

# Underground Networks

## *Overview*

31/Mar/2023

# Neoenergia Overview



## LINES

### 5 Distribution Utilities

- Concession area: 324k square miles
- Population: 37 MM

### 15 Transmission Utilities

- 7 in operation: 644 miles e 8 Substations
- 8 under construction: 3,480 miles e 11 Substations



## RENEWABLE

### Wind Generation

- 17 Plants in operation: 0,5 GW
- 27 Plants under construction: 1,0 GW

### Photovoltaic Generation

- 2 Plants under construction: 0,1 GW

### Hydroelectric Generation

- 7 Plants in operation: 3 GW



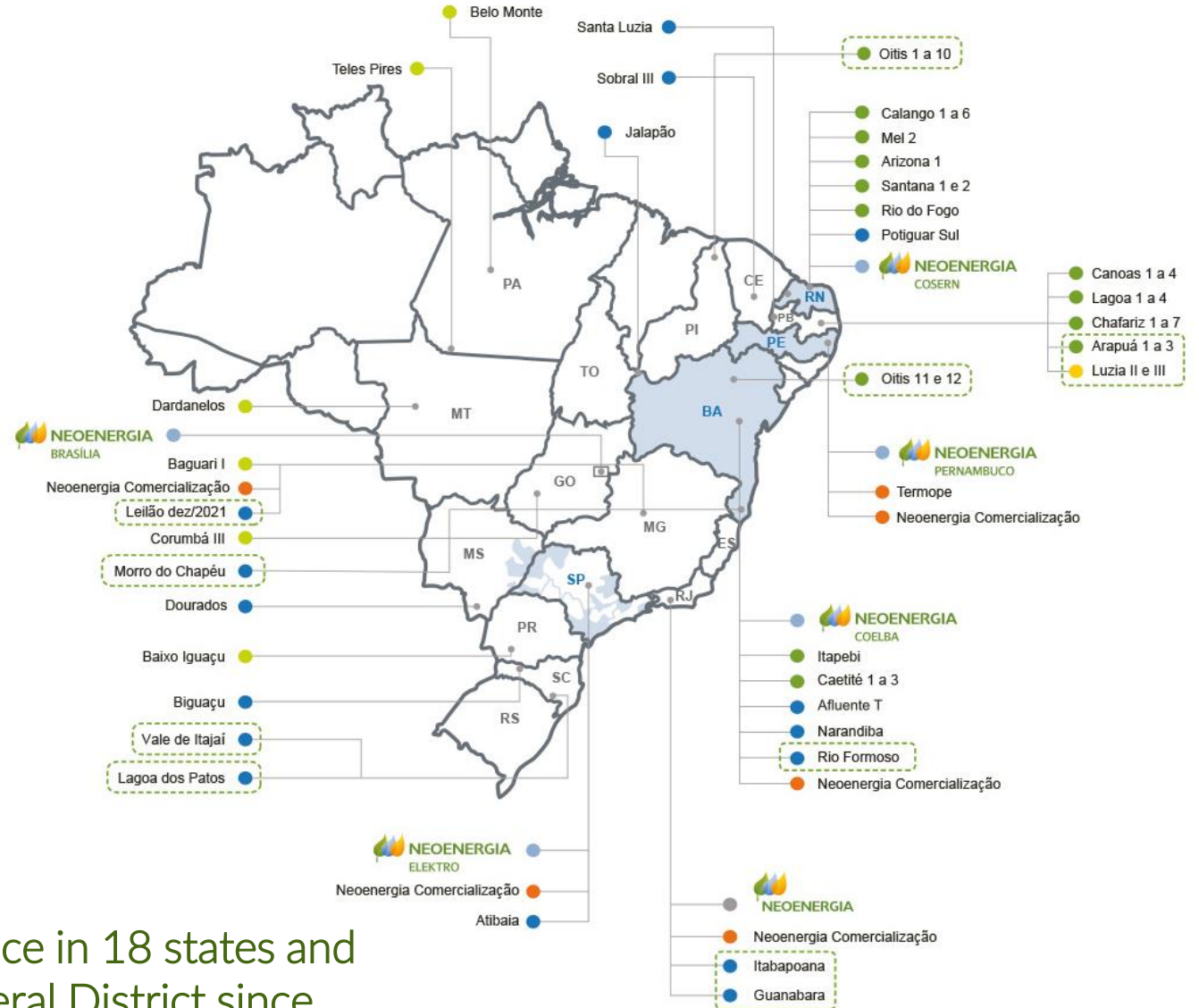
## OPEN MARKET

### Thermal generation

- 1 Plant in operation: 0,5 GW

### Marketing

- 767 Mwmed commercialized energy



Presence in 18 states and Federal District since March/21.

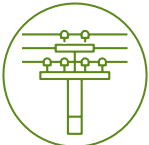
# Neoenergia COSERN in numbers



**1,4 M**  
Customers



**60 hab/km<sup>2</sup>**  
Population density



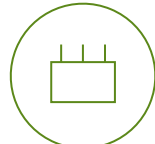
**58,541 mi**  
6 mi Underground Networks



**20,463 mi<sup>2</sup>**  
Concession área  
~West Virginia



**60 k**  
Transformers



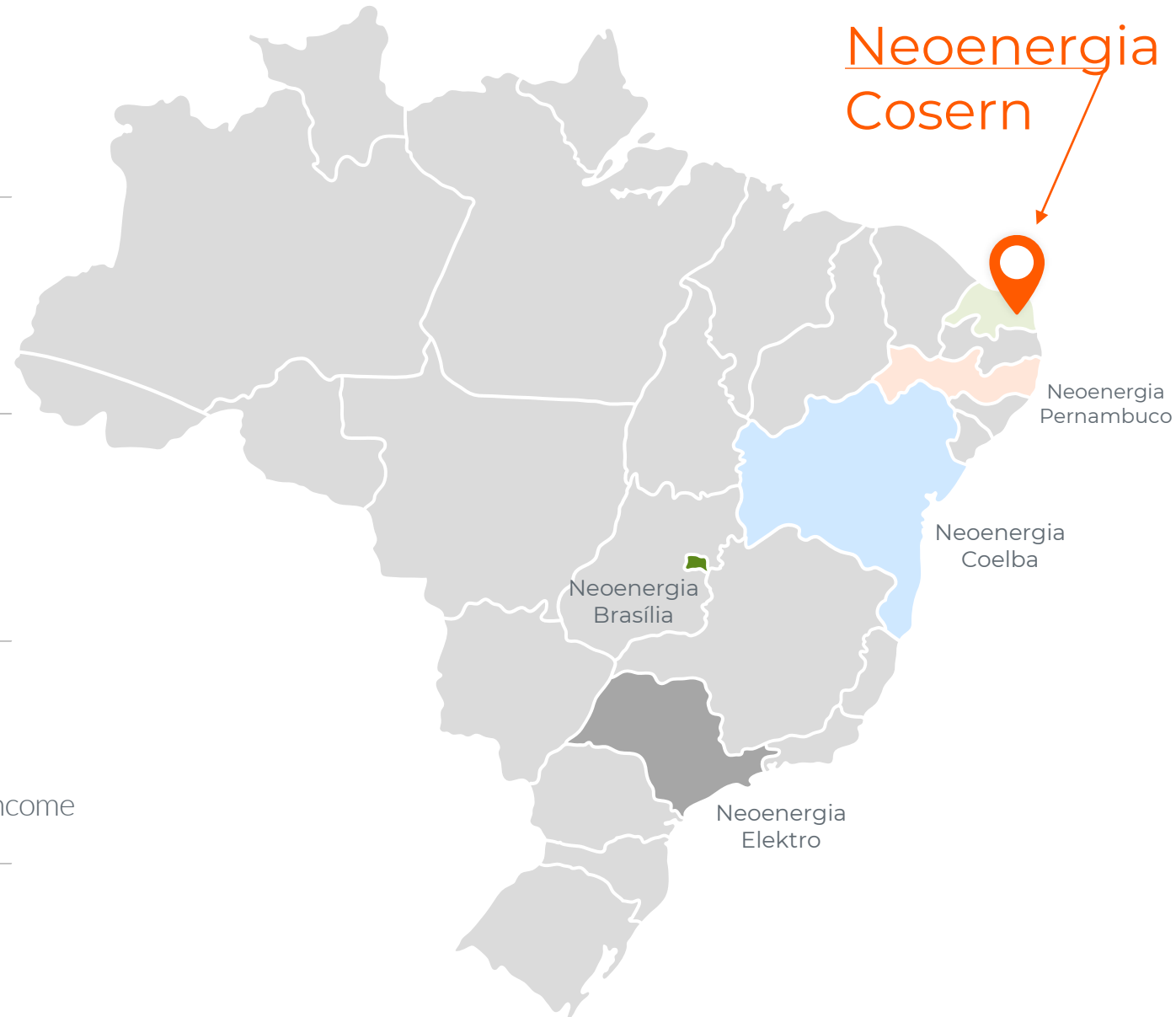
**78**  
Substations



**8,844 GWh/ano**  
Injected Energy



**253 US\$/person**  
14st Place per capita income  
in Brazil



# Neoenergia PERNAMBUCO in numbers



**3.8 M**  
Customers



**98 hab/km<sup>2</sup>**  
Population density



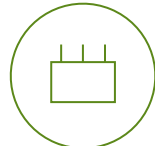
**146,087 mi**  
14.3 mi Underground Networks



**38,023 mi<sup>2</sup>**  
Concession área  
~ Ohio



**175 k**  
Transformers



**159**  
Substations



**14,246**  
**GWh/ano**  
Injected Energy



**202 US\$/person**  
23st Place per capita  
income in Brazil



# Neoenergia COELBA in numbers



**6 M**  
Customers



**25 hab/km<sup>2</sup>**  
Population density



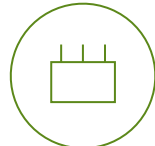
**339,651 mi**  
162 mi Underground Networks



**350 mi<sup>2</sup>**  
Concession área  
New Mexico + Texas



**315 k**  
Transformers



**367**  
Substations



**21,381**  
**GWh/ano**  
Injected Energy



**202 US\$/person**  
23st Place per capita  
income in Brazil



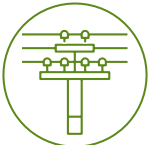
# Neoenergia ELEKTRO in numbers



**2,6 M**  
Customers



**166 hab/km<sup>2</sup>**  
Population density



**126,437 km**  
140 mi Underground Networks



**74,565 mi<sup>2</sup>**  
Concession área  
~Georgia



**210 k**  
Transformers



**155**  
Substations



**18,696**  
**GWh/ano**  
Injected Energy



**430 US\$/person**  
2nd Place per capita  
income in Brazil



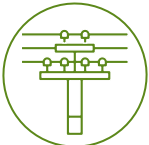
# Neoenergia BRASÍLIA in numbers



**1.15 M**  
Customers



**530 hab/km<sup>2</sup>**  
Population density



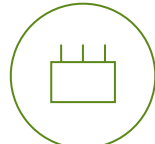
**14,000 mi**  
466 mi Underground Networks



**3,600 mi<sup>2</sup>**  
Concession área  
~Connecticut



**26 k**  
Transformers



**41**  
Substations



**7.590**  
**GWh/ano**  
Injected Energy



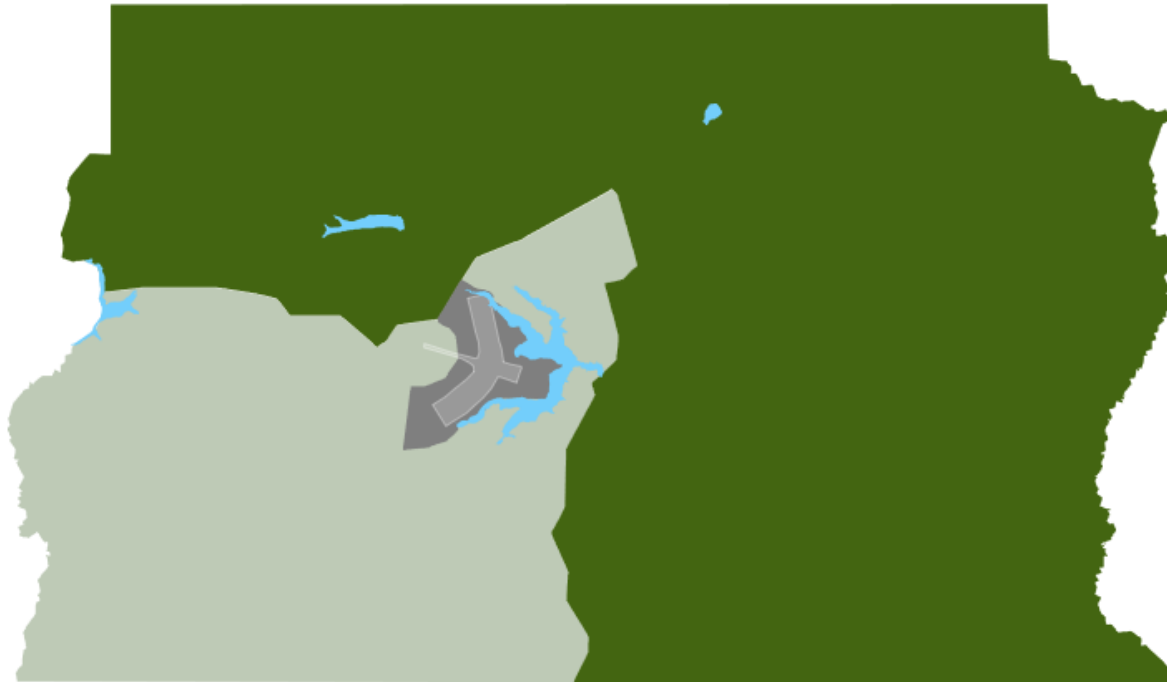
**495 US\$/person**  
Highest per capita income in  
Brazil



Neoenergia  
Brasília

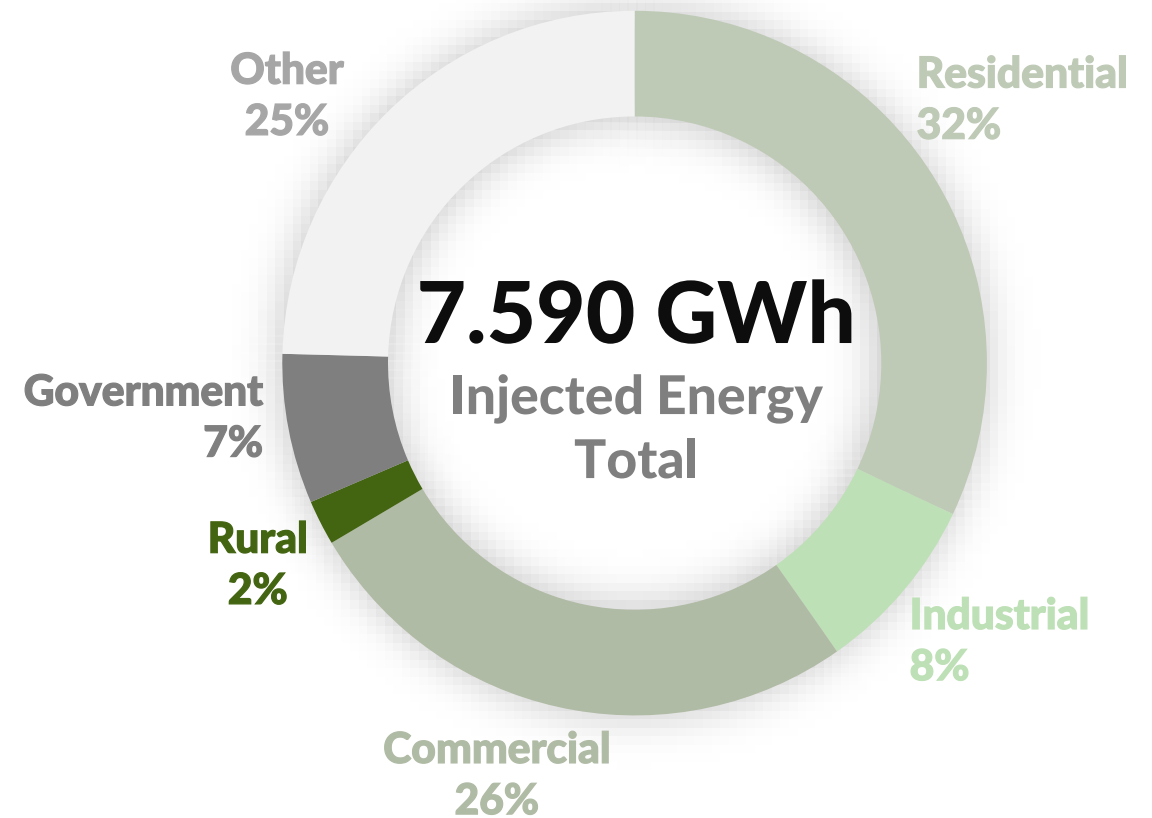
# Neoenergia BRASÍLIA Concession Area Characteristics

## TERRITORY



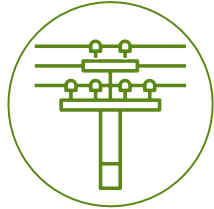
-  Predominantly Urban
-  Predominantly Rural
-  Federal Governmet
-  Pilot Plan

## ENERGY MARKET





# Regions with higher concentrations of **underground network**



Guará

Plano Piloto

Aguas Claras

Sudoeste/Octogonal


Taguatinga


Samambaia





# Underground Network - Numbers

 **138 kV**  
- 9 Lines  
- 26.2 mi Installed

 **34,5 kV**  
- 11 lines  
- 20 mi Installed

 **13,8 kV**  
- 143 circuits  
- 282.7 mi Installed

 **TRANSFORMING STATIONS**  
- 927 Units  
- 127 mil customers





# Underground Network - Numbers



+ 1,197 mil Primary Switches



+ 1,007 mil NWP



+ 531 Secondary Switches



+ 1,567 mil Transformers

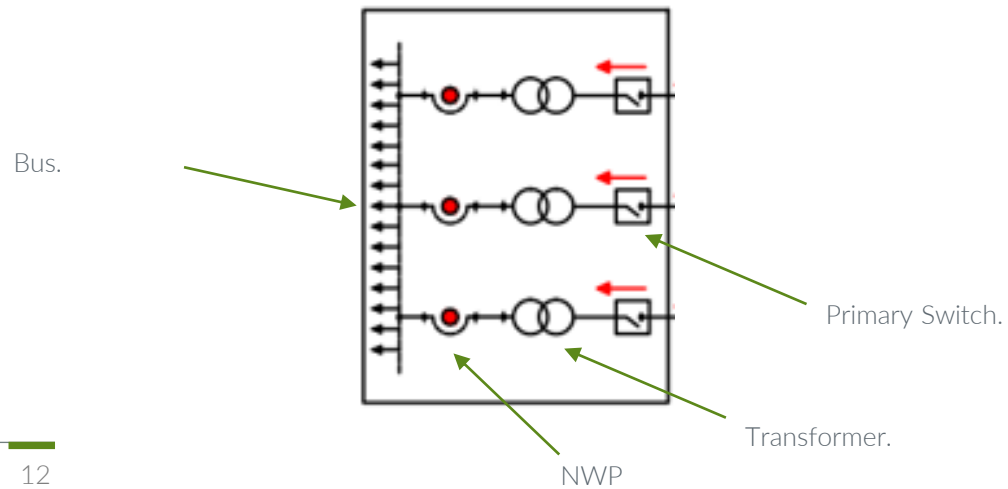


+ 1,46 mil Low Voltage Panel

# Spot Network System



Triple Spot Network  
Transformer Station



	Qty
Westinghouse	253
GE	284
Richards	10
Futura	402
Beghuim	58
<b>Total</b>	<b>1007</b>

## Pros

- ✓ Robust equipment;
- ✓ Low failure rate;
- ✓ Easy maintenance;
- ✓ Unventilated enclosure;
- ✓ Interchangeable;
- ✓ Fully extractable (safety).

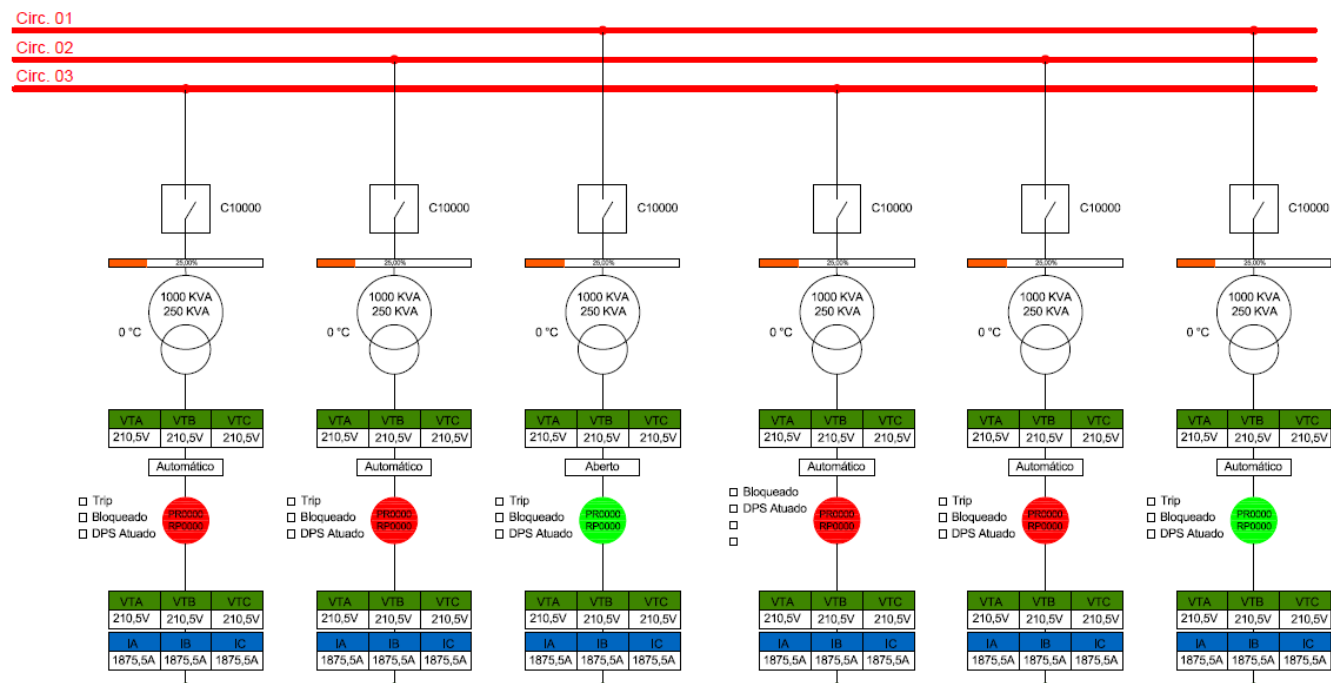
## Cons

- ✗ Requires periodic maintenance for mechanical adjustment.
- ✗ The lack of maintenance results in wear when under constant nominal operation.

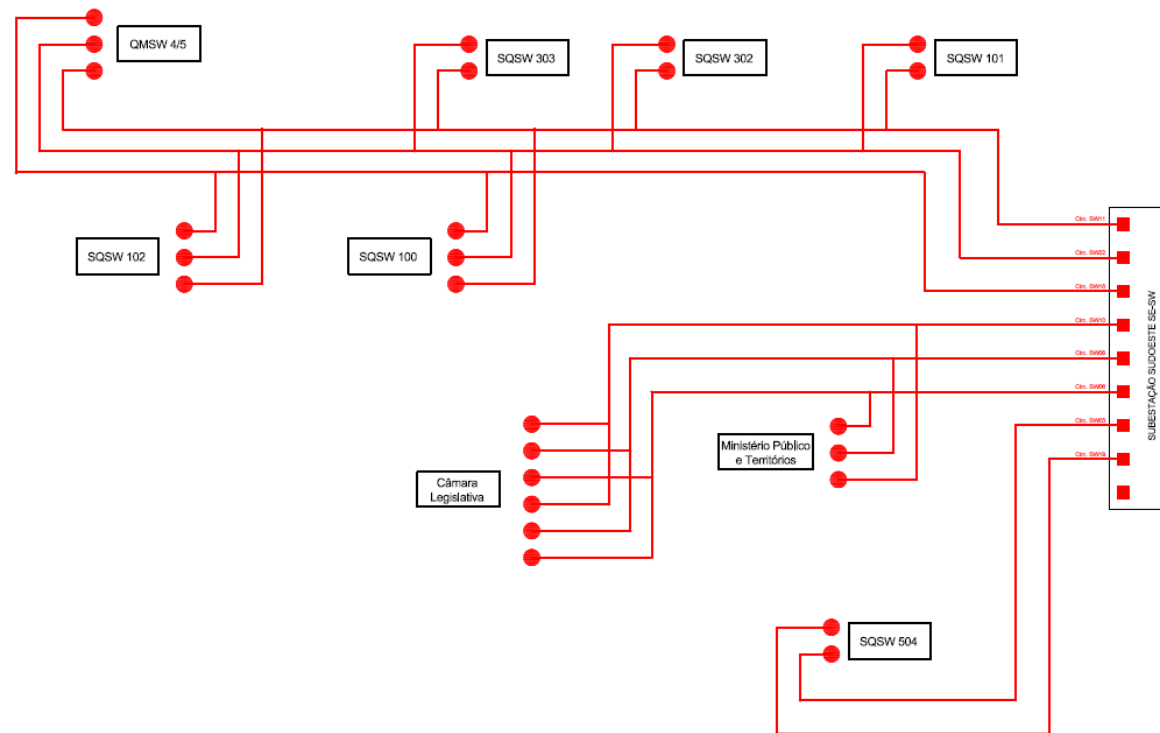


# NWP Supervision

## Suggested model



SCADA screen example

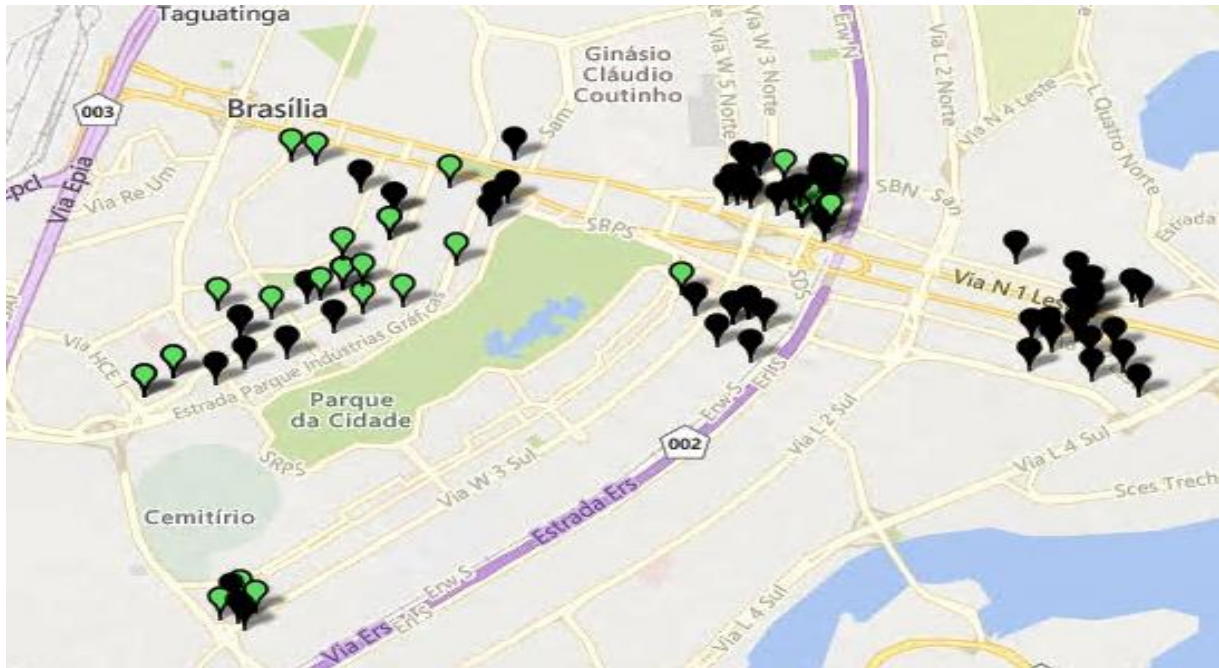


Example of a single-line diagram screen.



# Supervisory System - NWP

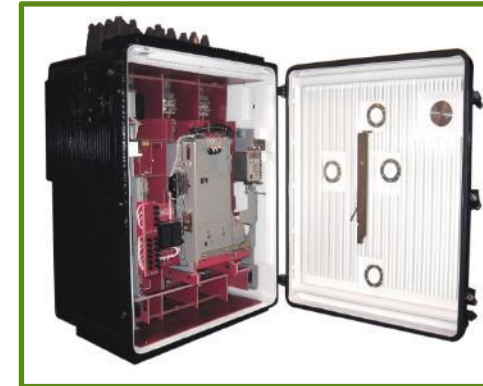
## Deployed Screens



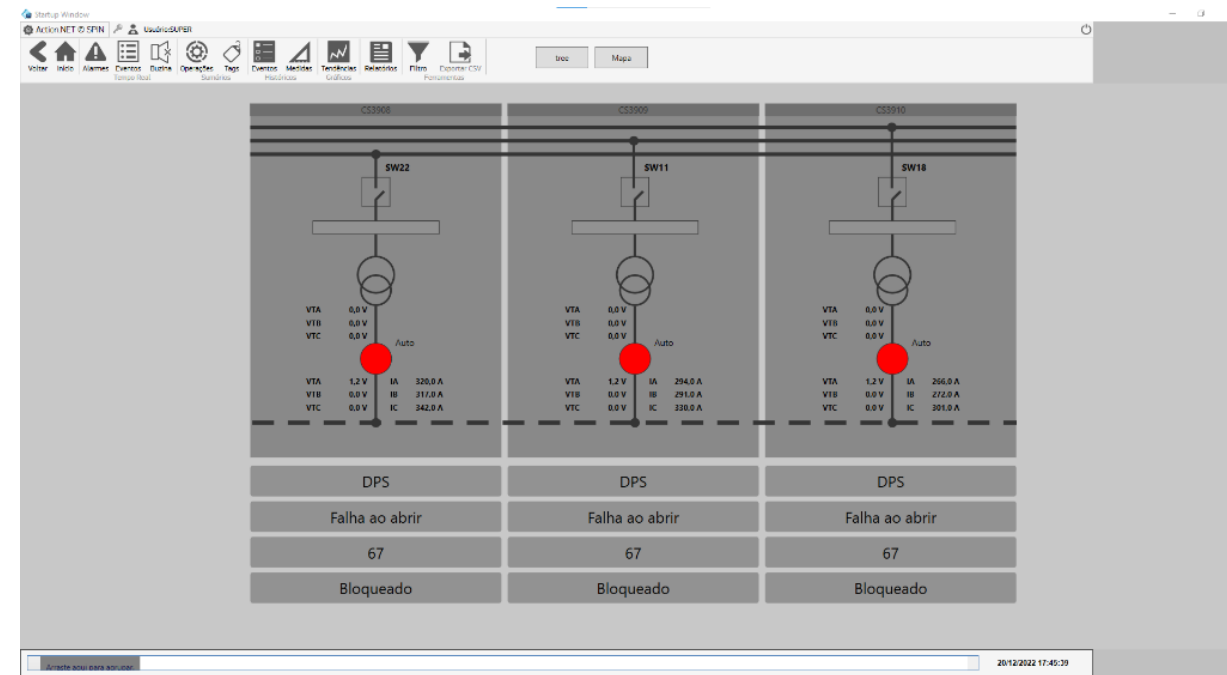
First screen with Available Equipments and Location



Internal Use

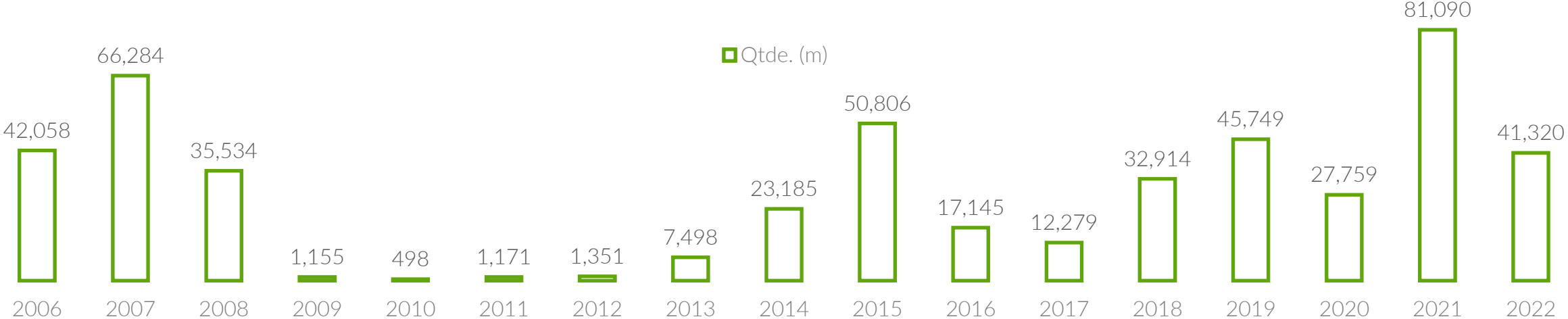


- Voltage
- Current
- Power
- Transformer Temperature
- Ambient Temperature
- NWP Temperature
- Lever Status
- Open/ Close
- SPD Status
- Door Status
- Protocol: DNP under Fiber Optics



Screen with NWP Information

# Underground Thefts Historical



303 mi  
cables in  
16 years



Thefts Reduction  
in 2022

26%



Working together  
Public Security  
Secretary





# Underground Networks

*Obrigado!*

*Thank you!*