



Recife,
November 27, 2013

GDF SUEZ

BY PEOPLE FOR PEOPLE

Main prerequisites when considering an investment in nuclear new build

International Nuclear Atlantic Conference
INAC 2013

Yves Crommelynck

Vice President Strategy and Partnership – Nuclear Development

Gustavo Henrique Labanca Novo

Vice President Business Development – Brasil

Paulo Olívio Ribas

Leme Engenharia - Nuclear

TABLE OF CONTENTS



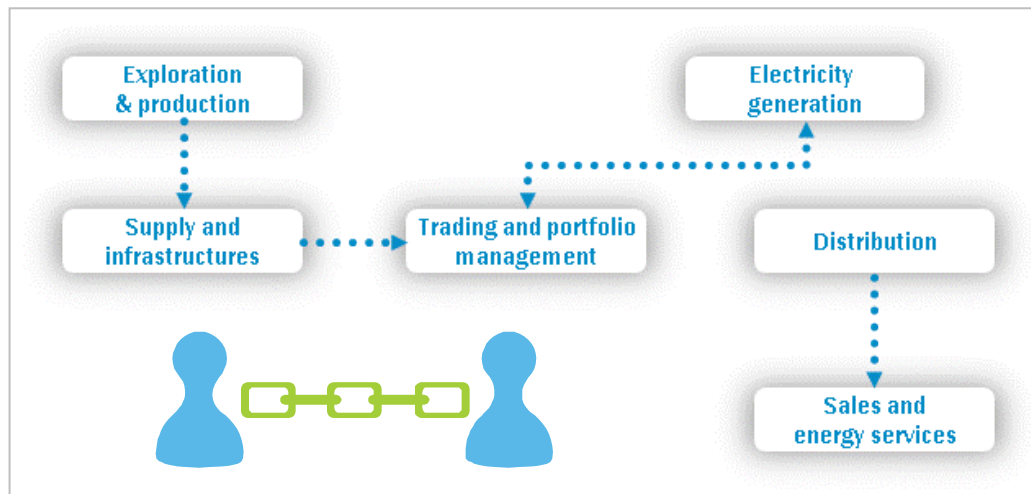
Main prerequisites when considering an investment in nuclear new build

INAC2013 - Recife

November 27, 2013

- **GDF SUEZ profile and presence in Brazil**
- Main prerequisites when considering an investment in nuclear new build
- Brief assessment of nuclear new build in Brazil
- An example : Sinop project in Turkey
- Conclusion

- **No.1** Independent Power Producer (IPP) in the world
- Active across the **entire Energy value chain** in electricity and natural gas, upstream to downstream



- **Diversified** supply sources
- **Flexible** and **highly efficient** power generation
- **Innovative energy solutions** to individuals, cities and businesses
- Our History began in **1822**

Key figures and breakdown of power generation

(as of December 31, 2012)

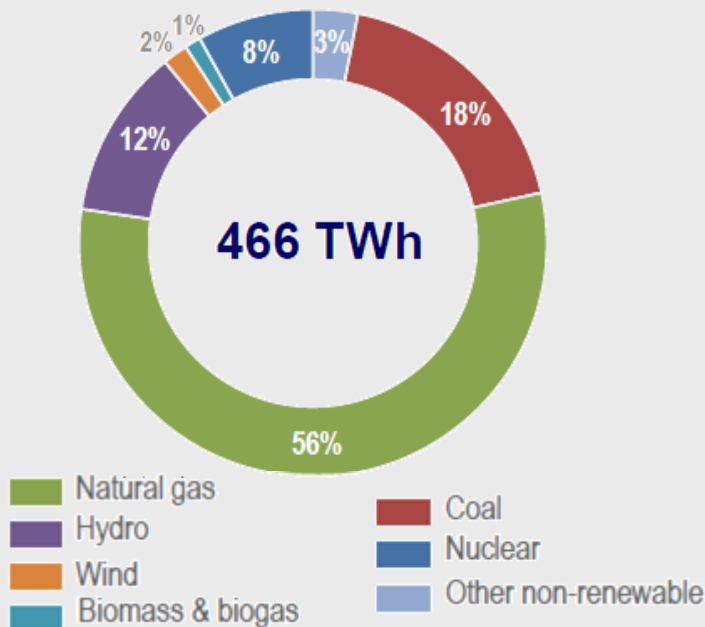
€97 billion
2012 revenues

219,300
employees

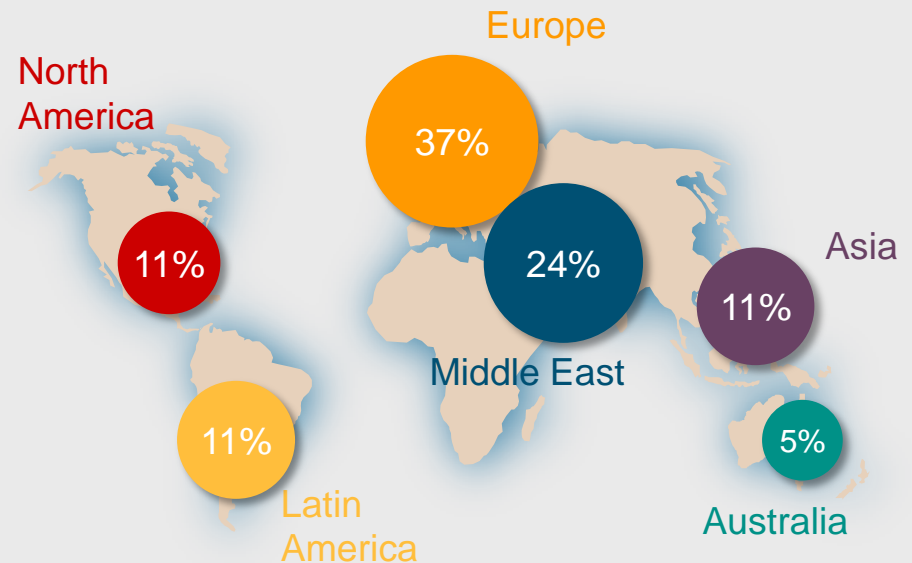
Capacity: **116 GW**
installed
10 GW under
construction

€7-8 billion of
investment per year
over 2013-2015

Total generation output breakdown by
technology



Total generation output breakdown by
geographic area



50 years of expertise in nuclear energy mastering the whole nuclear value chain

- **Stakeholder in Europe 1st commercial PWRs**
 - ✓ BR 3 (1962-1987)
 - ✓ Chooz A (1967-1991)
- **Operator of 7 reactors in Belgium**
(3 at Tihange and 4 at Doel)
- **The Group capacities : 6 134 MW**
 - ✓ Belgium 4 226 MW
 - ✓ France 1 208 MW (Chooz B and Tricastin)
 - ✓ Germany 700 MW (Unterweser, Gundremmingen B&C, Grohnde)
- **Strengths**
 - ✓ Independent from suppliers & vendors
 - ✓ Reactors from several vendors (all of PWR design)
 - ✓ Availability factor
- **Participations in Georges Besse II**
(Uranium enrichment plant)



**Nuclear Safety and Nuclear Security
are our overriding priorities**

Nuclear is part of the solution to face energy challenges

- ✓ Energetic independence & Fuel security of supply
- ✓ Stable, predictable and competitive generation costs
- ✓ Low greenhouse gas emissions

GDF SUEZ intends to

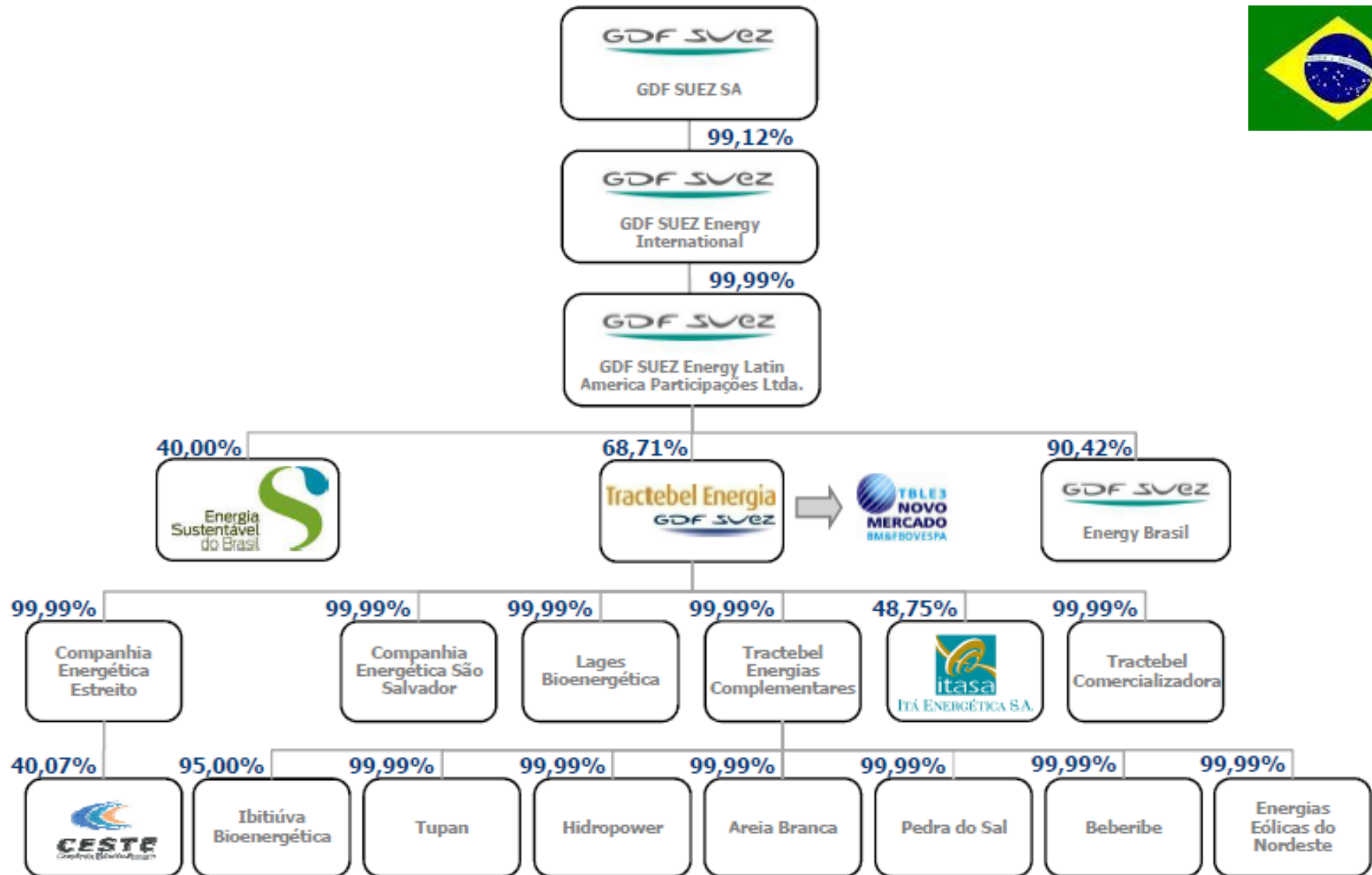
- **Maintain nuclear energy as part of GDF SUEZ electricity generation mix, in order to keep this mix competitive and well balanced**
- **Preserve and promote the Group's historic expertise in the nuclear field, both at human and technical levels:**
engineering - operation - maintenance - nuclear services and decommissioning

Considered countries

- ✓ **Europe** : **United Kingdom** (NuGen project at Moorside), *Poland, The Netherlands*
- ✓ **Middle East** : **Turkey** (SINOP project on the Black Sea), *Saudi Arabia, UAE*
- ✓ **Asia** : *Thailand, ...*
- ✓ **Americas** : **Brazil**, *where GDF SUEZ is the largest private energy player*

GDF SUEZ in Brazil...

... present since **1998**



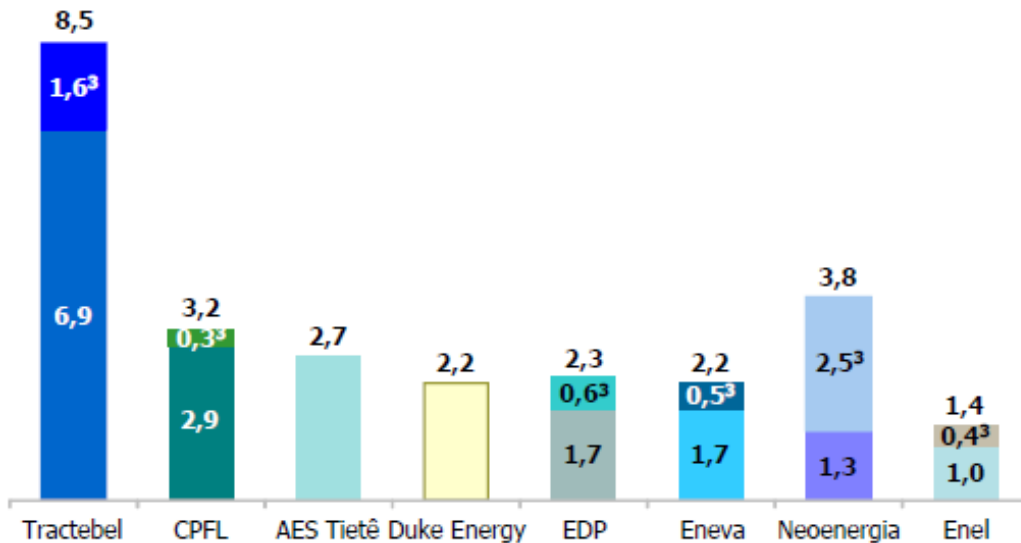
Obs.: Estrutura simplificada

GDF SUEZ is the largest private energy player in Brazil... through Tractebel Energia...

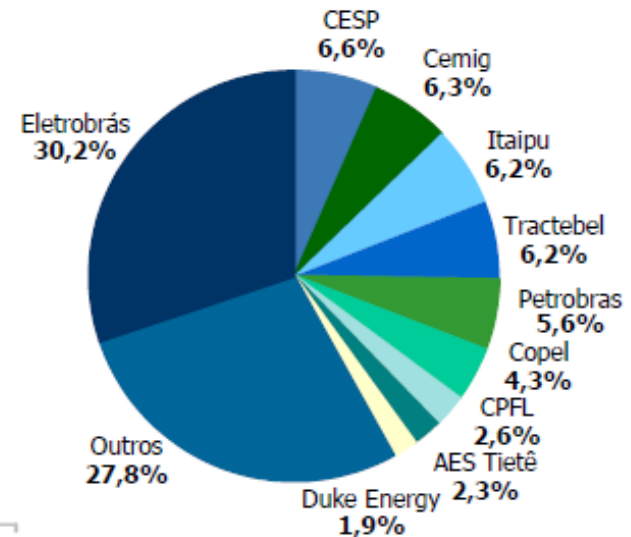


- **8.630 MW** of total installed capacity managed, being 6,909 MW own
 - 83% hydro or other renewable sources, 22⁽¹⁾ plants in operation all around the country;
- **1.618 MW** under construction⁵
 - 3,750 MW Jirau HPP (1,500 MW group's share), 115 MW from wind farms & 3 MW solar project 100% own;

Setor Privado – Capacidade Instalada (GW)



Brasil – Capacidade Instalada Existente^{1,2}



Fonte: Aneel, *websites* das empresas e estudos internos.

Notas:

¹ Valor correspondente ao SIN - Sistema Interligado Nacional.

² Inclui somente a parcela nacional de Itaipu.

³ Capacidade instalada em construção com base em informações da Aneel, ONS e estudo interno. Para a Tractebel, o valor inclui a participação da Controladora (40,0%) na UHE Jirau.

...and is well positioned to play a consolidating role

⁽¹⁾ 20, being one thermo power plant complex with 3 plants

GDF SUEZ in Brazil

A continental country...

... and a diversified portfolio of assets, with strategic location:



Usinas Hidrelétricas	Capacidade Instalada (MW)	Capacidade Comercial (MWm) ¹
1 Salto Santiago	1.420,0	723,0
2 Itá	1.126,9 ²	544,2 ²
3 Salto Osório	1.078,0	522,0
4 Cana Brava	450,0	273,5
5 Estreito	435,6 ²	256,9 ²
6 Machadinho	403,9 ²	147,2 ²
7 São Salvador	243,2	148,5
8 Passo Fundo	226,0	119,0
9 Ponte de Pedra	176,1	131,6
Total	5.559,7	2.865,9

Usinas Termelétricas	Capacidade Instalada (MW)	Capacidade Comercial (MWm) ¹
10 Complexo Jorge Lacerda ³	857,0	649,9
11 William Arjona	190,0	136,1
12 Charqueadas	72,0	45,7
13 Alegrete	66,0	21,1
Total	1.185,0	852,8

Usinas Complementares	Capacidade Instalada (MW)	Capacidade Comercial (MWm) ¹
14 Lages (Biomassa)	28,0	25,0
15 Rondonópolis (PCH)	26,6	10,1
16 Beberibe (Eólica)	25,6	7,8
17 José Gelazio da Rocha (PCH)	23,7	9,2
18 Ibitiúva (Biomassa)	22,9 ²	13,9 ²
19 Areia Branca (PCH)	19,8	11,1
20 Pedra do Sal (Eólica)	18,0	5,7
Total	164,6	82,8



Usinas em Construção	Capacidade Instalada (MW)	Capacidade Comercial (MWm) ¹
21 Jirau (Hidro) ⁴	1.500,0 ⁵	873,8 ⁵
22 CE Trairi (Eólica)	115,4	63,9
23 Nova Aurora (Solar)	3,0	0,5
Total	1.618,4	938,2

Notas: ¹ Valores segundo legislação específica.
² Parte da Tractebel Energia.
³ Complexo composto por 3 usinas.
⁴ A parcela da Controladora no projeto deverá ser transferida para a Tractebel Energia.
⁵ Parte da Controladora (40,0%), com base em capacidade instalada total de 3.750 MW.

GDF SUEZ in Brazil... appropriate governance... ... and solid partnership is key

- **Jirau HPP – 3,750 MW under construction**
 - **GDF Suez: 40%**
 - Eletrobrás: 40% (Eletrosul & Chesf 20% each)
 - Mitsui: 20%⁽¹⁾
- **Estreito HPP – 1,087 MW fully operational since Mar-13**
 - **Tractebel Energia: 40.07%**
 - Vale: 30.00%
 - Alcoa: 25.49%
 - Camargo Correa: 4.44%
- **Itá HPP – 1,450 MW fully operational since Mar-01**
 - **Tractebel Energia: 48.75% (ITASA holds 60.5% of the consortium)**
 - CSN: 48.75%
 - Itambé: 2.5% (Votorantim group)
- **Machadinho HPP – 1,087 MW fully operational since Jul-02**
 - **Tractebel Energia: 19.28%**
 - Alcoa: 25.74%
 - Votorantim group: 33.14%
 - Others: 21.84% (Vale, InterCement, CEEE and DME)



⁽¹⁾ Already approved by ANEEL and CADE (pending approval from BNDES and local Banks)

Brazilian Power Sector

What are our investment plans?

■ Hydro projects

- Feasibility studies of Tapajós hydro complex
- Finalizing the construction of Jirau
- Other mid size to large hydro projects (700 MW São Manoel HPP?)



■ Thermo projects

- Coal (South of Brazil)
- Natural Gas
 - ✓ Considering to invest in E&P to secure gas supply

■ Wind / Biomass

- Several projects in the portfolio / 115 MW under construction

■ Sector consolidation

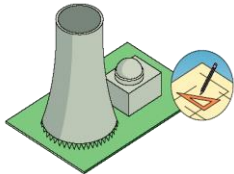
- Always analyzing M&A opportunities

■ Nuclear Power Plants

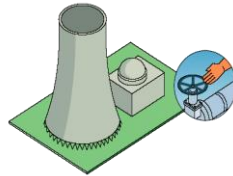
- Working towards creating the environment for new investments (ABDAN)
 - ✓ Legal framework
 - Establishment of a clear policy for both Nuclear and Environmental Licensing process
 - Create solid framework to allow public-private partnerships to develop NNB
- Cooperation Agreement signed with Eletrobrás Eletronuclear

TRACTEBEL ENGINEERING NUCLEAR ACTIVITIES

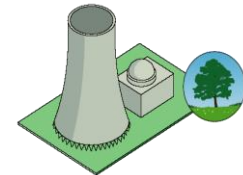
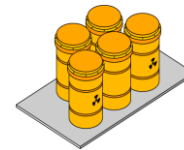
NEW PLANTS



**OPERATIONAL
SUPPORT**



**RADWASTE
MANAGEMENT
& DECOMMISSIONING**

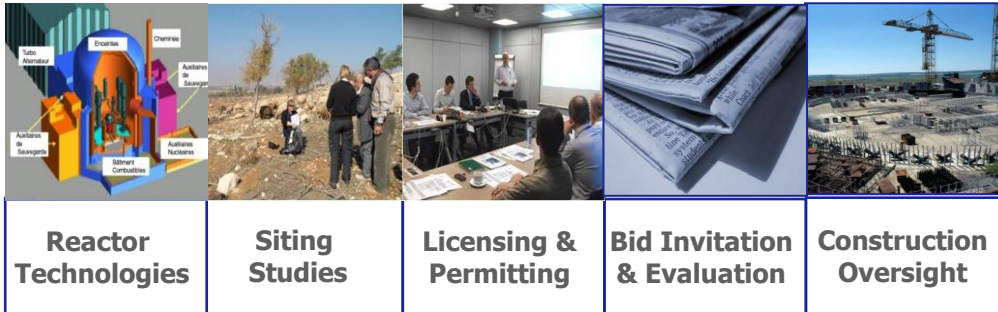


Architect Engineer, Owner's Engineer or Consulting Engineer

NEW PLANTS

OPERATIONAL SUPPORT

RADWASTE MANAGEMENT & DECOMMISSIONING



- ✓ **GDF SUEZ** : study of design documentation of the **AP1000** reactor design; GDA follow-up in UK; technical and safety assessment and recommendations to the parent company
- ✓ **GDF SUEZ** : study of design documentation of the **ATMEA1** reactor design; technical and safety assessment and recommendations to the parent company
- ✓ **GDF SUEZ** : comparative studies of **Generation III/III+** reactor technologies
- ✓ **GDF SUEZ** : preparation of bid invitation specifications and bid evaluation methodology for **new build** project(s)
- ✓ **EUR** : continuous involvement within **EUR** Steering Committee and Admin. Group; Deputy PM role for EUR Rev.D. Participation in EUR compliance assessment of **EPR** and **AP1000** (as Sponsor) and **APWR** (currently)

- ✓ **France** – GDF SUEZ: engineering support to project development for the construction of an ATMEA1 reactor
- ✓ **UK** – NuGen: site reconnaissance of Moorside ; site data collection; preliminary plant layout options; preparation of project specific bid invitation documents (ongoing)
- ✓ **Turkey** : Owner’s Engineer for Sinop project technical feasibility studies
- ✓ **Jordan** – JAEC: site survey and site selection studies encompassing cooling, seismic hazard, meteorology, transportation, environmental and societal impacts
- ✓ **China** – AREVA: civil engineering design of the reactor building and selected safety related structures of Taishan 1 and 2
- ✓ **Bulgaria**: Due diligence for the Belene units 1 and 2 construction
- ✓ **Romania**: Due diligence for the completion of Cernavoda units 3&4
- ✓ **Slovak Republic** : Pre-feasibility study for completion of Mochovce 3&4
- ✓ **Gen IV design studies**: RJH, ITER-IFMIF, MYRRHA, ASTRID, participation in EC programs
- ✓ Technological survey of **Small Modular Reactors**

GDF SUEZ

Energia Europa

Energia Internacional

Gás Global & LNG

Infraestrutura

Serviços de Energia

Meio Ambiente



TRACTEBEL Engineering
GDF SUEZ



LEME ENGENHARIA



- Sediada em Bruxelas, na Bélgica, é uma das maiores empresas de consultoria em engenharia da Europa
- Atende empresas privadas e públicas, bem como instituições nacionais e internacionais

TRACTEBEL ENGINEERING

Mercados

ENERGIA



Térmica



Hidráulica



Renovável



Nuclear



Transmissão
& Distribuição



Gas & LNG

INFRAESTRUTURA – INTELIGENCIA E SUSTENTABILIDADE



Edificações



Transporte



Infraestrutura
Hídrica



Ambiental

Faturamento

478 M€

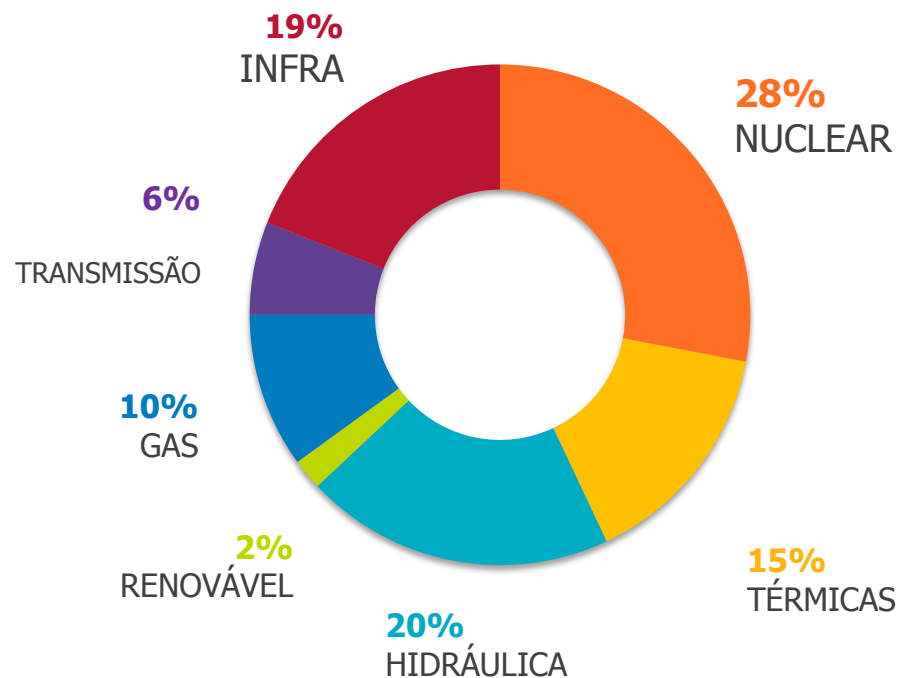
Faturamento em
2012

3300

Colaboradores

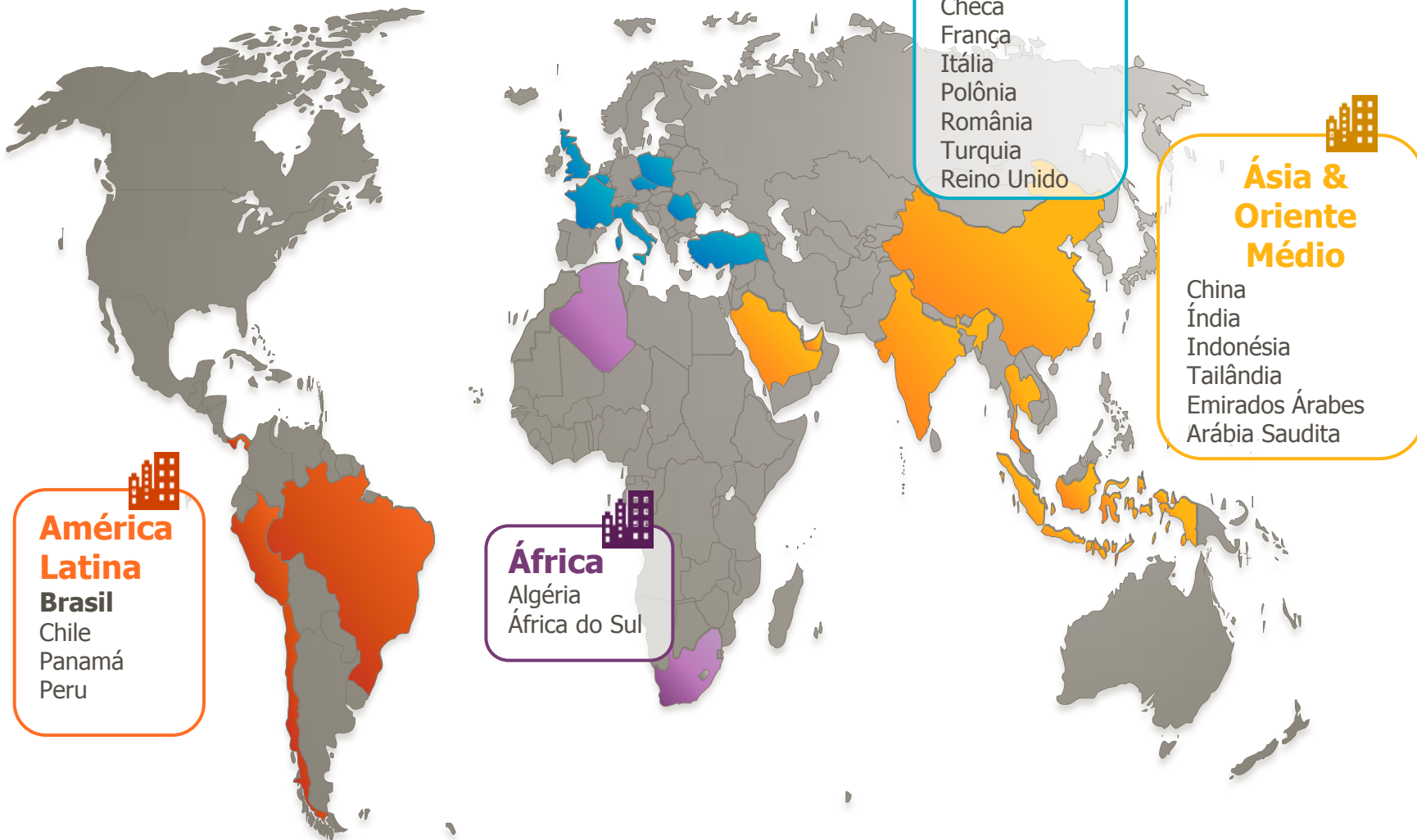
20

Países



PRESENÇA MUNDIAL

20 Escritórios Regionais



PRESENÇA NA AMÉRICA LATINA

Escritórios e Escritórios de Projetos





Estudou e projetou...

- Mais de **10.000 km** de extensão de Linhas de Transmissão de Extra-Alta Tensão
- **70 Subestações** de Extra-Alta Tensão projetadas
- **40.000 MVA** instalados
- **450** Subestações de Alta Voltagem
- **300** Estações de Telecomunicações
- Projetos para mais de **50** usinas hidrelétricas
- **19.000 MW** de capacidade instalada, com geradores com capacidade unitária entre **1 e 380 MW**
- Vazão superior a **50m³/s** em Planos Diretores e Projetos de Abastecimento de Água
- **200 cidades** atendidas em projetos de gerenciamento de obras de drenagem urbana e **mais de 10.000.000 de pessoas beneficiadas**

PRINCIPAIS PROJETOS DE HIDROENERGIA

- UHE Belo Monte (Brasil)
- UHE Jirau (Brasil)
- UHE Sopladora (Equador)
- UHE Toachi Pilatón (Equador)
- UHE Quitaracsa (Peru)
- UHE Bajo Frio (Panamá)
- UHE Laja (Chile)

- UTN Angra III (Brasil)
- UTE Black Fox (Chile)
- UTE GNL Mejillones (Chile)

PRINCIPAIS PROJETOS DE ENERGIAS RENOVÁVEIS

- Parque Eólico Talara & Cupisnique (Peru)
- Parque Eólico Jacobina (Brasil)
- P&D Fotovoltaica (Brasil)

PRINCIPAIS PROJETOS DE TRANSMISSÃO E DISTRIBUIÇÃO

- SD Eletrobras Distribuição Rondônia (Brasil)
- LT Yaciretá – Villa Hayes (Paraguai)
- SD Eletrobras Distribuição Acre (Brasil)
- ST Itaipu-Villa Hayes (Paraguai)

PRINCIPAIS PROJETOS DE INFRAESTRUTURA

- Centro Administrativo do Estado de Minas Gerais
- Infraestrutura Urbana Drenurbs II (Brasil)
- Projeto de Irrigação Jequitaí (Brasil)
- Hidrovia do Madeira (Brasil)
- Modernização Mineirão (Brasil)
- Projeto Linha 3 Metrô Belo Horizonte (Brasil)

TABLE OF CONTENTS



Main prerequisites when considering an investment in nuclear new build

INAC2013 - Recife

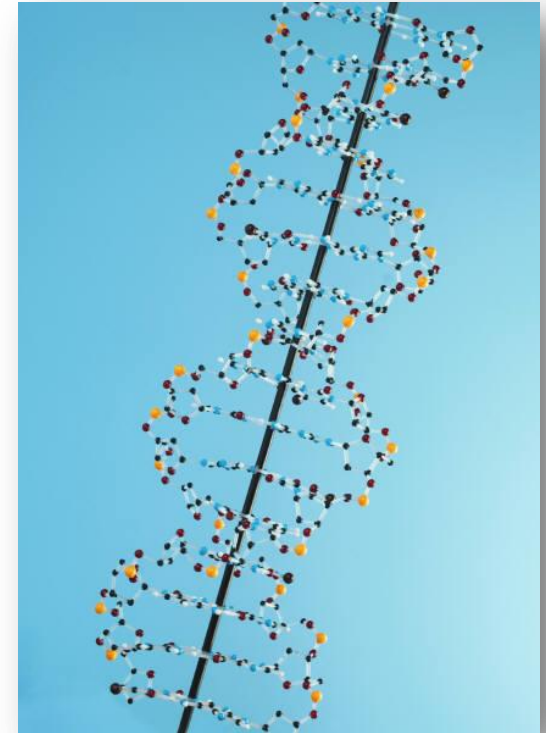
November 27, 2013

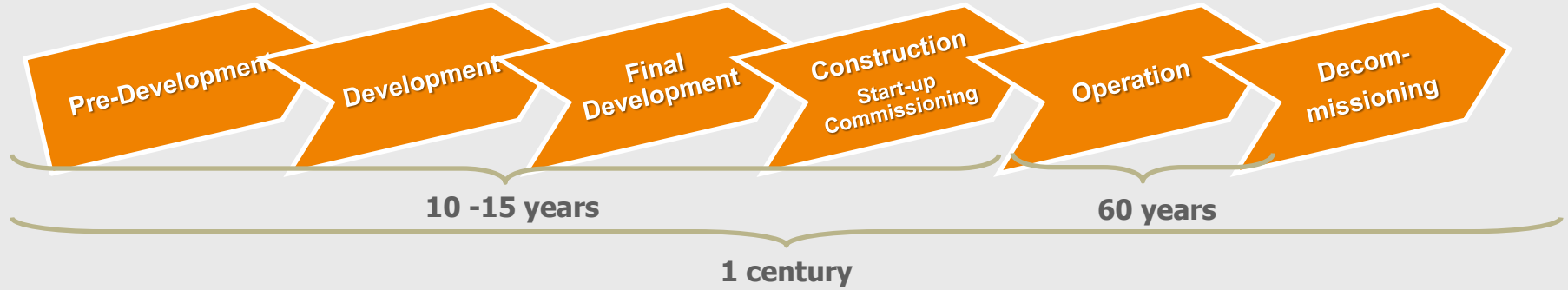
- GDF SUEZ profile and presence in Brazil
- **Main prerequisites when considering an investment in nuclear new build**
- Brief assessment of nuclear new build in Brazil
- An example : Sinop project in Turkey
- Conclusion

GDF SUEZ is willing to develop nuclear as a **co-owner and co-operator** for highest safety level PWR technology

- Based on **international IPP developer experience**,
- Through **sustainable partnerships** to share risks and costs and coping with local situation
 - At **equity level** : Utilities, Business partners and/or giant Consumers
 - At **political & industrial level** : local incumbent Utilities
 - At **contractual** level : Suppliers
- Within environments that are sufficiently **regulated and/or formalized through contracts**
- Through **plant delivery contractual schemes** with affordable risks

And to build-up the **“intelligent” local Nuclear operator**, unique counter-part of the Safety Authorities during the licensing process, the operation, the decommissioning





Main prerequisite issues when considering an investment in a specific country:

- ✓ Stable long term political commitment
- ✓ Clear and predictable long term legal and regulatory environment
- ✓ A suitable electricity market and a reliable High Voltage grid
- ✓ Site assessment
- ✓ **Technology** assessment
- ✓ Fuel cycle and radwaste management solutions
- ✓ Economics & **Financing**
- ✓ **Local acceptance**
- ✓ Reinforcement of **local nuclear competences**
- ✓ **Risk mitigation** measures



Generation III Reactors

Characterized by high level of nuclear safety, more than ever after Fukushima



Pressurized Water Reactors

Widespread worldwide (2/3)
& 50 year expertise

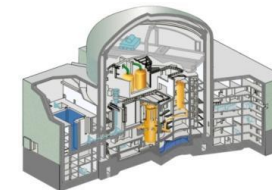
AP1000
Westinghouse / Toshiba



ATMEA1
AREVA-MHI



EPR
AREVA



On-going actions

- ✓ Conclude specific agreements with the reactors suppliers
- ✓ Build-up expertise and experience feedback
- ✓ Assess competitiveness of the models
- ✓ Active watch of other technologies (to keep open competition & to adapt to our customers' requirements)

- **Financing issues** different and more challenging than for conventional thermal plants
 - ✓ Nuclear projects **highly capital intensive**: 2 to 4 times the cost of thermal plants
 - ✓ **Construction period** 2 to 4 times longer than thermal plants
 - ✓ **Technical life time** 2 to 3 times longer than thermal plants
 - ✓ **Capacity to deliver and build on time and in the budget** is key
 - ✓ **High fixed costs** and **low variable costs** make electricity price very sensitive to **plant availability** and ability to operate in **base load**
 - ✓ **Specific risks** linked to nuclear : licensing, waste management, civil nuclear liability



➔ **Extensive risk mitigation and allocation is necessary**

Financing Nuclear Projects :

Risk allocation between stakeholders

■ **Licensing, development & construction risk**

- Governments and regulatory bodies to set adequate legal framework
- Developers, Utilities and Contractors to assume construction risks (delays, cost overruns)

■ **Market risk**

- Governments to offer clear environmental policy (Kyoto, CO₂ allocation)
- Developers to opt for the most secure possible environment (PPAs, regulated market, capacity fees, ...)


■ **Liability and safety risk**

- National Energy Policies, International Conventions and National Acts and Laws

■ **Radwaste disposal costs and decommissioning risk**

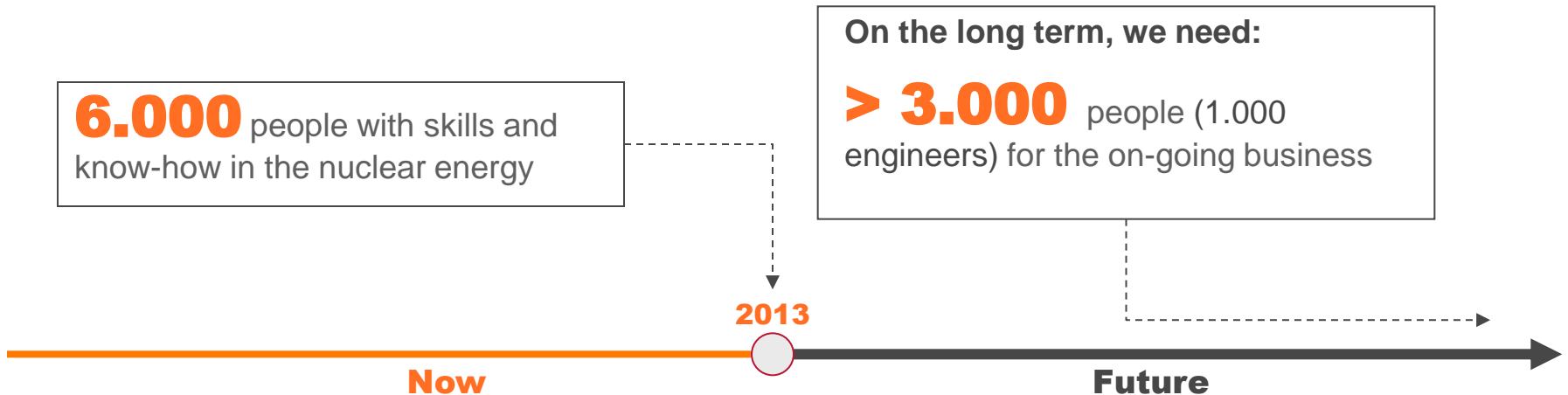
- Government to commit to solutions for radwaste disposal
- Sharing of risk by industry players and/or Government



Reason  Feelings

YOU ARE **AGAINST** NUCLEAR POWER AND YOU ARE **FOR** NUCLEAR POWER AND
YOU ARE **PROBABLY** RIGHT YOU ARE **PROBABLY** RIGHT

- Nuclear energy image has been deeply damaged after the Fukushima accident
- More than ever, **communication to the public is of paramount importance** and nuclear industry needs to improve communication
- Need to meet public expectations :
 - ✓ Main concerns: **nuclear safety + proliferation + long-lived nuclear waste**
 - ✓ Aim : **reassure & explain**
 - ✓ Tone : **transparent, factual**
- **Our Objectives**
 - ✓ More than ever proactively assume an **educational mission**
 - ✓ **Promote nuclear energy** as an acceptable way of meeting energy needs
 - ✓ Build up GDF SUEZ image as an **legitimate stakeholder in nuclear energy**



Action plan: Recruitment+Training+Développement

Nuclear Training Programs

- NTP-J** → Nuclear Trainees Program for **young** engineers (J=Junior)
- NTP-M** → Nuclear Trainees Program for **experienced** engineers (M=Major)
- NTP-S** → Nuclear Trainees Program for **support** services (S=Support)
- NTP-G** → Nuclear Trainees Program for **generation** key staff (G=Generation)
- NTP-T** → Nuclear Trainees Program for **technicians** (T=Technicians)

TABLE OF CONTENTS



Main prerequisites when considering an investment in nuclear new build

INAC2013 - Recife

November 27, 2013

- GDF SUEZ profile and presence in Brazil
- Main prerequisites when considering an investment in nuclear new build
- **Brief assessment of nuclear new build in Brazil**
- An example : Sinop project in Turkey
- Conclusion

- **Brazil is active all along the nuclear value chain** : producer of Uranium, covering the front-end of the fuel cycle, R & D Centres, a prototype PWR for naval propulsion under construction, a heavy components factory, two running nuclear power units, a third one under construction
- **Future contribution of nuclear to the energy mix remains unclear**
 - ✓ Petrobras is to exploit Brazil **gas** reserves
 - ✓ Planned substantial **wind** expansion
 - ✓ **Shale gas** reserves (first auction expected in 2013)
 - ✓ Unclear nuclear policy
- **Capacity gap** between 29 GW and 50 GW by 2030
- **Private ownership of nuclear power**
 - ✓ On-going debate if a constitutional change is required for any private ownership
 - ✓ What about the participation in the construction phase ?
 - ✓ What are the limitations for the operation of nuclear plants ?
- **Regulated market**
 - ✓ Capacity auctioned 3 to 5 years before delivery of new capacity (A-3 & A-5) and contract terms vary across technologies (15 to 30 years)
 - ✓ A-8 auction and 40 to 50 years' PPAs should be envisaged for nuclear

- **Government intervened in 2012-13** to reduce electricity prices, notably by cutting wholesale prices upon renewal of concessions
- **Local manpower technically competent** to the level required for nuclear power construction, operation and supply. However continuous capacity building is needed.
- **Grid can absorb large power**, although reinforcement is likely to be required in some locations
- **Low seismic risk** but non-negligible flood risk near big cities
- **National Energy Plan 2030 (PNE)** indicates the need of new nuclear plants considering three scenarios (4 GWe, 6 GWe and 8 GWe). 2050 Energy Plan under preparation.
- **Eletronuclear**
 - ✓ set up a program for site selection for construction of future nuclear plants
- **What will the auction process look like ?**

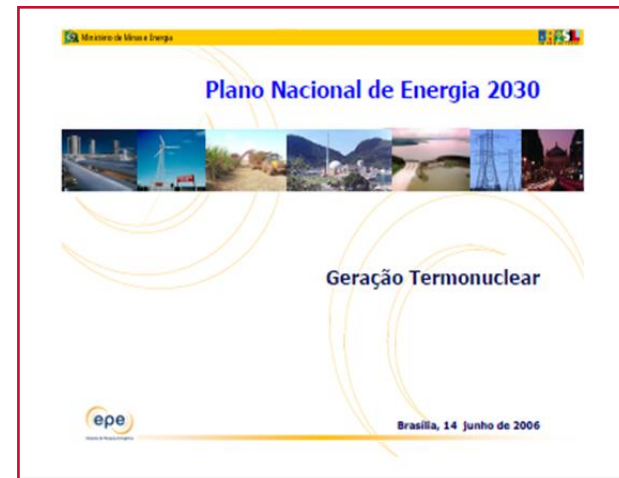


TABLE OF CONTENTS



Main prerequisites when considering an investment in nuclear new build

INAC2013 - Recife

November 27, 2013

- GDF SUEZ profile and presence in Brazil
- Main prerequisites when considering an investment in nuclear new build
- Brief assessment of nuclear new build in Brazil
- **An example : Sinop project in Turkey**
- Conclusion

- Turkey signed an Inter Governmental Agreement (IGA) with Japan for the construction and operation of 4 Gen III+ ATMEA1 (1120 MWe) units on May 3, 2013
- The Host Government Agreement (HGA) is to be ratified by the Turkish Parliament
- BOO with 20 years PPA (100%) and non-recourse financing – 70/30 D/E
- Partnership : EÜAŞ 49%, MHI, ITOCHU and GDF SUEZ 51%
- Lenders : JBIC (BTMU), NEXI, Commercial banks

GDF SUEZ is taking part in the project, by providing its expertise as

- ✓ **IPP** and **nuclear power developer**,
- ✓ future **Investor** and
- ✓ future **joint Operator**

with the support of **Tractebel Engineering**



- Extensive **Feasibility Studies** of the pre-conditions from a technical, economical, financial, business, legal and regulatory perspective are on-going
- **Power Purchase Agreement, Implementation Agreement** and other Project Contracts are under negotiation
- Exchanges with the **Safety Authorities** have started to define the reference plant and the permitting process
- Definition of **EPC term sheet** with EPC team lead by MHI is starting
- **Communication** and public acceptance issues are on the agenda

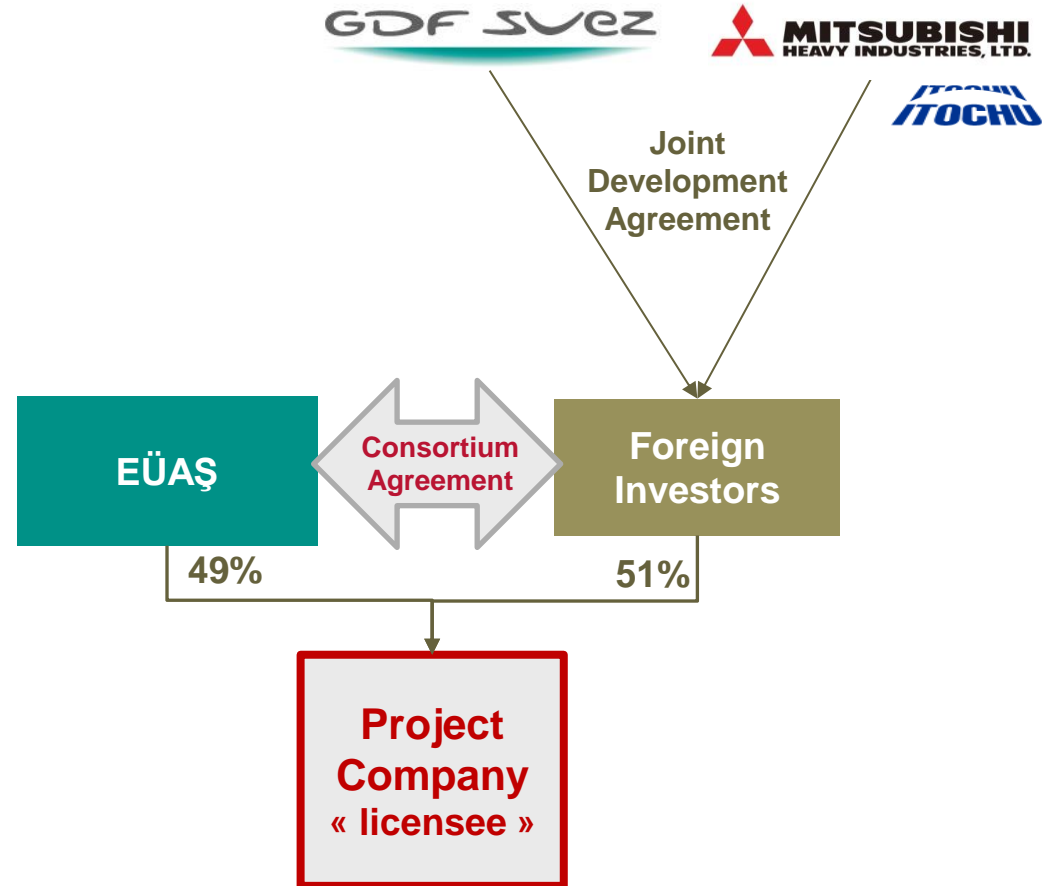


TABLE OF CONTENTS



Main prerequisites when considering an investment in nuclear new build

INAC2013 - Recife

November 27, 2013

- GDF SUEZ profile and presence in Brazil
- Main prerequisites when considering an investment in nuclear new build
- Brief assessment of nuclear new build in Brazil
- An example : Sinop project in Turkey
- **Conclusion**

GDF SUEZ to pursue operation of existing NPPs and to develop new Nuclear capacities as **co-Owner** and **co-Operator** of highest nuclear safety level nuclear reactors

In **key strategic countries**

Based on :

- ✓ International **IPP** developer experience,
- ✓ **50** years expertise as **Owner and Operator of NPPs**

Through :

- ✓ Developing sustainable **partnerships** to share risks and costs
- ✓ Opting for plant delivery contractual schemes with **affordable risks**
- ✓ Choosing the **most secure possible environment**
(PPAs, regulated, capacity fees, etc.)
- ✓ Relying on **Pressurized Water Reactors** with the **highest level of safety**
- ✓ With **Safety Culture** as the corner stone of our operational organization

- **Brazil energy market** has reached a mature level with regulations able to attract investors especially with long term PPAs
- Brazil is a **mature nuclear country** with ambitions for nuclear new build
- **GDF SUEZ is an important actor of the Brazilian electricity market**
 - ✓ the largest private IPP with 7 GW of owned installed capacity
 - ✓ through a diversified generation mix
 - ✓ and about 2 GW under construction (including Jirau HPP in partnership with the federal government through Eletrobras' subsidiaries)

GDF SUEZ definitely believes Brazil will take advantage of the long term experience of international investors-operators with strong local presence and nuclear experience, like GDF SUEZ, in partnership and in bankable schemes



GDF SUEZ

BY PEOPLE FOR PEOPLE

