an international level.

The policy briefs will be oriented to form a collection of brief case studies in a variety of themes and regions.

Potential schedule: 4 to 8 graduate students per year (2 to 4 months grants) and 3 to 6 post-graduate students per year (4 to 9 months grants), starting in 2015, with first public announcement late 2014.

4. High level Conferences

It considers the organization of a few high-level conferences over the next years aiming at engaging stakeholders, including policy leaders and corporate managers, along with Universities, research students and policy analysts, to jointly discuss emerging issues in oil and gas development policies.

Expected approach and schedule: 3-5 high level conferences over the next 5 years, starting in October 2014. Potential venues in selected developing countries applying as hosts and co-organizers, as well as in Lisbon, Rio de Janeiro, Luanda, Maputo.

5. Book Series

The goal is to engage experts, scholars and doctoral students worldwide in leading academic and policy research institutions in the preparation of a book series, including a reference guide as a practical critical instrument to assess and steer information on new opportunities for enterprises, resilient industries and skilled employment and encourage the stakeholders involvement in risk governance practices. This book series will include major case studies and should be published in parallel with the new series of S&T policy briefs, described before. It aims at facilitating the building up of coherent strategies towards the inclusive development of science and technology policies in developing countries and regions. The foreseen case studies will consider in-depth analysis of real processes leading to the building up science and technology capacities in those regions.

Expected launching date: three years after official launching of the project

Organization, Steering and Institutional building

Initial Promoters (Details in Annex 2):

- **Manuel Heitor**, IN+/IST, Lisbon (<http://in3.dem.ist.utl.pt/>); IRGC–Portugal (<http://www.irgc-portugal.org/>)
- **Adilson Oliveira**, IE/UFRJ, Rio de Janeiro
- **Elias de Souza**, ANP, Rio de Janeiro
- **Carlos Camerini**, ONIP, Rio de Janeiro
- **Artur Alvaro Pimenta**, Angola Oil Ministry
- **António Caldeira Pires**, Chief Technical Officer, SINTEF Brasil
- **Fernanda Rollo**, IHC-FSCH, UNL
- **Leonardo Mello**, UFRJ, Parque Tecnológico
- **Vladimiro Miranda**, INESC TEC, INESC BRASIL
- **Teresa Simas**, WAVEC, Lisboa

The Board of Directors of the Initiative, with include the promoters and other potential members to be discussed with sponsors and partner institutions. The participation of institutions from Angola and Mozambique is to be confirmed.

Steering (Details in Annex 3):

The initiative aims at creating a Steering Board involving representatives of the participating institutions.

Governance and Secretariat

The Steering Board will advise and oversee the operation of the Board of Directors that will conduct and manage the various activities proposed, together with a professional secretariat lead by an Executive Secretary, assisted by a small expert and technical team, including three post-doctoral researchers and experts.

Institutional building

The sustainable development of the various initiatives proposed here may have to involve forms of organizational and institutional building, involving an independent and nonprofit organization, which should be assessed and discussed with sponsors.

Projected Budget (Details in Annex 4)

Average minimal budget in normal running conditions (from 4th year of operation) is projected to reach about 1090 KEuros/year. The expected budget for the 1st year is of 500k Euros (2014).

Timetable (Details in Annex 5)

A first meeting of the International Steering Board should take place by mid 2014. The Board would then define and approve the Initiative multiannual outline, as well as next year's activities and set external evaluation procedures.

The Secretariat is expected to become operational by March 2014 and to prepare the first meeting of the Steering Board.

Potential Funding Institutions:

- CNPQ, Brasil
- CAPES, Brasil
- FINEP, Brasil
- ANP, Brasil
- Angola Oil Ministry
- Portuguese Science and Technology Foundation, FCT, Portugal

Private Corporations and Institutes:

- Petrobras, Brasil
- GALP Energia, Portugal
- PArtex OIL&Gas, Portugal
- SOnangol, Angola
- ENH, Mozambique
- IRGC, Switzerland
- *Others to be identified*

Annexes

Annex 1: Technical Annex - Research, Innovation and Graduate Education Plan

Annex 2: Promoters (brief biographies)

Annex 3: Proposed initial Steering Board (at launching phase)

Annex 4: Proposed Budget (preliminary)

Annex 5: Proposed Timetable (preliminary)

Annex 1: Technical Annex
(preliminary)

SOUTH OIL&GAS 2030

A web-based Observatory for participatory risk
governance and opportunities for boosting industry

**New innovation dynamics and the sustainable Oil&Gas industries in
South Atlantic and Sub-Saharan Africa**

(Draft for discussion, November 2013)

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1 Summary

This project considers new research and collaboration activities aimed to continuously inform and assist the development of a new web-based Observatory, “**SOUTH Oil&Gas 2030**” to provide information on new opportunities for enterprises, resilient industries and skilled employment and encourage the stakeholders involvement in risk governance practices. A research platform will be set up with academic, regulatory and business partners from Brazil, Portugal, Angola, Mozambique, US and Norway, as a preliminary stage towards desining the *Observatory*. The focus will be on the Brazilian, Angola, Mozambique and Southern European regions to identify industrialization and specialization pathways through comparative studies of knowledge networks, supply chains, and industrial geographies with the north of Europe and the US.

The current context of energy geopolitics is associated with: 1) the recent identification of new and vast hydrocarbons resources in the South Atlantic and Sub-Saharan Africa regions; 2) the technological innovation that led to the rapid increase of unconventional hydrocarbons resources such as shale gas in the USA; and 3) the new patterns of trade likely to result from the expansion of the Panama Canal in 2015.

The proposed *Observatory* aims to identify and analyse the opportunities for the market and regulatory conditions of the Oil&Gas sector in the South Atlantic and Sub-Saharan Africa, adopting new technologies and/or synergies with other industrial sectors, promoting, simultaneously, the sustainable development of the Atlantic and Southern regions. For this purpose, research will be oriented to analyse the emerging opportunities for the sector supply chains, including subsea technologies (e.g. submarine drilling, robotics and processing units), construction of new and specialized platforms and support vessels, as well as strategies to minimize health, safety and environmental risks across all elements of these systems. The analysis will include the development of energy generation networks, integrating (offshore) renewable energy sources in offshore Oil and Gas infrastructures, including subsea energy supply.

In addition to the analysis focused on the Atlantic and southern regions, the work will seek insight from comparative studies of the sector development in other regions in the last decades, especially in the North Sea (i.e., Norway and Scotland), integrating technology innovation and development of related value-chains. The progress of the North Sea Oil and Gas sector in the coming years will be also considered including the potential for the creation and development of new technology-based industries and firms, together with skilled employment. New ways for international companies soft-landing will be studied for generating knowledge flows between these companies. These paths will be explored through the organization of a “**Forum N3: New Businesses, New Technologies and New Job Opportunities for the Oil and Gas Industries**”, to be launched in the beginning of the project and to be continued in the coming years.

Since the development of a given industrial sector is not possible without the key stakeholders’ involvement in the adoption of modern industrialization patterns and

knowledge strategies for development, the roles of emergent stakeholders have on structuring the economy will be examined. Thus, the contact with relevant companies such as oil operators, oil field services, new technology-based industries, technology parks, academic and research units, city councils, industrial organizations, business councils, regulatory agencies, etc., will be stimulated to build a network of key strategic stakeholders in developing regions in the Atlantic coast and East Africa. Close collaboration will be launched with Petrobras in Brazil, Galp Energia and Partex Oil&Gas in Portugal, Sonangol in Angola and ENH in Mozambique and, during the course of the project, this collaboration is expected to evolve with other oil operators and oil field services in the region, including Statoil, Total, Shell, Anadarko, Schlumberger, FMC, Technip, AKER, Teekay/Remora, among others.

The proposed analysis will be strongly associated with the global energy demand forecasts for the developing countries in the regions under study. The current forecasts for energy demand in the developing world may be understated because they do not accurately capture the dramatic increase in demand associated with poverty reduction. Research will be developed to demonstrate better methods for energy demand calculation, which includes an adequate characterization and treatment of the inherent uncertainties. These methodologies will be applied to adjust current projections and use such results to analyse the progress of the energy sector in the proposed regions.

2 Vision and rationale

The identification of vast hydrocarbons resources in the Brazilian pre-salt formation and the technological innovations that led to the rapid increase of shale hydrocarbons resources in the USA are both reshaping energy geopolitics¹. The increase supply of hydrocarbons in the North Atlantic (USA, Canada and potentially Mexico) and in the South Atlantic (Brazil), West Africa (Angola), East Africa (natural gas in Mozambique) and Caribbean's (potentially Venezuela) diminishes the economic risks of the disruptions in the Middle East oil supply for Europe and the Atlantic nations². Once appropriate infrastructure is in place, they also hold the potential to diminish the risks to Europe arising from dependence on Russian gas³.

The effects of this new context are not fully understood and as yet, certainly, poorly measured. Among other issues, the emergence of the area of "digital oil fields" is attracting and increasing attention worldwide in academia and business⁴, with particular relevance to open new frontiers of knowledge for the application of ICT based services and solutions⁵.

In addition, recent data suggest that a process of reindustrialization is emerging in North

¹ Maugeri, L. (2013), "The Shale Oil Boom: A U.S. Phenomenon", Belfer Center for Science and International affairs, Harvard Kennedy School, in June 2013.

² Yergin, D., 2011. *The Quest: Energy, Security, and the Remaking of the Modern World*. Penguin Books.

³ World Bank, 2009. *The Petroleum Sector value chain*, World Bank.

⁴ Fishman, A., 2011. *Petroleum in Brazil: Petrobras, Legislative Changes & the Role of Foreign Investment*, George Washington University.

⁵ IBM, 2004. *Meeting the challenges of today's oil and gas exploration and production industry. Leveraging innovative technology to improve production and lower costs*. IBM Business Consulting Services.

America and that the industrialization process in the South Atlantic is gaining momentum⁶. If this happens, Latin America, Africa and Europe will need to foster a proactive industrial innovation strategy and better use its historical ties to the south Atlantic and the south Indian Ocean. This is because trade among Atlantic nations is likely to take off with obvious impact on Europe, as well as on trade between Pacific and Atlantic nations⁷.

In any circumstance, the hydrocarbons resources of the Portuguese speaking countries will play a significant and growing role in reshaping the geopolitics of energy, with profound implications for Latin America, Europe and Africa⁸. There is a need for technologies and policies to govern the new offshore Oil&Gas fields in such a way as to promote the clean safe and cost effective development of these resources while simultaneously promoting social and economic development across the region. An additional challenge is to help preparing Atlantic nations for the expansion of the Panama Canal (completion expected in 2015) as a result of which sea traffic and major commercial sea routes will be significantly enhanced⁹.

These changes may impact many port zones and technology parks in Latin America (e.g., Rio de Janeiro and Santos in South-eastern Brazil; Bahia, Recife and Pecém in North-eastern Brazil), in Angola and in Mozambique, as well as in Southern Europe (including Sines and Leixões in Portugal, Valencia in South-eastern Spain, Las Palmas in Canarias, Algeciras). There will also be impacts on ports in northern Europe (e.g., Rotterdam, in the Netherlands), promoting entry/exit gates of merchandise, thus leading to develop existing and adding new markets and opportunities for trade, as well as new risks to those regions. It will be essential to develop policies that build on these changes for the creation of new jobs and technology-related industries, as well as the need to tackle technological and systemic risks¹⁰. These include maritime related risks in association with the expected increasing traffic in South Atlantic and the opening of the Panama Canal. But the enormous opportunities for naval and offshore related industries in the coming decades also require attention¹¹.

New industrialization strategies around the South Atlantic and Sub-Saharan Africa is of significant interest to Latin America, Africa, as well as to Southern European and Mediterranean countries, including Portugal, Spain, Algeria, Tunisia and Morocco¹². Literature suggests that the process by which countries or regions can develop and foster their industrial structure in a sustainable and responsible way, is to either explore different

⁶ Hepburn, D., 2011. Mapping the World's Changing Industrial Landscape, *The World's Industrial Transformation Series*, IE WIT BP 2011/01, *Chatham House*, July 2011.

⁷ Hidalgo, C. A., Hausmann, R., 2009. The building blocks of economic complexity, *Proceedings of the National Academy of Sciences of the United States of America*, 106, 26, 10570-10575, 30 June 2009.

⁸ Além, A.C., Giambiagi, F. (org.), 2010. O BNDES em um BRASIL em Transição, *BNDES*, Rio de Janeiro, 2010.

⁹ Rodrigues, J.P. and Notteboom, T. 2010. The Panama Canal expansion: business as usual or game-changer? *Port Technology International*, March, www.porttechnology.org

¹⁰ Dantas, E., Bell, M. 2011. The Co - Evolution of Firm Centered Knowledge Networks and Capabilities in Late Industrializing Countries: The Case of Petrobras in the Offshore Oil Innovation System in Brazil. *World Development*, 39, 9, 1570-1591.

¹¹ Silvestre, B.S., Dalcol, P.R.T., 2009. Geographical proximity and innovation: Evidences from the Campos Basin oil & gas industrial agglomeration—Brazil. *Technovation*, 29, 546-561.

¹² Heitor, M., Bravo, M., 2010. Portugal on the crossroads of change, facing the shock of the new: People, knowledge and ideas fostering the social fabric to facilitate the concentration of knowledge integrated communities, *Technological Forecasting and Social Change*, 77, 218-247.

combinations of the capabilities they already possess, or accumulate new capabilities¹³. Although exogenous shocks may create opportunities to explore different activities¹⁴, endogenous growth is a complex and time consuming process, very much dependent on the structure and level of infrastructures, incentives and institutions, which are particularly affected by existing regulatory frameworks.

3 Strategic plan

The initiative proposed herein is framed by the emerging academic area of “Technology Policy”, combining aspects of “Technica Change and Entrepreneurship”. Overall, it will identify and analyse the opportunities for the market and regulatory conditions of the Oil&Gas sector in the South Atlantic and Sub-Saharan Africa, to foster the adoption and dissemination of potential new technologies or synergies with other industrial sectors. Specifically, the research, education and innovation components of this initiative will be oriented by the following goals:

- **Identification improvement and/or creation of suitable Information and Communication Technologies (ICT)** to the Oil & Gas industry in the South Atlantic and Sub-Saharan Africa (e.g. application of digital oil fields software), covering as well other relevant and related industries which, in collaboration, could mutually benefit from promotion and dissemination;
- **Identification, analysis and promotion of most appropriate existing and new subsea and offshore technologies and processes** e.g. autonomous units of production, with self energy production and distribution systems; technologies for inspection and maintenance of subsea systems; emerging specialized support vessels for oil extraction and offshore platforms; reliable onshore gas exploration processes;
- **Assessment of the sector risk governance**, covering aspects related to the prevention of environmental risks; monitoring and remediation of risks; governing risks and public participation;
- **Analysis and discussion of new opportunities, new businesses, new technologies and new jobs** for the offshore and onshore industries involving the creation and/or amelioration of infrastructures such as ports, technology parks and emerging urban contexts; promoting new technology-based companies in

¹³ Conceição, P., Heitor, M., Veloso, F., 2003. Infrastructures, Incentives and Institutions: fostering distributed knowledge bases for the Learning Society, Technology Forecasting and Social Change, Special Edition.

¹⁴ Amsden, A. H., 2001. The Rise of “the Rest” – Challenges to the West from Late-Industrializing economies, Oxford University Press.

international cooperation; and encouraging the commercialization of science, technology and the incubation of new industries.

These goals will be achieved through the development of several Work Packages (WP) which name, sequence and interdependence as well as link with the three required components, research, education and innovation, are schematically represented in Fig.1.

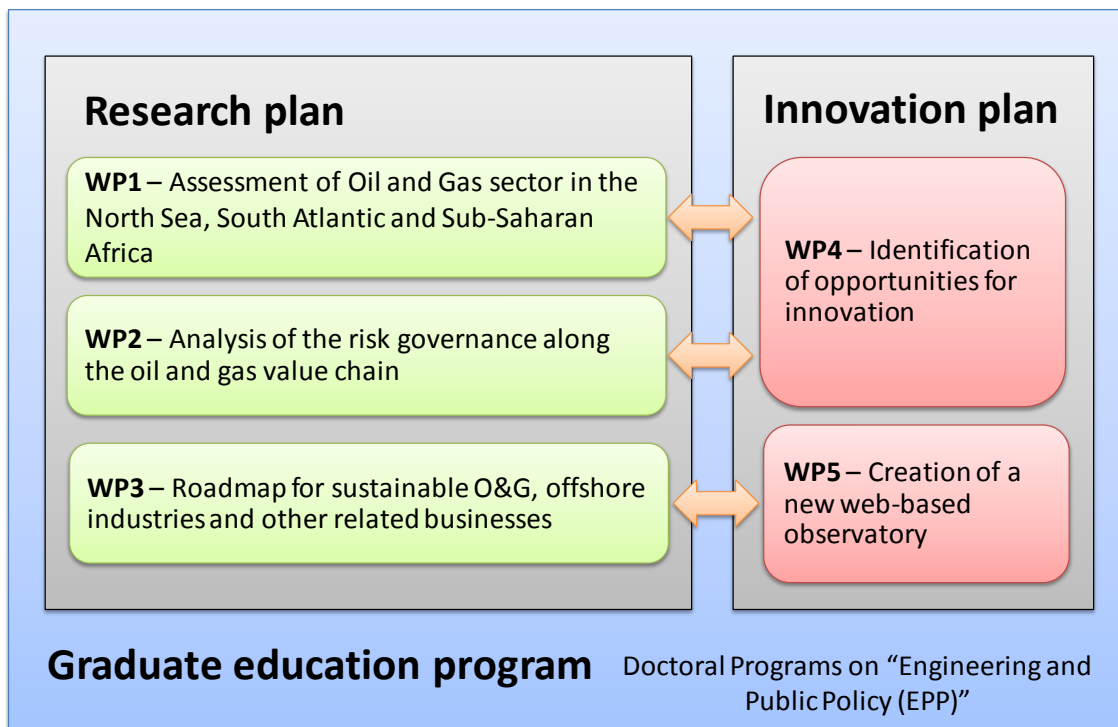


Fig. 1 – Work packages names, sequence and interdependence as well as link with research, education and innovation components.

The research plan will involve three WP where an assessment of the Oil&Gas sector and other related industries will be developed to understand the current state-of-the-art regarding policies, regulatory context, technology, market routes, geographical distribution, infrastructures, risks etc. The main output of the first WP will be a classification of geographic areas according to the Technology Readiness Level together with a review of the regulatory and policy context and a governance risk assessment. The research plan will ultimately include the production of a roadmap for sustainable Oil&Gas sector and other related industries and businesses in the South Atlantic and Sub-Saharan Africa.

The Innovation program will be transversal to the research plan informing and being informed by the research plan outputs. The innovation program consists of two main WPs where the opportunities for creating innovation products, enterprises and industries will be identified supporting the design of a web-based Observatory, which will be developed in parallel.

The graduate education program will be the vehicle of the research and innovation programs through the strategic use of professional master and doctoral education programs already in place in the partner Portuguese universities (IST, Lisbon and FEUP, Porto; including dual degree programs with Carnegie Mellon University in the USA) and at UFRJ (including the PPED program of the Institute of Economy and COPPE), PUC-Rio, USP and UNICAMP. A detailed description of each WP together with the indicators to measure their progress and impact are presented in the sections below.

3.1 Research plan

3.1.1 Strategic research plan

The collaborative initiative proposed herein will plan, design and forecast the deployment of strategies to develop technologies and processes for industrialization strategies in the Oil&Gas sector. It will also consider how best to ensure undisrupted navigation in the South Atlantic. Major stakeholders worldwide will be identified, together with a range of scenarios for their engagement in the process of developing new routes in the south Atlantic/ Sub-Saharan Africa region, and new industries in Europe, especially in Southern Europe.

One element of the project's work on regulatory frameworks will follow a comparative analysis at the international level, including comparative assessments between Norway, Brazil and central Europe, in a way to foster and stimulate new forecasts for future smart specialization and related regulations.

3.1.2 Detailed research plan

WP1 – Assessment of the sector in the North Sea, South Atlantic and Sub-Saharan Africa

A characterization of the dynamics of offshore related industries in the last 40 years will be carried out for major EU zones, with emphasis on the North Sea and related industrial development of Norway. The goal is to derive lessons learned to guide prospective studies oriented towards a potential new centrality for the south Atlantic. The work carried out in WP1 will also consider the current situation regarding main infrastructures in South Atlantic and East Africa regions such as major ports and technology/business parks. These are characterized by a few large industrial plants and infrastructures, most of them not contributing for endogenous growth of those regions and, in many cases, having major impact on carbon emissions, as well as on environmental preservation. However, they are still potential sources of short term economic development and thus a trade-off between these two factors is expected.

Using life-cycle assessment and possibly a general equilibrium model, an assessment will be conducted to describe both direct and indirect impacts associated with the development of oil and gas in the proposed regions. Indirect environmental impacts would be high compared to the direct: for example, if shipping is increased, there will be an increase in emissions associated increased traffic in north south shipping lanes. These shipping lanes can be identified now in heat maps of methane emissions.

Natural gas and oil developments in the regions will be heavily impacted by other world energy developments and trends, materials costs, and costs of competing energy sources and technologies, and thus cannot be considered in isolation. We propose to assess those linkages using influence diagrams which will be discussed with the industrial players and governmental agencies, and other relevant stakeholder participating in this proposal

WP1 consists of three main tasks which are described below.

Task 1.1 – Characterisation of macro-level geographies

In this task a characterisation will be carried out of the macro-level geographies to review the historical evolution of the Oil and Gas industry, science and technology capacity, knowledge base, employment, supply chain, qualifications and skills, economic performance, trade flows and social well-being. The analysis will encompass:

1. The evolution of the industrial base, supply chains, trade flows, knowledge base, skills and requirements for training, framing whenever possible Portugal in the global context;
2. Integration of SME and technology-based start-ups in the supply chains and knowledge networks;
3. The role of different industrial sectors in different periods and regions, and why ones have succeeded and prevailed while others have failed;
4. The impact of major events and political options;
5. The role of other geopolitical and geostrategic options and determinants in industrialisation processes, framed in the context of the global political power balances and handovers;
6. The role of natural resources in industrial and socioeconomic development, in line also with the “resource curse” vs. “resource blessing” discussions.

This analytical framework will analyse firms and industries in order to capture the complexities of industrial development and competitive profile to understand the main variables that have influenced the current geographies of the Oil&Gas industry, innovation and knowledge. Based on the results obtained, the analysis will continue to understand the current supply chains, their competitive profile and evolution, and their impact on the

socioeconomic framework, globally and locally. This new methodology require to go beyond the existing approach for analysis that is currently based in codes of economic activities, such as the NACE codes (similar to Portuguese CAE) and also beyond the ones developed by Pavitt, which classify industries based on technology. It will consider the available macro and micro data on industrial sectors and firms regarding technology and knowledge bases, outputs and markets, trade flows and employment. Research will depart from the analysis of available data from existing databases. The final output of this investigation will be the understanding of the evolution of the Oil and Gas sector in major regional blocks through the characterisation of the dynamic system industry-region-knowledge-people.

Important factors to foster local sustainable and endogenous growth through manufacturing industries include access to low-cost and/or high-skill labour, proximity to demand, efficient transportation and logistics infrastructure, availability of inputs such as natural resources or energy and proximity to centres of science and education. The main ports and other related facilities such as industrial parks and research centres will be listed, characterised and compared in order to identify main infrastructure barriers and accelerators to the development of the Oil&Gas sector in the Atlantic. Examples of such facilities shall include the South European ports infrastructures in Sines, Portugal, Valencia, Algeciras and Las Palmas in Canarias, Spain, as well as the ports in Rio de Janeiro and Santos in South-eastern Brazil, Bahia and Pecém in North-eastern Brazil. Since labour skills are paramount to ensure the sustainable endogenous growth of the regions considered, this factor will also be included in the analysis. The characterisation of the industrial evolution in major port zones, as induced by a potential new centrality for the south Atlantic and South Indian Ocean, will be carried out considering the expected trade-offs, to forecast the overall sector development.

A complementary goal in this task will be to develop refined data products (e.g. geo-referenced maps and spatial analysis of data sets) to facilitate the interpretation of the analysis mentioned above and to share it with a wider audience. Such products will feed the development of a web-based visualisation tool which is intended to be an Information and Communication Technology (ICT) to be conceptualised and designed in the innovation plan of this ERI (see WP4 description).

Task 1.2 – Characterisation of regional geographies

This task will focus on comparative analyses of selected regions with comparable sizes, namely regions that host around 10 to 15 million inhabitants. The initial part of the regional analysis will replicate the one performed on macro-regions to assess derogations from the average that can provide additional insights on the weight of different variables and location-related issues. The comparative study of industrial evolution and accumulation of scientific and technological skills in selected regions will include:

- Evolution of economic activity in each sector in different regions;
- Diversification and complexity of industry in different regions;

- The interactions within regions (between different industrial sectors) and of the regions within its surroundings through trade and people flows;
- The geography and dynamics of economic development and specialization – how scientific, technological and industrial bases have evolved and impacted socioeconomic development;
- Knowledge spill over between industries and regions, based on knowledge networks;
- Human capital specialisation of the industry in different regions;
- The structure, geography and dynamics of supply chains and knowledge networks in different sectors and markets;
- Availability and management of natural resources;
- Public policies to foster local industrialization processes, namely through supporting firms and the creation of new technology based start-ups, promoting research and innovation, structuring public investment and intensify international trade (e.g. public procurement, local production agreements, public expenditure in R&D and training).
- Deindustrialisation processes, characterising them and identifying, analysing and governing related risks.

It is expected from this analysis:

- The characterisation of deindustrialisation risks and their impact on regional economic competitiveness, human capital and social well-being;
- The characterisation of how Oil and Gas industrialisation can foster socioeconomic resilience in different regions;
- Mapping of regional geographies of Oil and Gas knowledge, innovation and production in the Atlantic;
- The understanding of the effectiveness and efficiency of different policies to foster industrialisation processes.

The task will encompass a comparative analysis of regions that were the traditional industrial powers, distinguishing between the ones that have continued to invest towards having a manufacturing industry and the others; the ones that have emerged as world-class competitors in the last decades and regions that can host new dynamics of innovation and leverage industrialisation strategies in the future. Work in this task will be based in the analysis of existing data and on missions to selected regions to collect data from primary sources and build databases for analysis.

As in Task 1.1, refined data products will be produced to facilitate the interpretation of this analysis and to share it with a wider audience. Such products will also feed the development of a web-based visualisation tool to be conceptualised and designed under the innovation plan (see WP5 description).

Task 1.3 – Characterisation of industrial geographies

In parallel to the regional characterisation of industrialisation processes and the impacts of local policies in fostering them, it is necessary to look at the same problem from the perspective of industries and firms in the Oil&Gas sector that, on the one hand, are not bounded to a certain region but have their performance strongly dependent on the regions where they are located. We will target Oil&Gas sectors that are complex in nature namely due to having one or more of the following characteristics:

- Have global supply chains, allowing for a comparative analysis between regions, highlighting the competition among them be involved in the sector;
- Are strongly dependent on political options;
- Are capital intensive, requiring public and private sources of funding;
- Involve extremely complex engineering systems that integrate state-of-the-art technology and require highly qualified workforces; or
- Are strongly dependent on natural resources.

This work will be based on the study of cases and leverage on existing collaborations with researchers looking to these processes at firm-level, on collaborations with universities and research centres in other European countries, Brazil and the US, as well as with world renowned companies in oil exploration such as Petrobras.

As in Task 1.1, refined data products will be produced to facilitate the interpretation of this analysis and to share it with a wider audience. Such products will also feed the development of a web-based visualisation tool to be conceptualised and designed under the innovation plan (see WP5 description).

Indicators of WP1 progress and impact

The indicator of the good progress in WP1 will be the production reports on the characterisation of the Oil&Gas sector by macro-level and regional geographies considering Technology Readiness Level (TLR). In these reports a classification of systems and subsystems in the Oil&Gas and related sectors will be proposed in relation to their complexity, interdisciplinary, technological risks, required infra-structure, etc. Similarly a classification of the regions will be proposed in relation to the available infra-structures in the region, the level of technology available, the type and number of qualified man-power,

the investment in R&D and quality of R&D institutions, etc. These classifications can be seen as generalized versions of NASA's Technology Readiness Levels, respectively for the Oil&Gas systems and subsystems and the regions. A matrix with these classifications is expected to identify which systems and subsystems can be developed in the different regions according to their technological and scientific robustness and is expected to guide governments in defining their technology roadmaps and companies in identifying their supply chain.

In addition, it is expected that research papers will be submitted to peer-reviewed journals from the end of the second year the initiative.

WP2 – Analysis of the risk governance along the Oil&Gas value chains

Complex sectors of activity, such as the energy or gas, have very complex supply and value chains, with very specific hierarchies. The globalisation of trade and supply chains led to the emergence of increasingly competitive global markets and to facilitated access to new suppliers, independently of their geographic location. Such globalisation involves systemic risks, dependent on global trends and evolution, major global events, variables that shape the geographies of the industry and innovation and socio-economic impacts. WP2 include the analysis of vulnerability to hazards of natural, technological, human and other origins, as well as opportunities related with the adequate prevention of such hazards.

The findings of this WP will help delineating the participatory risk governance platform to be developed under the Innovation Program of the current ERI in order to promote public and key stakeholders' discussion on the general and specific risks for the sector as well as to improve public awareness about the sector development, technology and progress.

Task 2.1 – South Atlantic and Sub-Saharan Africa value chain characterisation

The Oil&Gas value chain of South Atlantic and East Africa will be characterised through the identification of the main companies which are supplying the plants located in related port zones. This assessment will also include what are being supplied locally and what competences are being planned.

Task 2.2 – Identification of deficits on the potential risk governance

Potential risk governance deficits will be discussed, including insufficient awareness to new threats, unequal organizational capacity, and the difficulty of dealing with dispersed responsibilities among stakeholders with diverging interests.

Indicators of WP2 progress and impact

A series of reports on the risk assessment of the Oil&Gas development in the South Atlantic and Sub-Saharan regions will be produced in the context of this WP. In addition, it is expected that research papers will be submitted to peer-reviewed journals from the end of the second year of the initiative.

WP3 – Roadmap for sustainable, offshore industries and other related businesses

The development of the Oil&Gas sector and market is strongly stimulated by the energy demand. When looked at retrospectively the past performance by national and international organizations and others that have engaged in projecting future energy-related variables (demand, prices, etc.) has been *very poor*. Similarly, methods for forecasting the future evolution of technologies and their likely cost and capabilities have not performed as well as they should. For example, while it has been common to use learning curves that decrease steadily with number of units deployed, retrospective assessment of large process technologies (e.g., as performed by investigators in the Department of Engineering and Public Policy at Carnegie Mellon), have shown costs first rising until the underlying design is perfect which then begins to fall after the technology reaches maturity.

Recent data suggests that a process of reindustrialization is emerging in North America and that the industrialization process in the South Atlantic is gaining momentum. Anyway, Latin America, Africa and Europe need to foster a proactive industrial innovation strategy and better use their Atlantic front. This is because trade among Atlantic nations is likely to take off with obvious impact on Europe, as well as on trade between Pacific and Atlantic nations. The hydrocarbons resources of the Portuguese speaking countries will play a significant role in the reshaping of the geopolitics of energy. The main challenge is to help preparing Latin America and Europe for the expansion of the Panama Canal in 2015 and the new offshore Oil&Gas fields in a way to stimulate new opportunities for industrialization.

WP3 will be completed in two main tasks which will forecast the main possibilities for the development of the Oil&Gas sector integrating other related offshore industries, based on realistic results for technological and energy forecasting.

Task 3.1 – Technological and energy forecasting for energy networks

There is a large untapped demand for end-uses of electricity, heating, and for transportation in most African countries. For example, Nigeria's current electricity consumption today is about 11GW in 2010, but unmet demand by 2030 is expected to be about 200GW. In

addition to a large growth in demand, this growth is highly uncertain in magnitude. Using expert elicitations, scenario modelling, and historical regression analysis, among other, a tool will be developed to forecast demand and characterize its uncertainty between 2013 and 2030 which will be fed as input in other work packages. This key methodological contribution will involve the development and demonstration of improved methods for projecting energy-related variables and forecasting the likely future cost and performance of key energy-related technologies. This work will build on the very considerable background and interest in these issues that have been developed by the Department of Engineering and Public Policy at Carnegie Mellon over the course of the past several years.

Task 3.2 – Technological and energy roadmap

The main output of this WP will be a roadmap that will provide practical, independent and objective analysis of pathways to achieve the sustainable development of the South Atlantic and Sub-Saharan Africa Oil&Gas, including the prospects of other related offshore industries and businesses. The roadmap will be based on the findings and conclusions achieved in Tasks 1.1, 1.2 and 3.1.

Indicators of WP3 progress and impact

A series of reports will be produced during the course of WP3. The first one (D3.1) will present a review of the methods for energy demand calculation. A second report (D3.2) will describe and a new methodology to calculate energy demand and will present the results of its application. The third report on the Oil&Gas roadmap for the South Atlantic and Sub-Saharan regions, will be produced based on the projections obtained in the application of the new methodology for energy demand calculation.

In addition, it is expected that research papers will be submitted to peer-reviewed journals from the end of the second year the initiative.

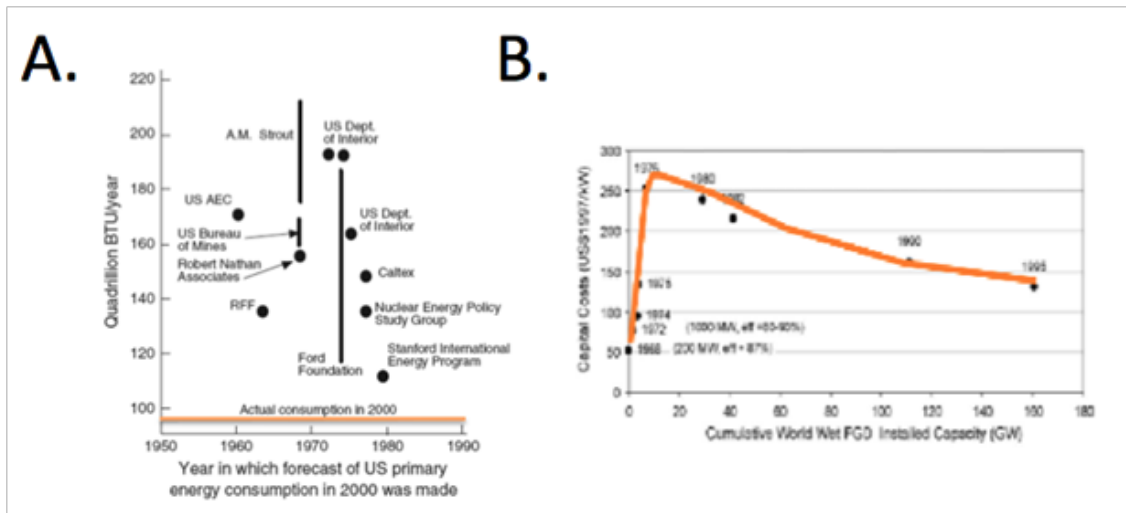


Fig. 2 – A. Comparison of how US energy forecasts for the year 2000 have compared with actual demand (orange line at bottom); redrawn from Smil; B. Example of cost over time of SO_x control Technologies; redrawn from Rubin.

3.2 Innovation program

The innovation program consists of two WP which will be supported and informed by the research activities carried out during the research program (WP1, WP2 and WP3). The focus will be on the identification of opportunities for new businesses, new technologies and new jobs for the Oil and Gas Industries through engagement activities with the main stakeholders of the sector including oil operators, oil field services, new technology-based industries, technology parks, academic and research units, city councils, industrial organizations, business councils, regulatory agencies, etc. A web-based Observatory will be designed to accommodate information on research findings (e.g. geo-referenced maps, spatial analysis of datasets) and promote participatory risk governance.

WP4 – Identification of opportunities for innovation

The main goal of this WP is to identify routes for benefitting from the development and accumulation of academic, scientific and technological capabilities to foster sustainable economic development in South Atlantic and Sub-Saharan Africa through new industrialization patterns and creation of new opportunities for enterprises, resilient industries and skilled employment. The focus will be on the role new technology-based industries and firms have on the economy with an emphasis on the emerging industrial opportunities and systemic risks in the Atlantic and Sub-Saharan regions. Factors such as the expansion of the Panama Canal in 2015 and the increasingly importance of new oil sources in the coast of Brazil will drive the analysis in order to understand the development of offshore and subsea related innovation dynamics e.g. in the vicinity of Rio de Janeiro in the coming decades.

The analysis of the Oil sector is proposed to be performed through the interaction with Petrobras in Brazil and Galp Energia in Portugal, among other oil operators and oil field services in the region (including StatOil, BG, Schlumberger, FMC, Baker Hughes, Halliburton). The scope of the opportunities emerging with the recent discovery of new reservoirs in the South Atlantic will be considered since they can foster the establishment of new industries in Brazil, having in mind future explorations in the African coasts of South Atlantic and in the North Atlantic, as well as related impact in Southern Europe.

Task 4.1 – Analysis of the technological innovation trends for sustainable O&G growth

The analysis of new opportunities for innovation in Oil&Gas industry in the South Atlantic and Sub-Saharan Africa will follow four main streams presented in Table 1. For each one of these innovation streams, technology and product innovation focus have been already identified and these will be reviewed to identify and list market solutions already in place or being developed.

Task 4.2 – Identification of new businesses new technologies and new jobs for O&G

New ways for international companies soft-landing will be studied for generating knowledge flows between companies. These paths will be explored through the organization of a **“Forum N3: New Businesses, New Technologies and New Job Opportunities for the Oil and Gas Industries”**, to be launched in the beginning of the project and to be continued in the coming years. The forum will be composed of representatives of the main key stakeholders involved in the development of the Oil&Gas sector of South Atlantic and Sub-Saharan Africa as well as other representatives from related stakeholders. One workshop will be organised during the course of the project to present project results and discuss new opportunities for the sector. The conclusions and material coming from the forum activity will feed the web-based observatory development described in WP5.

Indicators of WP4 progress and impact

The progress and impact of WP4 will be measured through the accomplishment of the implementation of “Forum N3: New Businesses, New Technologies and New Job Opportunities for the Oil and Gas Industries” in terms of number and type of participants in the web-based platform (WP5) and participating in the workshop organised during the course of the initiative. The first workshop was held in Porto, in October 2013, under the XV Conference on Latin Ibero-American Management of Technology - ALTEC 2013, which represented an unprecedented event in Portugal (in the city of Porto at the end of October

in 2013; <http://www.altec2013.org/>). Other workshops will be organised in the years to come to discuss with relevant stakeholders from the South Atlantic and Sub-Saharan Africa the technology innovation and infrastructures and new opportunities for businesses, education and qualified employment.

A serie of reports on opportunities for innovation will be produced under the scope of WP4 timeline. In addition, it is expected that research papers will be submitted to peer-reviewed journals from the end of the second year the initiative.

Table 1 – Main streams for the analysis of technological innovation trends and product innovation focus.

Innovation streams	Technology and Product Innovation Focus
Environmentally Friendly & advanced Drilling, increased oil recovery and clean production	<ul style="list-style-type: none"> • Advanced and environmentally friendly subsea and sub-surface solutions • Prevention of mud spills to sea • Centralized network of cleaning units • Waste management systems • Clean design engines with low NOx emissions
Zero Discharge Concept on FPSOs	<ul style="list-style-type: none"> • Reduced Energy Consumption and Minimization of Emissions to Air in Oil Production • Zero harmful discharge to sea: produced water injection, drainage handling, use of green chemicals, waste handling system, sewage treatment, closed flare, low NOx turbines, VOC recovery systems, Energy efficient solutions, environmentally friendly ships
Oil Spills Preparedness and Clean-ups	<ul style="list-style-type: none"> • Advanced sea-going recovery systems with access to dispersion resources • Remote measurement technologies • Coastal and shoreline preparedness
Digital Oil Fields	<ul style="list-style-type: none"> • Software and applications that can help to increase production rate and recovery, ensure precise wellbore placement, reduce total cost of ownership, anticipate problems and optimize decisions

WP5 - Creation of a new web-based Observatory

A web-based Observatory – **SOUTH Oil&Gas 2030** – for participatory risk governance and opportunities mapping will be conceptualised and designed to enable the analysis of the evolution of systemic risks, together with the geographies of industry, innovation, science and competencies/human capital with relevance for south Atlantic and Sub-Saharan Africa and with emphasis on Oil&Gas industries.

Through the use of geo-referenced data, innovation and industrial trends and their relations with the evolution in the geographies of knowledge and its flows, will be visualised at three different levels:

1. **Macro-level geographies**, to characterise the dynamics, relations and geographies of the system industry-innovation-knowledge-people, stressing the way distance interacts with economies of scale to drive competitiveness.
2. **Regional geographies**, for comparative analysis on the evolution of industrial innovation, diversification and complexity, trade and knowledge flows between regions and sectors, and existing public policies.
3. **Industrial geographies**, for encompassing the specificities of different industrial sectors and how they are affected by relative globalisation, capital intensity, technological dependence, resource base and also by the role of user-innovation.

This tool is also intended to play a visible role in emerging systemic risks in the South and a better understanding of the role of science and technology and innovation in related processes. This will contribute towards facilitating public discussion – and therefore democratising – these issues. Other related initiatives, listed in Table 2, will be considered during the course of the web-based Observatory development. The findings of the Research Plan (WP1, WP2 and WP3) as well as the work with stakeholders carried out during the N3 Forum will be the background of the proposed web-based Observatory development.

Table 2 – Web-based Observatory related initiatives.

Name	Description	Website
Observatory of Economic Complexity"	A joint initiative of a few research groups at Harvard and Massachusetts Institute of Technology	http://atlas.media.mit.edu
Science of Science Cyber-infrastructure	Indiana University's cyber-infrastructure	http://sci.cns.iu.edu
Places & Spaces: Mapping Science	Supported by the US NSF, the Indiana University, Thomson Reuters, Elsevier and others	http://scimaps.org
Atlas of Science	Published by the Massachusetts Institute of Technology	https://mitpress.mit.edu/books/atlas-science

Indicators of WP5 progress and impact

The Web-based Observatory will be the main output of WP5. A preliminary version of this virtual platform will be launch by the end of the second year of the project and constantly improved and updated with the findings and stakeholders / public inputs during the course of the project. The impact of the Observatory will be accomplished through the number of visitors and participants in web based forums that will be created.

3.3 Graduate education plan

3.3.1 Existing graduate education programs

The existing Post-Graduate and Doctoral Programs on “**Engineering and Public Policy (EPP)**” at IST-Lisbon (Technical University of Lisbon) and at FEUP (School of Engineering, University of Porto), allowing for a double-degree between the Portuguese Schools and Carnegie Mellon University in Pittsburgh, USA, together with the existing Post-Graduate Program on “**Public Policies, Strategies and Development (PPED)**”, at UFRJ in Rio de Janeiro, and will act as the main “vehicle” to foster doctoral research in the areas of this initiative. These programs all focus on problems in science, technology and public policy in which the interaction of technology, humans and institutions are of central importance and should not be ignored. The programs address unstructured and complex problems that are best tackled by combining fundamental and applied knowledge from various traditional research fields using multidisciplinary research mechanisms and tools.

The Post-Graduate Program in Rio de Janeiro on Public Policies, Strategies and Development, PPED will be an adequate vehicle of cooperation since it considers innovative strategies of social actors and firms in the context of the transformation of the role of public policies and intends to contribute to the renewal of the public action committed to development. The Program aims to qualify the members/students not only for the identification of priorities, gaps and possibilities of action in public policies, but also to effectively qualify them for strategic decision-making processes and action directed to institutional change and development issues. It is anchored in the interdisciplinary area of CAPES (Coordination for Qualifying of Graduate Personnel), in the Department of Human and Social Sciences (CAInter II).

The two Post Graduate Programs (EPP and PPED) provide a unique interdisciplinary and inter-institutional framework together with collaborative ties among a group of professors from different academic backgrounds. These programs also aggregate a combination of knowledge fields from Engineering, Economics, Political, Human and Applied Social Sciences, Law, History and Geography. Due to their characteristics, the two Programs make use of both qualitative and quantitative research methods, as to transpose the barriers of compartmented knowledge, as well as to foster a broad circulation of ideas, students and professors. They are intended to broaden the dialogue between teaching and research committed to reflection on: 1) development in different countries and continents; 2) governance and varieties of capitalism and regulatory approaches; 3) compared state capacities; 4) innovation, science and technology policies; 5) firm’s strategies, and 6) intellectual property rights under a perspective of an innovation and sustainable development agenda.

3.3.2 Desired characteristics of new graduates

This initiative focuses on problems in science, technology and public policy in which the interaction of technology, humans and institutions play are of central importance. It addresses unstructured and complex problems that are best tackled by combining fundamental and applied knowledge from various traditional research fields using multidisciplinary research mechanisms and tools.

We propose to focus on the idea of technical change and its implication for sustainable development, with a specific application for Oil&Gas sector and related applications for policy, risk governance and industry. Engineering and other scientific disciplines have contributed dramatically to technical change but the issue has been studied extensively mainly by economists. Thus, the study of technical change departing from an understanding of the technology is still largely missing. Engineers and scientists who develop new technologies understand specific technologies, but often have no interest in exploring their economic and social implications. This raises the need for them to understand technical change (and, therefore, innovation) departing from an understanding of specific technologies, and drawing from the conceptual framework of the interactive models of technical change.

The challenge is to establish “technology and policy” as a field of study that focuses on complex engineering systems and products, viewing those systems and products in their broad social and industrial context. This requires faculty from engineering, management, and the social sciences committed to integrative, interdisciplinary engineering systems and policy programs.

The following specific focal themes for advanced doctoral studies are suggested:

- Industrialization, geography and policy: It is important to develop new competencies, at a post-graduation level, on industrial policy and complement generic research on how technical change contributes to productivity together with job creation, with specific analyses of new and advanced manufacturing technologies at the firm and sectorial level. Attention should be focused on knowledge flows along the value chains of oil & gas, together with the necessary competences and capacities to devise policies to promote a sustainable future. It will include analysis of “technology infrastructures”, consisting of science, engineering, and technical knowledge available to industry.
- Networked and critical infrastructures, by extending methods developed in the context of more conventional disciplinary problems to issues of both technology and policy, with emphasis on energy systems and their integration with information and communication technologies, giving priority to the integration of renewables in the energy network.

- Knowledge for development: the idea that investments in S&T can, rather than a cost for governments, be a driver of productivity and innovation in developing societies is now a well-established hypothesis, but lacking empirical testing. Thus, it is important to invest in new competences enabling us to improve our understanding of the mechanisms through which investments in S&T lead to modern societies in developing regions and to help training a new generation of technology and policy leaders for those regions.
- Risk governance: Analysis of emerging and systemic risks, facilitating societies to benefit from technical change, while minimizing the negative consequences of associated risks. The focus is on technological risks, as analysed together with major societal risks. The ultimate goal is to help designing engineering practices to deal with uncertainty (i.e., “design for uncertainty”), including industrialization strategies that consider major opportunities associated with the need to mitigate energy and environment related risks, as well as emerging risks in association with urban concentrations. This includes the discussion of stakeholder engagement processes to help communicating emerging risks and to foster their mitigation.
- Regulation and policies towards emerging forms of technological innovation, with emphasis on adaptive regulatory frameworks and including the analysis of new convergence paradigms among health sciences, physical sciences and engineering (i.e., with particular application in bioengineering).

The ultimate goal is to help training the future generations of science and technology policy leaders with relevance for Oil&Gas sector. This requires adding a social science dimension to the engineering and technological skills in order to address unstructured and complex problems that can only be tackled by combining fundamental and applied knowledge from different traditional research fields, using multidisciplinary research techniques and tools.

3.3.3 Activities to impart desired characteristics in the students

The education process to be developed in the area of “engineering and public policy” considers:

- Scope: policy versus management – complementary and different
- Method: the need to go beyond the narrow technocentric and cognitive-engineering approaches to system design, and to consider intuition, subjective judgement and tacit knowledge, together with a scientific methodology:
- Formulating a research question;

- Defining a research hypothesis;
- Selecting and designing the method of analysis, either qualitative or quantitative;
- Presenting the results: facts, analysis, hypothesis

And (eventually):

- Scenario planning and assessment
- Designing and assessing policies

Practical actions for the international consortia formed beyond the practical implementation of degree programs, includes:

Level 1:

- A research-based consortium with international reputation and institutionally independent, to help consolidating an emerging engineering discipline in the various institutions, namely through:
 - Workshops, and high level conferences
 - Setting international terms of reference and formulation of reference guidelines: Competences for technology policy makers; Competences for managers of technology; Overall thesis requirements.

Level 2:

- Exchange of experiences and mutual learning
- Promoting mobility of students and teachers and long distance education
- Promoting joint curricula development
- Developing internationally-relevant case studies involving technology, policy and management
- Fostering joint publications
- Promoting joint policy research fellowships
- Developing an annual “Doctoral Consortium” with a strong international flavour, in the form of a one-week doctoral school

Level 3:

- Promoting a global research agenda on technology policy and management of science and technology, including issues of intellectual property and competition, as well as the sustainable funding of science, technology and innovation in society.

The ultimate goal is to foster a consortium of post-graduation degree programs and research activities linking:

- People, by fostering Tools for Understanding: developing human resources and promoting the generation and growth of international networks of experts, enhancing mobility of people;
- Knowledge, by developing Understanding for Action: conducting leading-edge, high quality research in collaboration with leading world groups and institutions;
- Ideas, by promoting Action for Results: engaging in specific, results-oriented initiatives, leading to meaningful improvements of internationally relevant topics, through funding new ideas.

This approach questions the traditional way of viewing economic development and argues for the need to promote systems of innovation and competence building based on learning and knowledge networks. Thus, the object of the materials to be taught and considered will be based on complex and diversified systems of practical relevance, involving technical aspects and/or determined by technical change, and associated to non-structured problems, and the focus on the level of complexity will be on technical systems with human and institutional interaction, driven by mutual interaction and learning, and affected by collective efficiency.

Annex 2: Promoters (brief biographies)

Manuel Heitor, IN+/IST, Lisbon

Manuel Heitor is Full Professor at Instituto Superior Técnico, IST, the engineering school of the Technical University of Lisbon, www.ist.utl.pt. From March 2005 to June 2011 he served as Secretary of State for Science, Technology and Higher Education in the Government of Portugal. Most recently, in the 2011-12 academic year he was a Visiting Scholar at Harvard University's Graduate School of Design and in the Science, Technology and Public Policy Program at the Harvard's Kennedy School.

He earned a PhD at Imperial College, London, in 1985 in combustion research and did post-doctoral training at the University of California San Diego. Then, he pursued an academic career at IST, in Lisbon, where he served as Deputy-President for the period 1993-1998. Since 1995, he has been Research Fellow of the IC2 Institute, Innovation, Creativity and Capital, the University of Texas at Austin. His research work includes publications in the area of higher education policy, management of technology and the development of science, technology and innovation policies. He is co-editor of the book series on "Technology Policy and Innovation", launched through Greenwood Publishers, Connecticut and continued through Purdue University Press.

He was the founding director of the IST's "Center for Innovation, Technology and Policy Research", which was awarded in 2005 by the International Association of Management of Technology, IAMOT, has one of the top 50 global centres of research on "Management of Technology". In 2003 he was awarded with the Dibner Award of the Society for the History of Technology, SHOT. He was co-founder in 2002 of "Globelics - the global network for the economics of learning, innovation, and competence building systems". He is a founding member of the Science and Technology Council of the "International Risk Governance Council", IRGC. He is currently a member of the Advisory Board of the Council of the University of Macau, China.

While in the Government of Portugal, Manuel Heitor was successfully involved in attracting public and private investment on R&D, strengthening the research landscape of the country and in the reform and modernization of higher education. He was particularly instrumental in conceiving, implementing, and building up international consortia in research and advanced training with leading American universities, encompassing industry-science relationships and technology commercialization activities.

Adilson Oliveira, IE/UFRJ, Rio de Janeiro

Possui graduação em Engenharia Química pela Universidade de São Paulo(1969), doutorado em Economia do Desenvolvimento pela Université de Grenoble(1977) e pós-doutorado pela University Of Sussex(1988). Atualmente é professor titular da Universidade Federal do Rio de Janeiro. Tem experiência na área de Economia, com ênfase em Economia Industrial.

Elias de Souza, ANP, Rio de Janeiro

Superintendente de Pesquisa e Desenvolvimento Tecnológico na Agência Nacional do Petróleo, Gás Natural e Biocombustíveis. Professor Convidado no Instituto Federal de Educação Ciência e Tecnologia da Bahia, IFBA.

Carlos Camerini, ONIP, Rio de Janeiro

Superintendente da Organização Nacional das Industrias de Petróleo, no Brazil.

Artur Pimenta Alves, Angola Oil Ministry

Outros Promotores:

António Caldeira Pires, Chief Technical Officer, SINTEF Brasil

Fernanda Rollo, IHC-FSCH, UNL

Leonardo Mello, UFRJ, Parque Tecnológico

Vladimiro Miranda, INESC TEC, INESC BRASIL

Teresa Simas, WAVEC, Lisboa

Annex 3: Proposed initial Steering Board (preliminary)

The proposed initial Steering Board is foreseen to include representatives of partner Institutions, whose agreement to participate has been already personally confirmed to the promoters. Designation of representatives to the first meeting of the Steering Board will be asked for in a formal letter of invitation to be addressed to the top leadership of the founding institutions.

Below is the list of preliminary contacts already established during the workshop organized in Porto by the end of October 2013.

- Alfredo Renault, ONIP, Brasil
- Aleksandar Jovanovic, EU-VRi / Steinbeis Advanced Risk technologies Group, DE
- António Costa e Silva, Partex Oil & Gas, Portugal
- António Sarmiento, WavEC-Centro da Energia das Ondas, Portugal
- Carlos Costa Pina, GALP Energia, Portugal
- Eloy Fernandez y Fernandez, ONIP, Brasil
- Fernando Roberto, Sonangol, Angola
- Franz Josef Kaltner, LUSOTECHNIP, Portugal
- Guilherme Sales Melo, Diretor, Engenharias, Ciências Exatas, Humanas e Sociais, CNPq, Brasil
- Granger Morgan, Carnegie Mellon University, USA
- Jean Pierre Contzen, belgian Academy of Sciences, Von Karman Institute, Belgium
- Jose Manuel Mendonça, Presidente, INESC TEC, Portugal
- Júlia Dias, National Hydrocarbon Enterprise, ENH, Mozambique
- Luís Guerreiro, Partex Oil& Gas, Portugal
- Manuel Cruz, ISQ, Portugal
- Manuel Ferreira De Oliveira, GALP Energia, Portugal
- Marcus Assayag, CENPES - Petrobras, Brasil
- Mario Fernandes Biague, UNILAB, Brasil
- Matthias Flinger, EPFL, Swiss
- Maurico Guedes, UFRJ, Parque Tecnológico, Brasil
- Nelson Ocuane, ENH, Mozambique
- Ortwin Renn, Stuttgart University, D
- Renata Lebré La Rovere, UFRJ, Brasil

Annex 4: Proposed Budget (preliminary)

Average budget (years 4 and 5)

Item	Observations	K Euros
7. Technical and Research Team	Six post-doctoral researchers Two Web designers and a technical assistant	500
1. Intl. Steering Committee	Annual meeting: 6 trips from US (2500€ each) 6 trips in EU (1500€ each)	25
2. Advanced Study Workshops (annual)	Annual meeting: 20 participants 10 fellowships: travels and accommodation (4000€ each) 5 lecturers (45000€) Proceedings (15000€)	100
3. Policy Fellowships	4 to 8 graduate students per year (2 to 4 months grants; 8000€ each) 3 to 6 post-graduate students per year (4 to 6 months grants; 15000€ each)	140
4. PhD Fellowships	3 new students each year (4 years grants) average size of program after 4 years: 12 students average fees/student: 3000€/year annual PhD grant: 20k€	240
8. Directorate and Secretariat	Considers Executive Secretary and one Assistant, together with travel expenses of Directorate	85
Total		1090

Based on the figures above, the expected budgets for the initial years are as follows:

1st year (2014): 500 k€

2nd year (2015): 650k€

3rd year (2016): 780k€

Annex 5: Proposed Timetable – preliminary plan for initial 18 months

2013:

- Initial Workshops: Porto, 29-30 October 2013
- Discussion of launching and installation phases
- Discussion of Governance model with partner institutions

2014:

January - June 2014:

- Publication of call for applications for Executive Team (two post-doctoral researchers)
- Publication of call for applications: Policy fellowship program
- Publication of call for applications: PhD program
- Hiring of Executive Team (two post-doctoral researchers)
- Hiring of Executive Secretary and Installation of Secretariat
- Publication of call for applications: 1st Advanced Study Workshop (2014)
- 1st meeting of the Steering Committee (1st week of December; Venue to be decided)

July - December 2014:

- 1st Advanced Study Workshop
- Implementation of Policy Fellowships 2014
- Starting of PhD Fellowships 2014
- Publication of initial set of Policy Briefs
- High level Conference (2014)