

# 26<sup>th</sup> World Gas Conference

1 – 5 June 2015 – Paris, France



**WGCPARIS2015-G/33-126**

## INTEGRATING CONTROL AND MONITORING SYSTEMS IN GAS GRIDS WITH SECURITY ISSUES IN IRAN GAS INDUSTRY

Saeid Momeni/Behzad Babazadeh  
National Iranian Gas Company





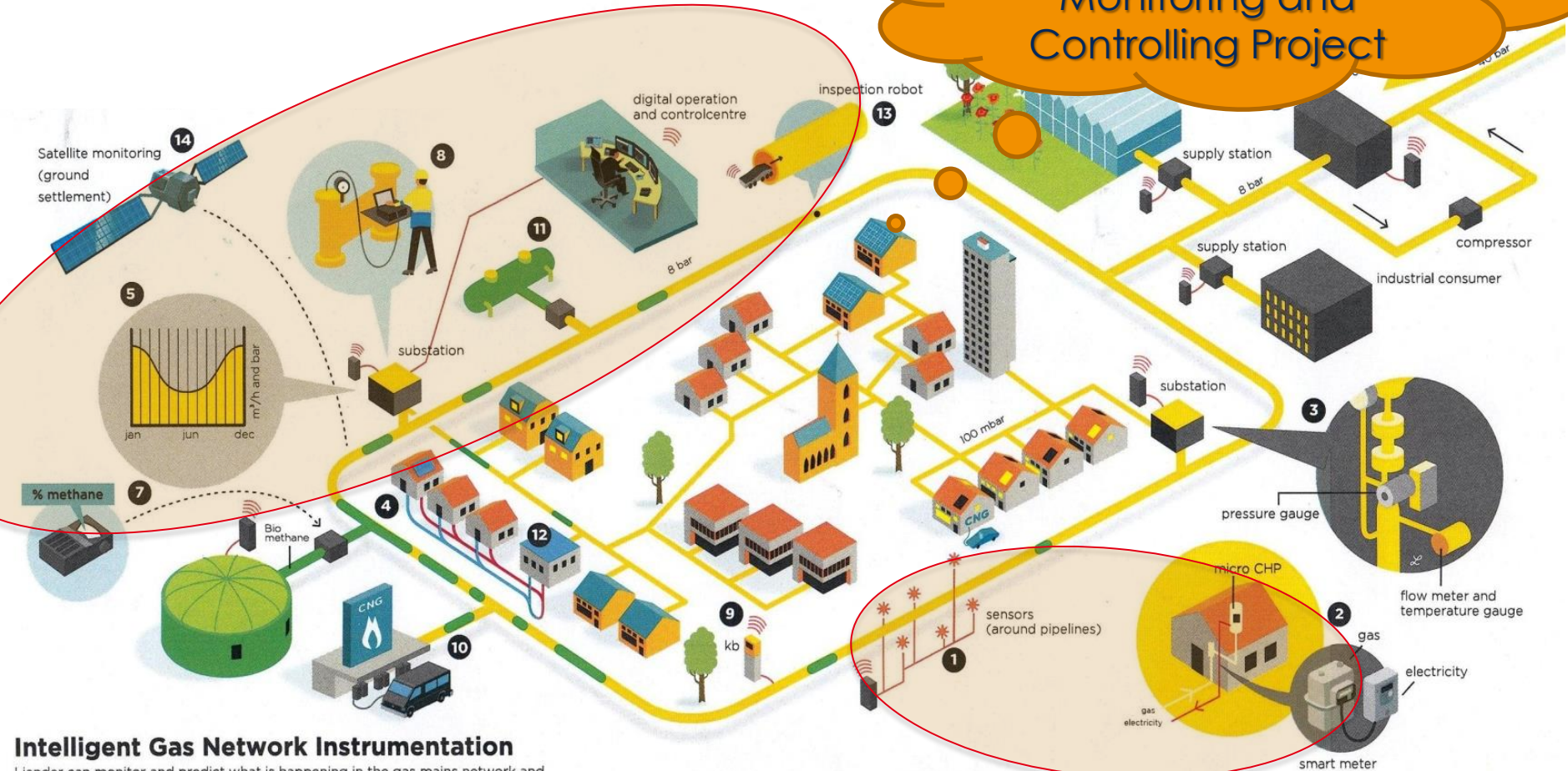
# Contents

- A. Introduction: **Smart Gas Grids**
- B. Control , Monitoring & Data integrity
- C. Control and monitoring tools
  - I. **Home smart metering**
  - II. **Integrated gas monitoring and automation**
  - III. **Gas SCADA system**
  - IV. **Wireless sensors in gas grids**
- D. **Security Issues**



# Smart Gas Grid

Thus the Pilot has been planned, called Monitoring and Controlling Project



## Intelligent Gas Network Instrumentation

Liander can monitor and predict what is happening in the gas mains network and intervene in timegrid using remote measuring and control equipment.

### 1 Gas Grid Monitoring

Sensors measure ground vibrations, traffic loads, ground settlement, gas leakages, etc, around gas mains 24/7.

### 2 Smart Metering

Gas meters record gas consumption profile and make this data available in digital format.

### 3 Measurements in stations

Remote monitoring of gas inlet and outlet pressures, volumes and temperatures.

### 4 Gas Diffusion

Sensors and computer models measure and predict gas flow diffusion and mixing.

### 5 Dynamic Pressure Management

Varying the gas pressure depending on demand and supply.

### 6 City Gate

Real-time GTS (Gasunie) data for gas outlet pressures, volumes, temperatures and quality.

### 7 Monitoring Gas Quality

The quality of bio methane added to the grid is monitored 24/7.

### 8 Station Diagnostics

Periodical diagnostics are run to ensure control systems are working properly.

### 9 Cathodic Protection

Remote diagnostics and monitoring of the polymer coating around steel pipelines.

### 10 Gas for mobility

Filling stations for gas used as vehicle fuel on the road and on the water.

### 11 Local Storage

Storage of overcapacity of bio methane.

### 12 Energyhub in residential area

CHP analog gas driven heat pump for district heating and electricity.

### 13 Inspection Robots

Internal pipeline inspection.

### 14 Satellite Monitoring

Monitoring ground settlement at a street and neighbourhood level.



# Main **BENEFITS** of Control and monitoring systems in gas grids in our project

- Network efficiency
- Reduction of pressure losses
- Energy savings
- Reduction of gas storage utilization (in/out)
- Security and emergency management:
  - Quick detection of anomalies or failure
  - Management of a critical path to guarantee constant flows
  - Data management about the possibility to switch with other energy sources



# Control and monitoring **CHALLENGES** in gas grids

- Safety, Reliability, and System Integrity
- Cost Control and Productivity Enhancement
- Real time monitoring of the network
- Environmental Aspects
- Security Issues



# Control and monitoring **REQUIREMENTS** in gas grids

- Gas quality remote monitoring
- Analyzing gas quality at the injection points in the network
- Active flow and pressure remote control
- Improved network analysis and capacity planning
- Bidirectional gas networks



# Iranian Gas Industry

## Control and monitoring tools in gas grids

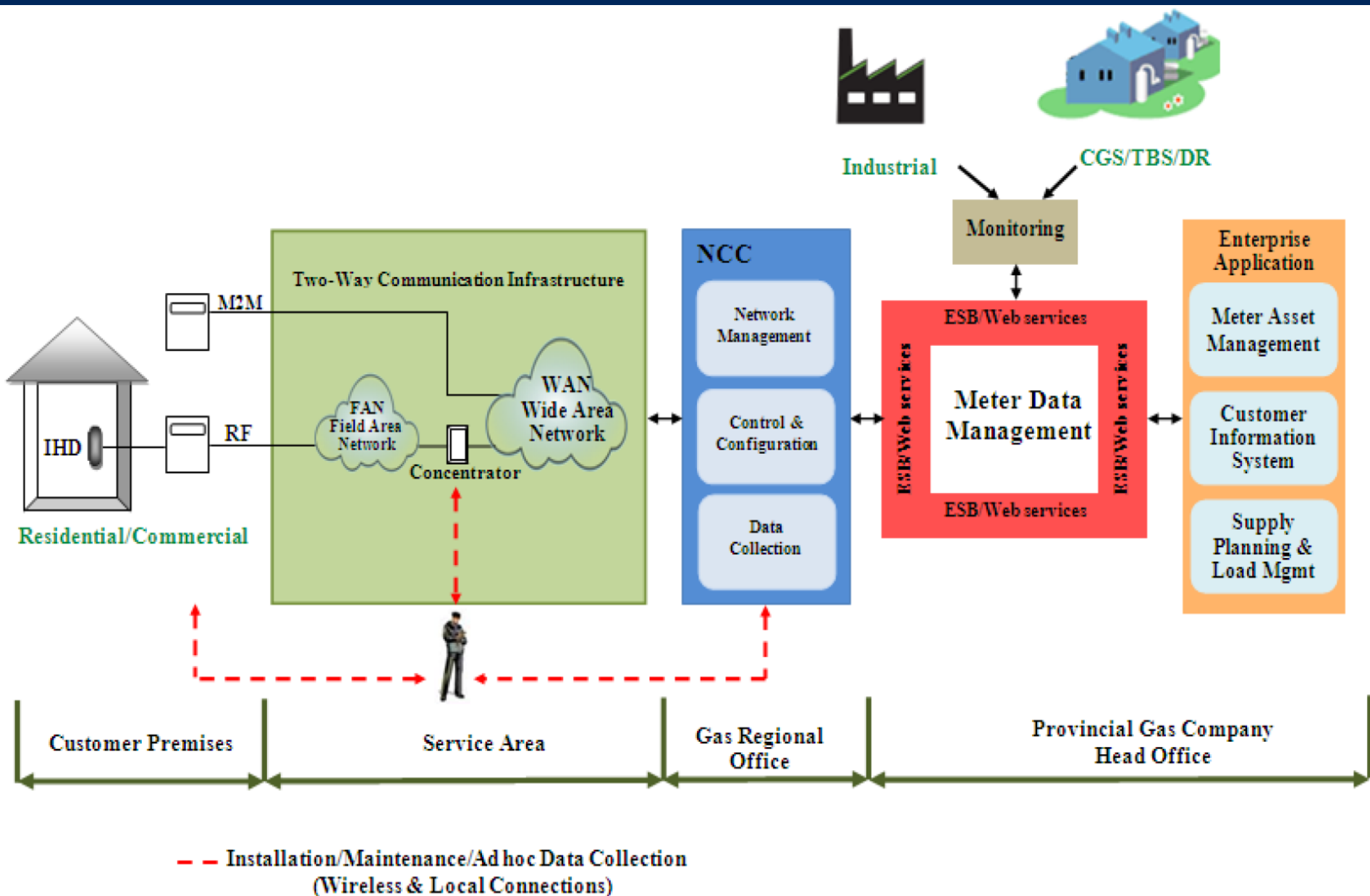
### 1. Home Smart Metering Advantages

- Gathering and storing hourly and daily data of smart metering
- Communicates to a central system
- Provides outage notification
- Acts as a control device
- Interfaces with in-home display & home area networks



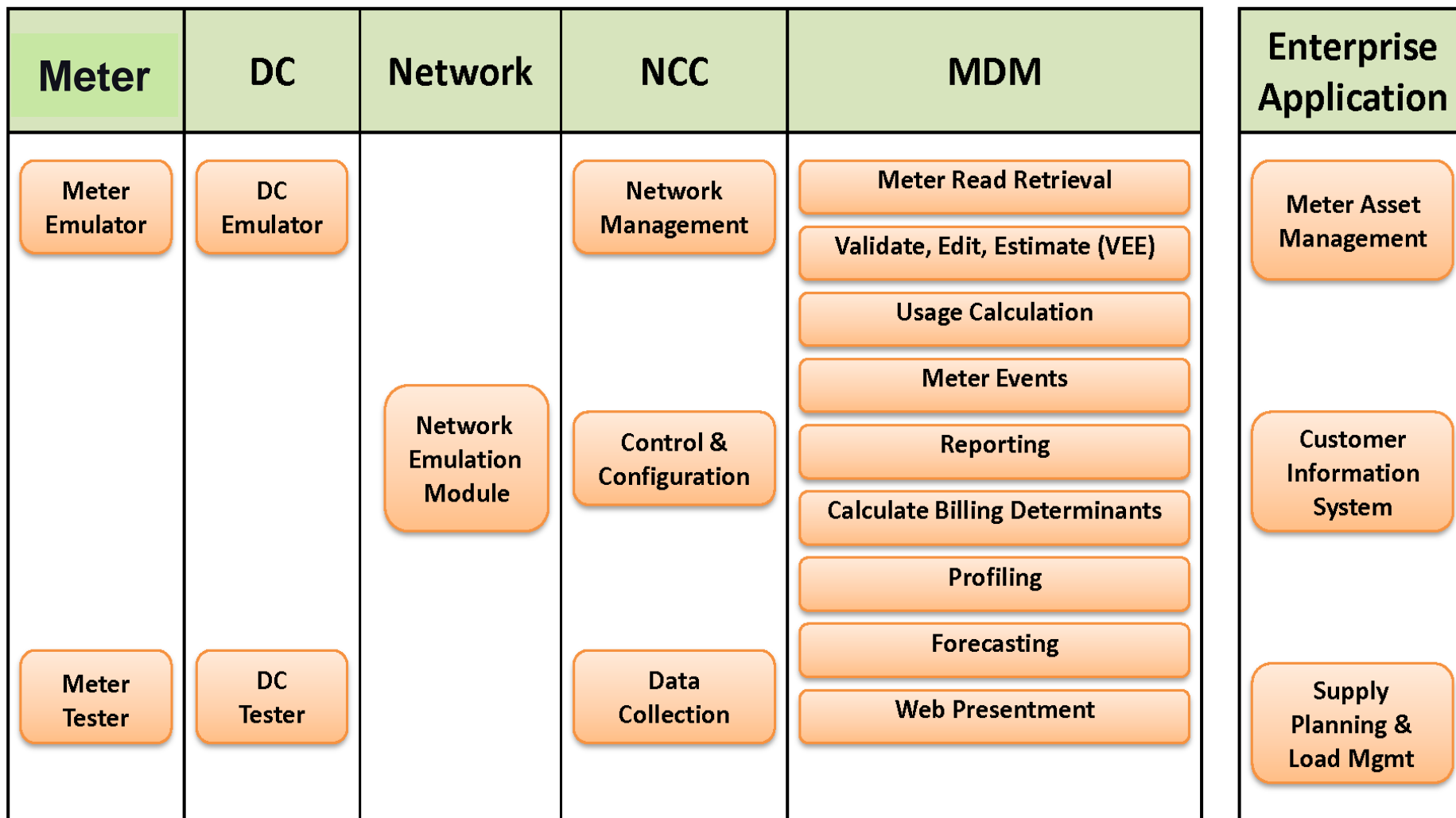


# Conceptual Model for Smart Metering Model





# Software Model for Smart Metering System





# Iranian Gas Industry

## Control and monitoring tools in gas grids

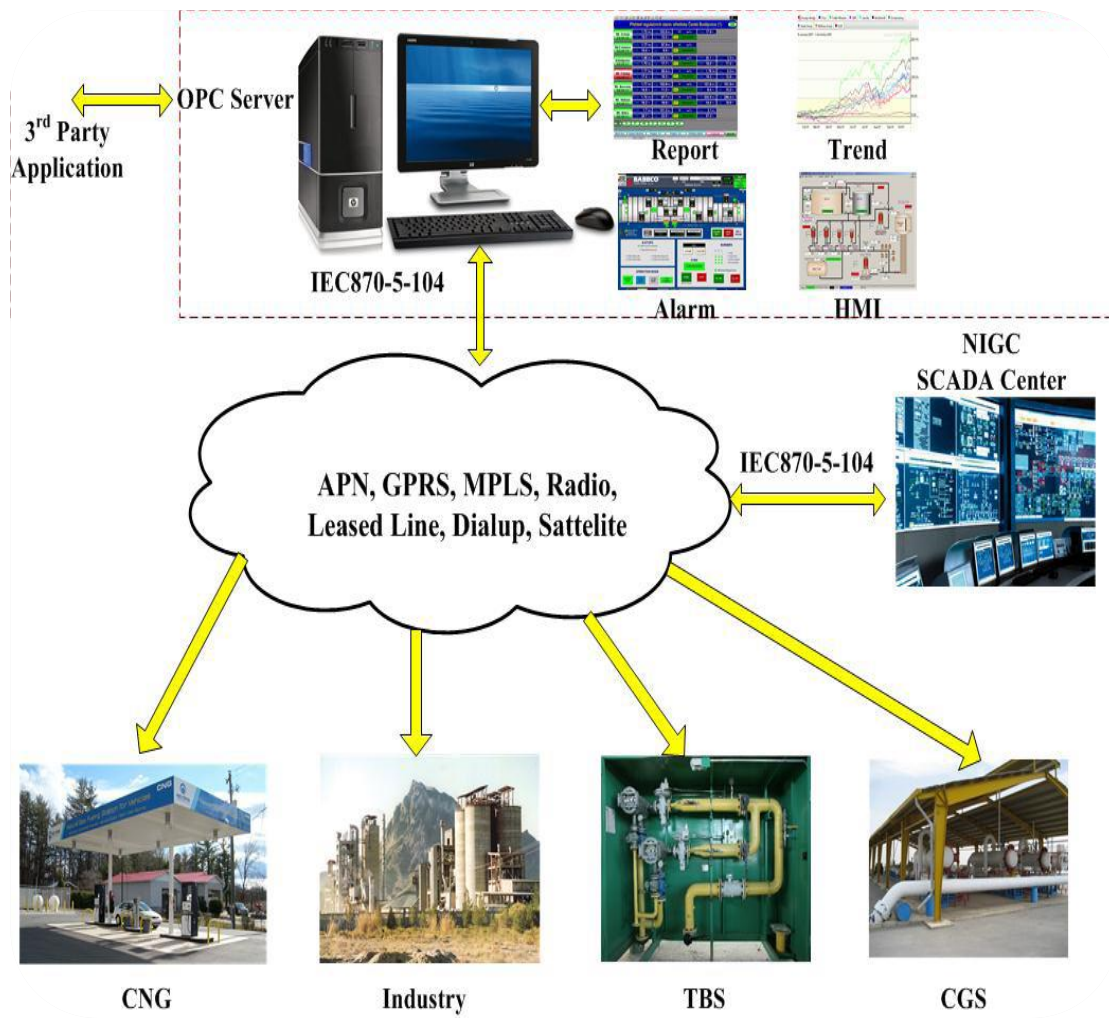
- In the project, an integrated control and monitoring system for all T.B.S and C.G.S stations is performed.
- All stations is monitored and control from the Central Control Room.
- All the data of this system are available to the GIS and the Management Information Systems in the company.
- Wireless Sensor Networks are also used for easier and safer monitoring of the stations. We are using some of these sensors.
- Intelligent monitoring algorithms being developed to forecast the changes in trends of conditions and also for better presentation of data received from sensors.



# Iran Gas Integrated gas monitoring and automation system

## 2. Integrated gas monitoring and automation

- C&M system for T.B.S & C.G.S
- CCR
- GIS data contact to MIS
- WSN
- Intelligent Monitoring





# Integrated gas monitoring and automation

**Industrial automation  
and monitoring systems**

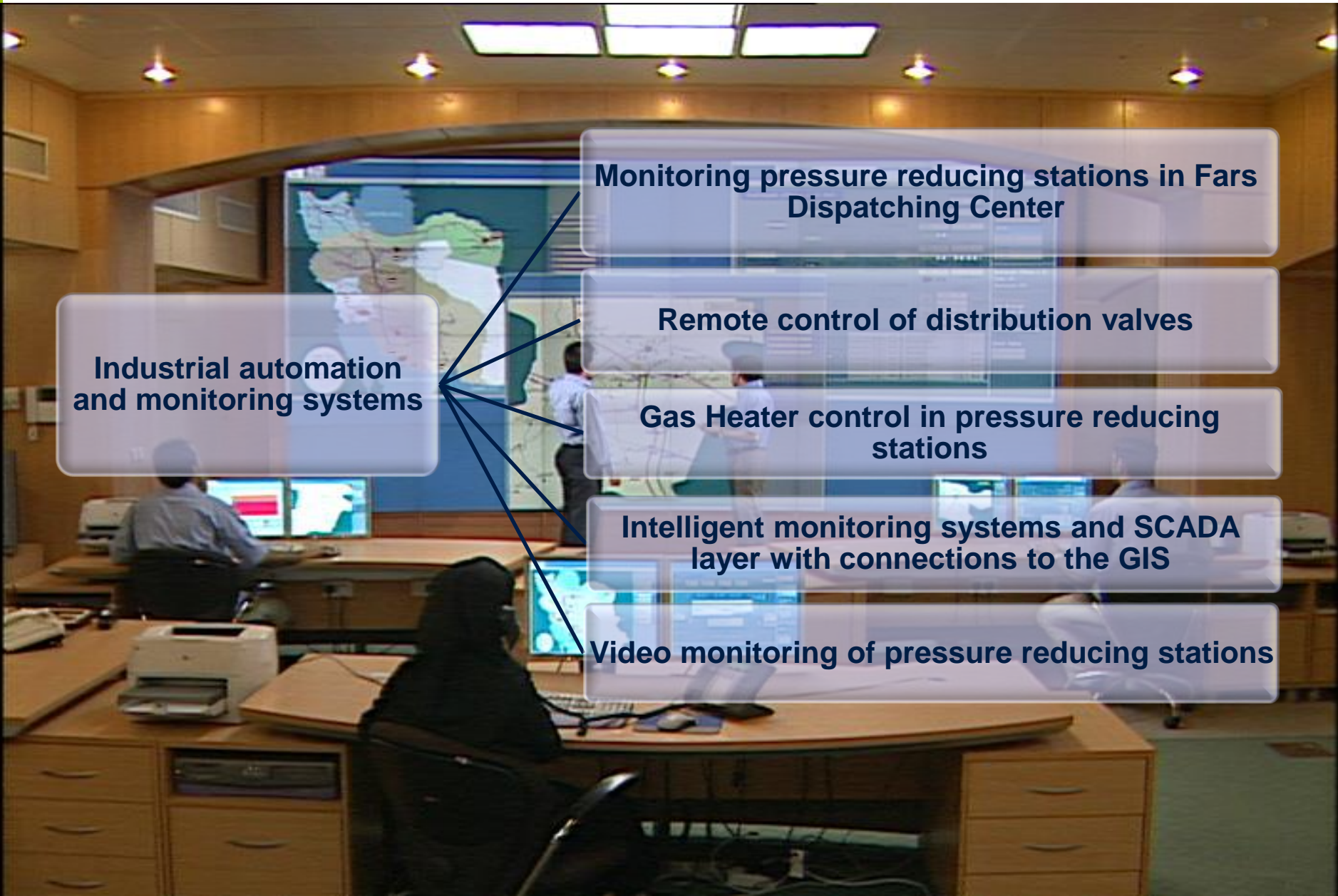
**Monitoring pressure reducing stations in Fars  
Dispatching Center**

**Remote control of distribution valves**

**Gas Heater control in pressure reducing  
stations**

**Intelligent monitoring systems and SCADA  
layer with connections to the GIS**

**Video monitoring of pressure reducing stations**

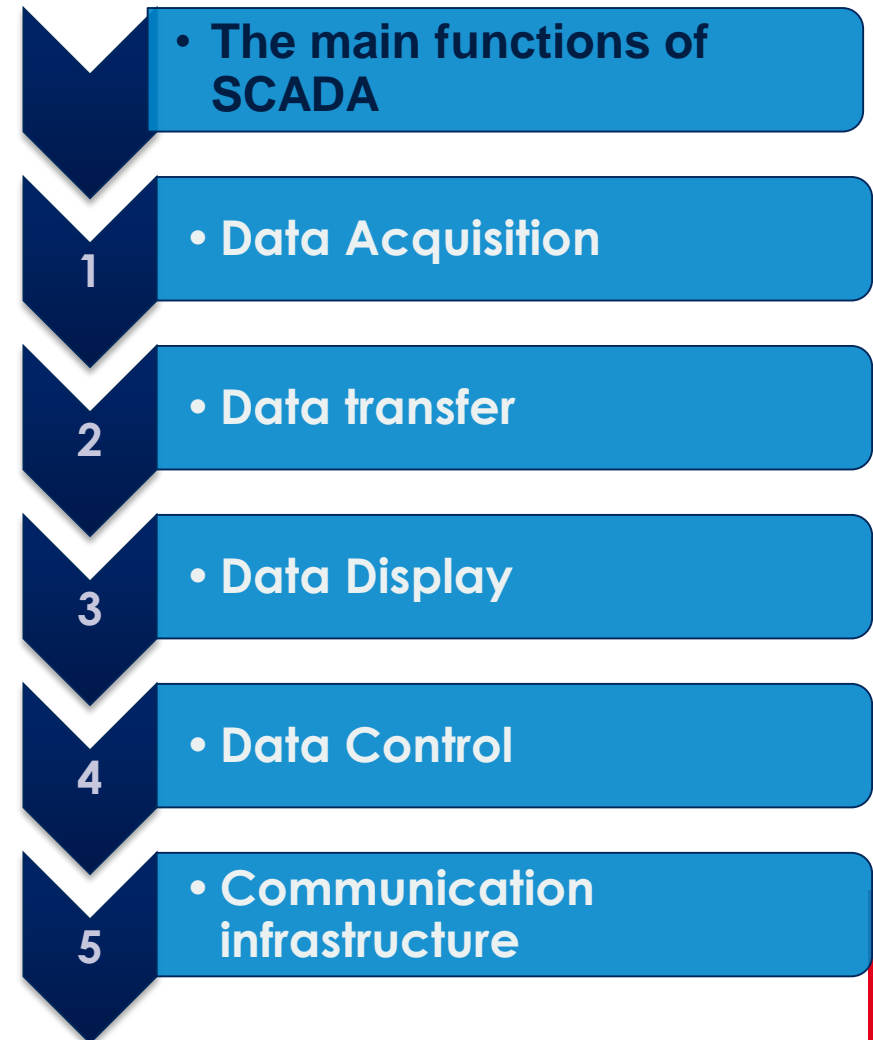
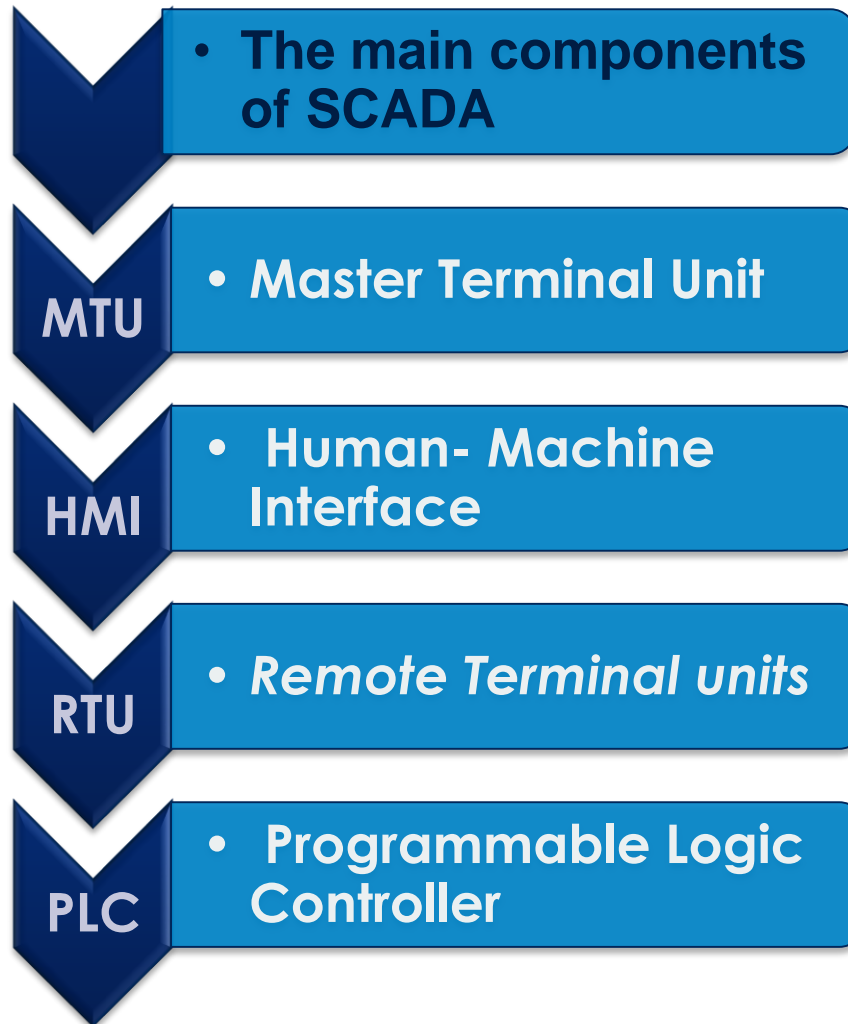




# Iranian Gas Industry

## Control and monitoring tools in gas grids

### 3. Gas SCADA system





# Iranian Gas Industry

## Control and monitoring tools in gas grids

### 4. Wireless Sensors in gas grids





# Applications of wireless sensors in gas grids

- Process Control Systems, (like SCADA, DCS, PLC, etc)
- Fire & Gas Solutions
- End-to-end Control Solutions
- Unit Control Systems
- Cost Effective Leak Detection and
- Repair Monitoring of Fugitive Emissions





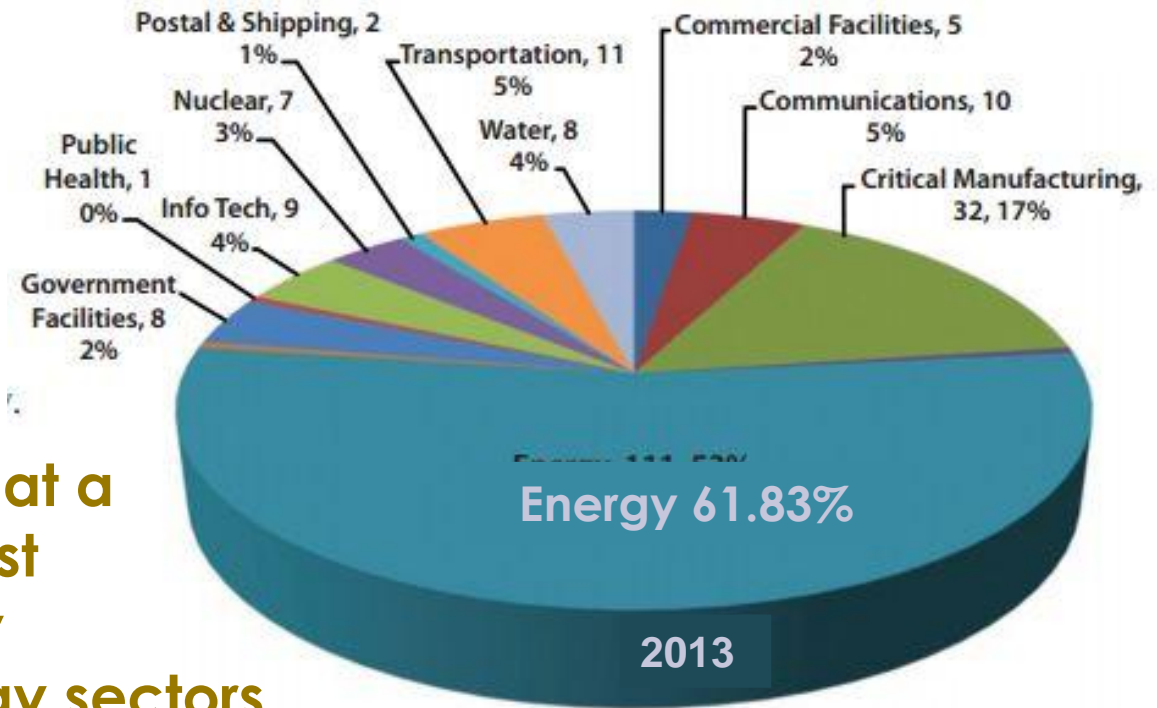
# Advantages of wireless sensors in gas grids

- Securely access remote locations
- Reduce installation, maintenance and operating costs
- Continuous monitoring enables abnormal readings to be identified so early
- Increase plant safety
- Early detection of loss of flow is now possible
- Reduced number of manual measurements in hazardous areas



# Security issues in industrial systems

Secure and robust energy networks are essential for the continued improvement in the operation of the energy market. This will only be possible if the associated information and communication networks are secure and robust.



Recent studies show that a surge of attacks against control systems mainly belonging to the energy sectors.



## Attack into Control Systems via Field Devices

- Today new field equipment itself has the capability to be accessed remotely
- When left unsecured, an attacker can connect remotely with little effort, and the remote connection may be difficult to detect
- Even secured modems with user identities and passwords are still sensitive to attacks
- We need very efficient and effective methods to protect against such problems.



**Thanks For  
Your Attention!**

