

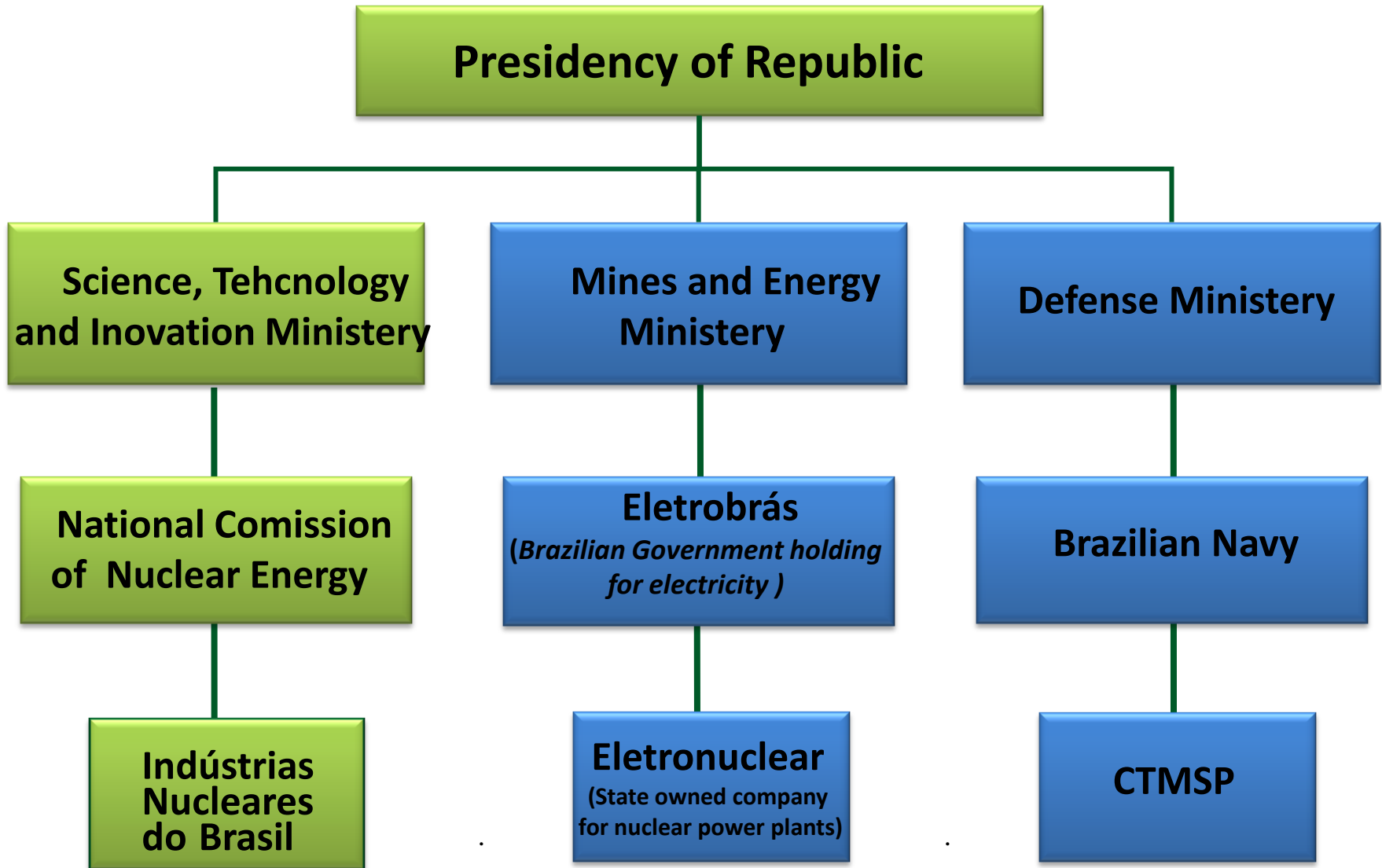


THE NUCLEAR FUEL CYCLE
INDUSTRIAL CHALLENGE
INNOVATIONS IN NUCLEAR TECHNOLOGY
DECEMBER 2012

ALFREDO TRANJAN FILHO
PRESIDENT

GOVERNMENT BRAZILIAN NUCLEAR ORGANIZATION

In Brazil radioactive issues are monopoly of the State



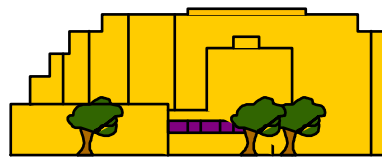


INB MISSION

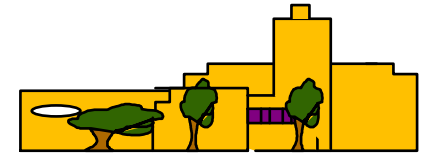
To ensure the supply of
nuclear fuel for electric power
generation in Brazil.



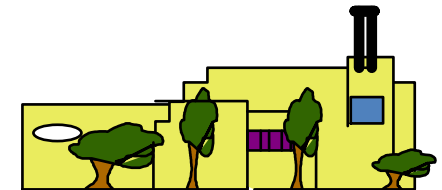
URANIUM MINING AND U_3O_8
CONCENTRATE PRODUCTION



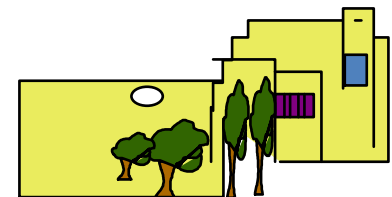
CONVERSION OF
 U_3O_8 INTO UF_6



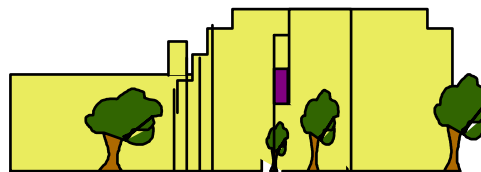
ISOTOPIC ENRICHMENT



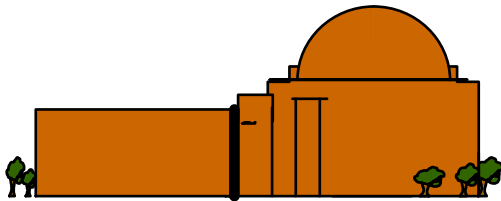
CONVERSION FROM UF_6
INTO UO_2 POWDER



UO_2 FUEL PELLET
FABRICATION



FUEL ELEMENT FABRICATION



POWER GENERATION

Nuclear Fuel Cycle

**SANTA QUITERIA
PROJECT
PHOSPHATE-
URANIUM DEPOSIT
(State of Ceará)**



INB's Mining and Industrial Units

**URANIUM CONCENTRATE UNIT – URA
CAETITÉ / State of Bahia**



**NUCLEAR FUEL FABRICATION PLANT
State of Rio de Janeiro**

UNIT 1



UNIT 2

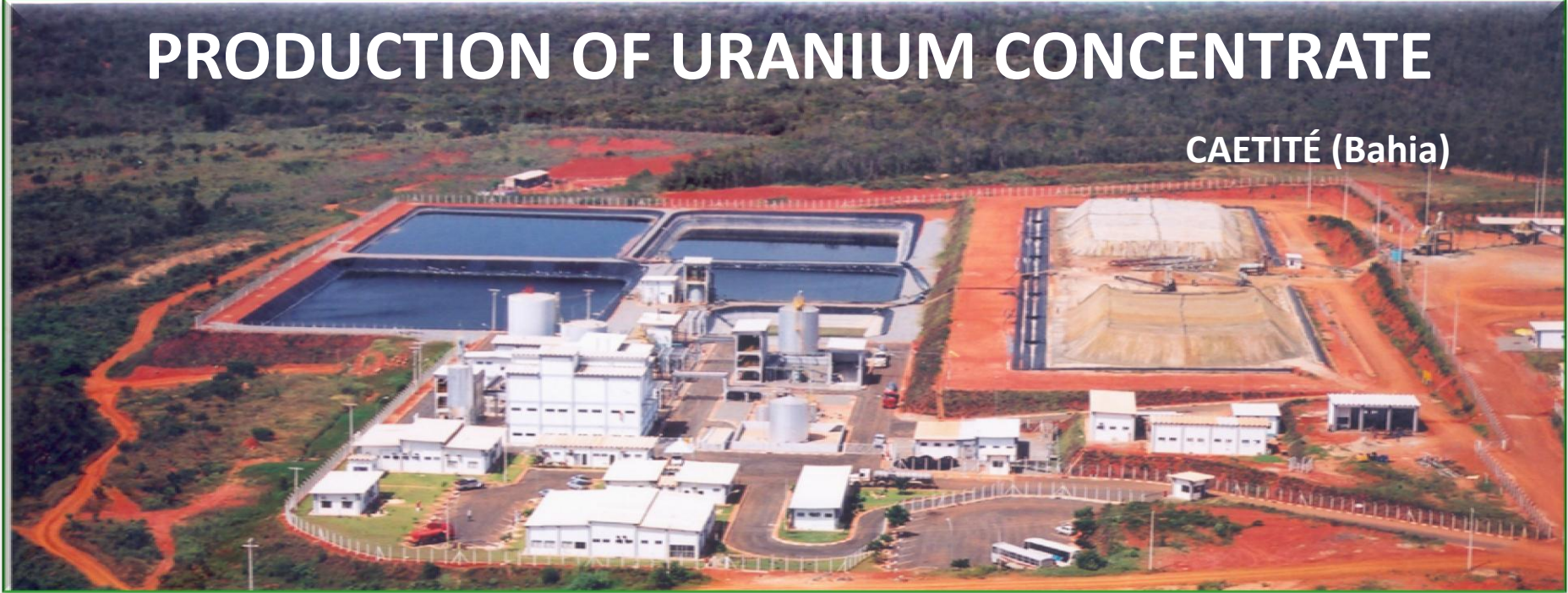


PRODUCTION OF URANIUM CONCENTRATE UNIT



PRODUCTION OF URANIUM CONCENTRATE

CAETITÉ (Bahia)



THE PRESENT

Installed Capacity: 400 tons/year

THE FUTURE:

Expanding: 800 tons/year

PRODUCTION OF URANIUM CONCENTRATE

Santa Quiteria Project

Exploitation of the phosphate-uranium deposit

RESERVES

PHOSPHATE: 9 MILLION t P_2O_5

URANIUM: 80 THOUSAND t U_3O_8

t U_3O_8

Production (2016): 1,200

Expanding (2021): 1,600



Uranium-bearing phosphate

NUCLEAR FUEL FABRICATION PLANT

ENRICHMENT, UF_6 to UO_2 CONVERSION and Fuel Pellets

COMPONENTS AND ASSEMBLY

CONVERSION PLANT



**TWO UNITS OF 1,500 t/YEAR
FROM 2017**

NUCLEAR FUEL FABRICATION PLANT (FCN)





Conversion Plant Capacity Premises

- ✓ **FIRST INDUSTRIAL PLANT:**
1,500 t UF₆ /y
Start Operation in 2017.
- ✓ **EXPANDING to 3,000t UF₆ / y**
Starting in 2019.

ISOTOPIC ENRICHMENT PLANT MODULAR CONSTRUCTION



CAPACITY

- ✓ 1ª step: 100% A1 e 20% A2 (2016)
- ✓ 2ª step: Angras and Others (2017)

NUCLEAR FUEL FABRICATION PLANT (FCN)



ISOTOPIC ENRICHMENT PLANT MODULAR CONSTRUCTION

- ✓ **EXPANDING CTMSP CENTRIFUGES PRODUCTION CAPACITY TO 100,000 SWU / YEAR STARTING IN 2012.**
- ✓ **NEW CENTRIFUGES FABRICATION UNIT TO BE BUILT AT CENTRO EXPERIMENTAL DE ARAMAR UNTIL 2012.**
- ✓ **NEW CENTRIFUGES ASSEMBLY UNIT TO BE BUILT AT INB UNTIL 2012.**
- ✓ **NEW UF₆ HANDLING UNIT TO BE BUILT AT INB UNTIL 2014.**

UF₆ TO UO₂ CONVERSION

Installed Capacity 160 t/year of enriched uranium dioxide :

A1, A2, A3, N1, N2, N3 e N4.



NUCLEAR FUEL FABRICATION PLANT (FCN)



Fuel Pellets

Installed Capacity 120 t/year of
 UO_2 pellets

A1, A2, A3, N1 e N2.



NUCLEAR FUEL FABRICATION PLANT (FCN)



FUEL PELLETS AND UO_2 POWDER

REQUIREMENT

- ✓ EXPANDING FCN UF_6 To UO_2 CONVERSION AND FUEL PELLETS AFTER 2014:
- ✓ PLANNED CAPACITY 200 t UO_2 (ENRICHED).
 - PROJECT - 1 YEAR.
 - CONSTRUCTION, PROCUREMENT END COMMISSIONING - 2YEARS.
 - START PROJECT – 2012/13.
 - START OPERATION – 2015/16.
 - CAPACITY: 200 t/ YEAR.

COMPONENTS AND ASSEMBLY



NUCLEAR FUEL FABRICATION PLANT (FCN)



COMPONENTS AND ASSEMBLY

**Installed Capacity in 2 shifts:
240 t / year of enriched
uranium**

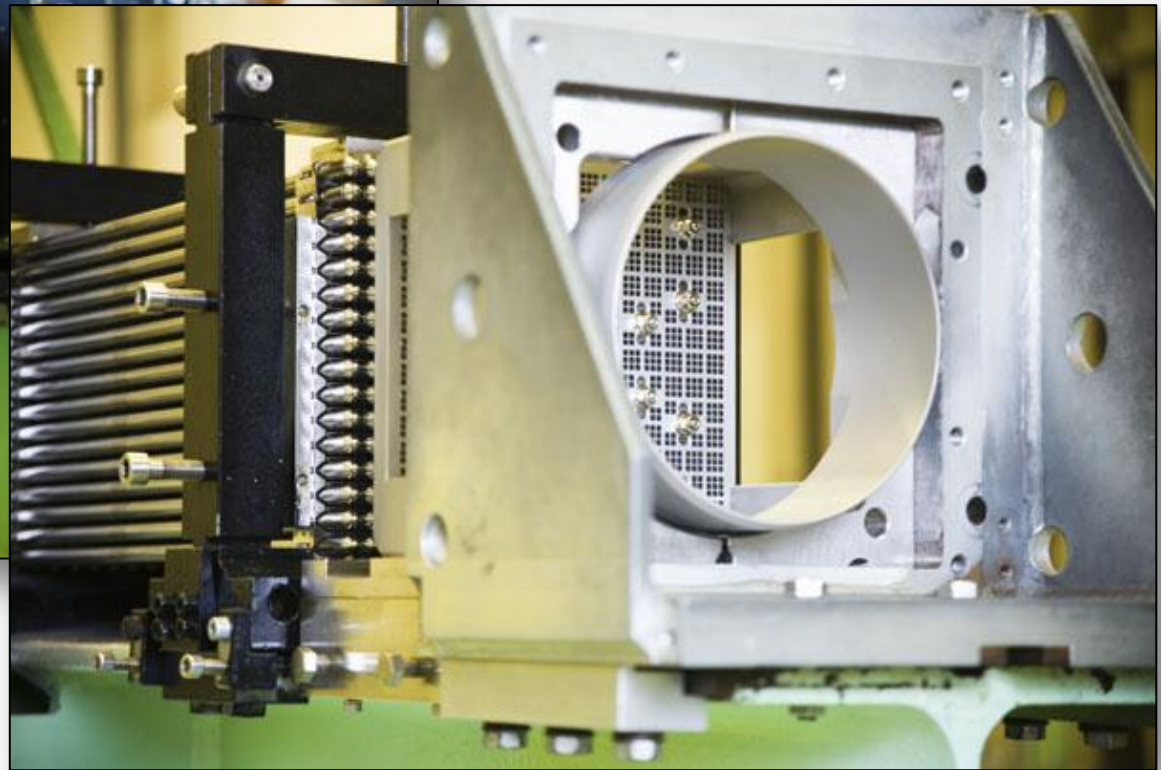
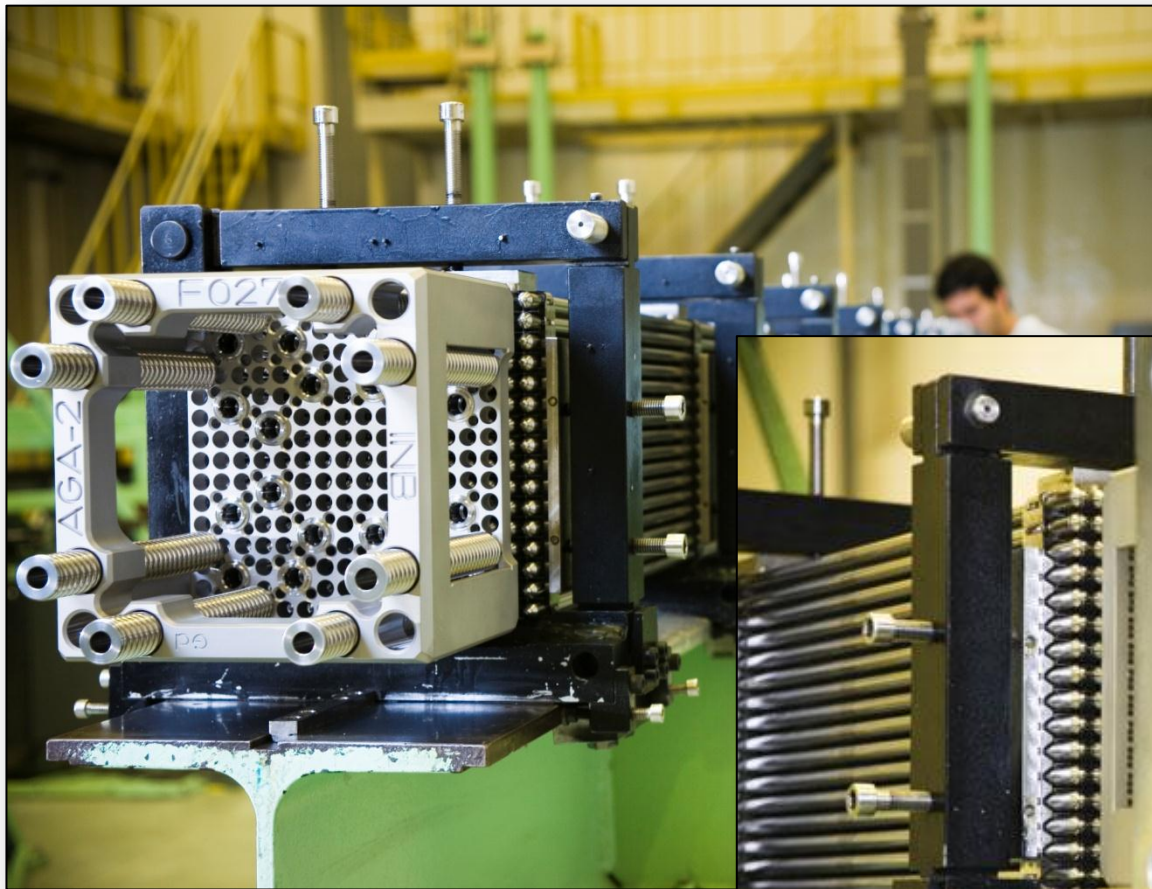
A1, A2, A3, N1, N2, N3 and N4



NUCLEAR FUEL FABRICATION PLANT (FCN)

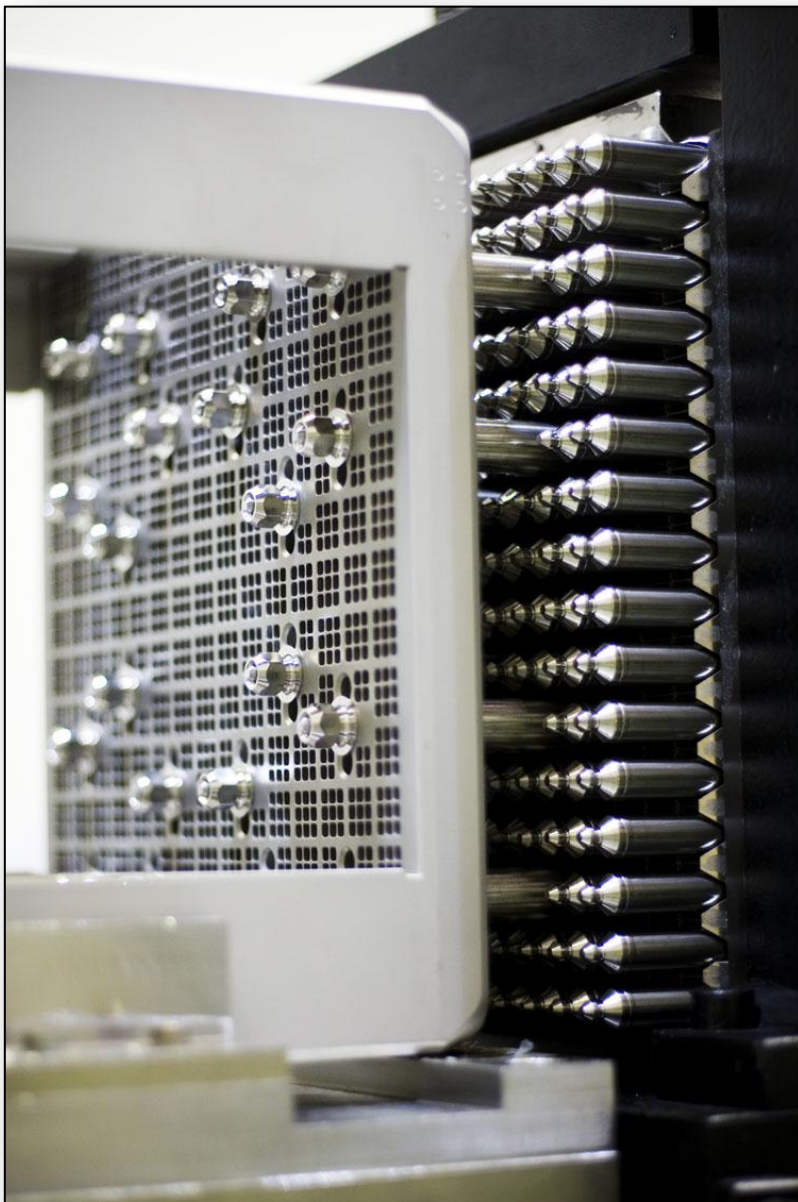


COMPONENTS AND ASSEMBLY



NUCLEAR FUEL FABRICATION PLANT (FCN)





COMPONENTS AND ASSEMBLY

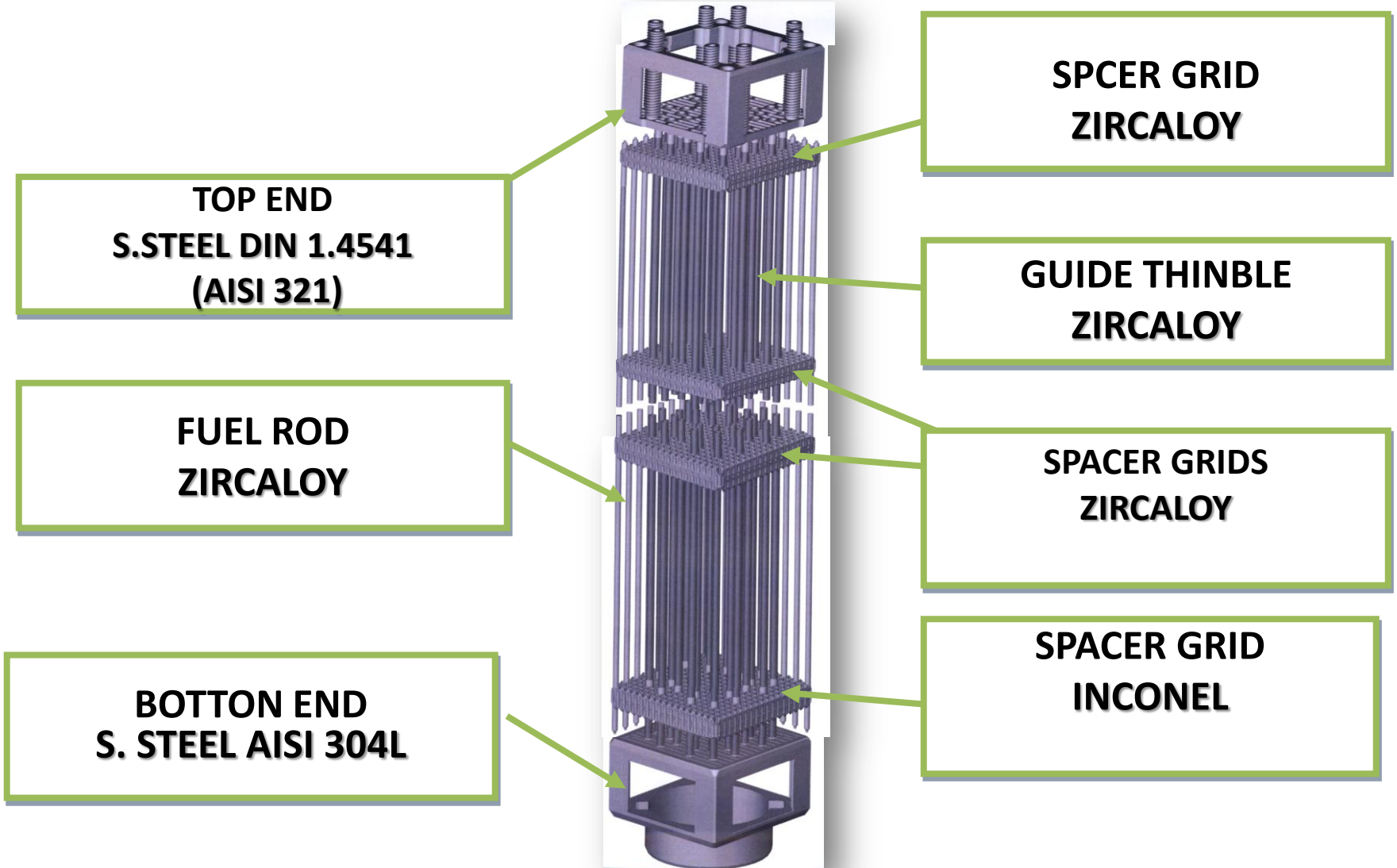


NUCLEAR FUEL FABRICATION PLANT (FCN)



MATERIALS PRODUCTION PROGRAM

ANGRA 2 FUEL ELEMENT



COMPONENTS AND ASSEMBLY REQUIREMENT

**EXPANDING FUEL ELEMENTS
PRODUCTION CAPACITY TO 300t OF
ENRICHED UO_2 AFTER 2018 .**

NUCLEAR FUEL CYCLE

PRODUCTION X DEMAND

PRODUÇÃO U308

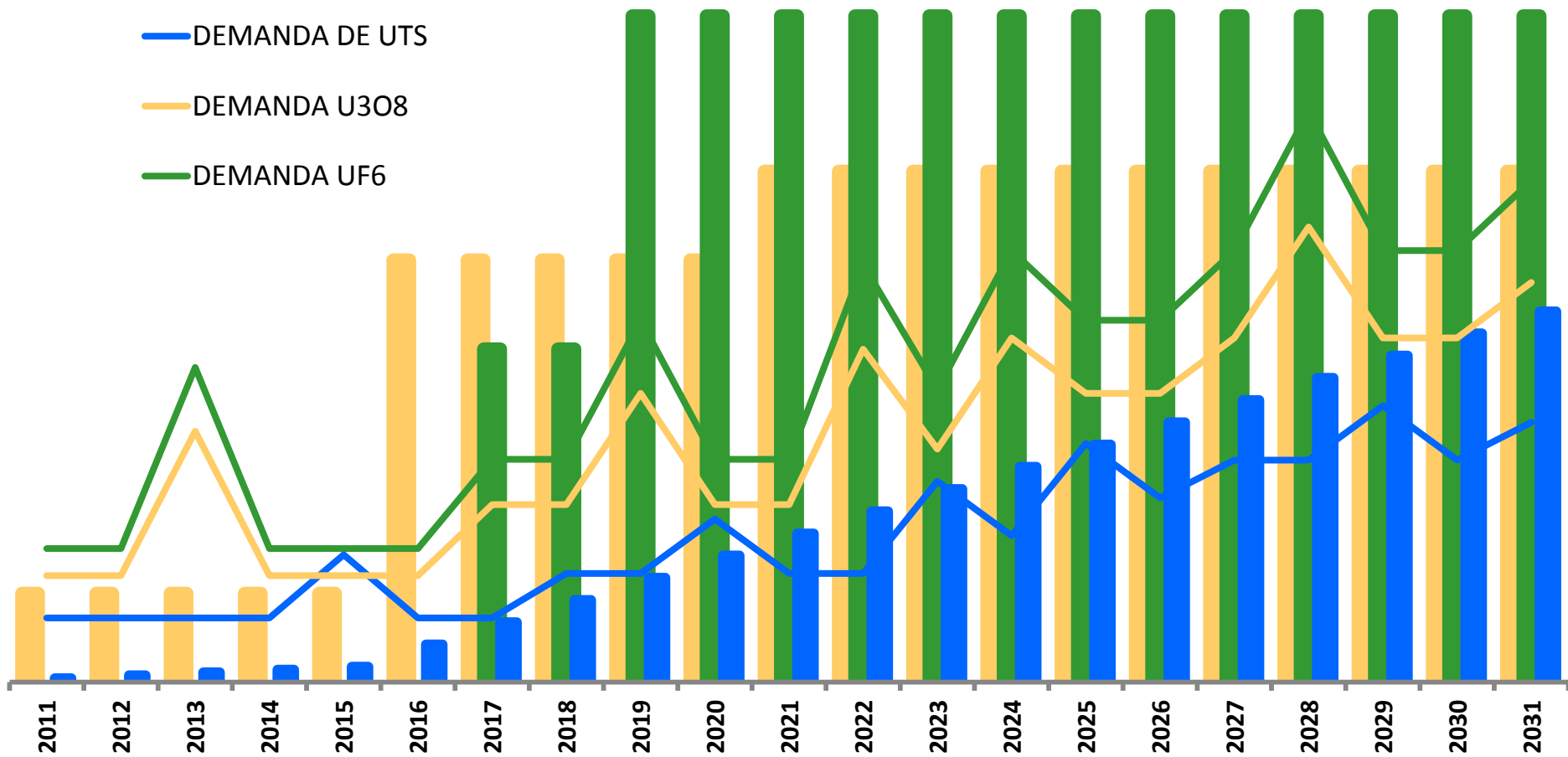
PRODUÇÃO UF6

PRODUÇÃO UTS

DEMANDA DE UTS

DEMANDA U308

DEMANDA UF6





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