



PiMSOFT
INNOVATIVE SOLUTIONS

Sigmafine for Gas Transportation & Distribution

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Pimsoft S.p.A.



Milan

SIGMAFINE SUMMIT 2019™
engineering data for digital transformation

Table of Contents

- 1 Industry forecast**
- 2 Natural Gas Value Chain**
- 3 Sigmafine application**
- 4 Advantages & benefits**



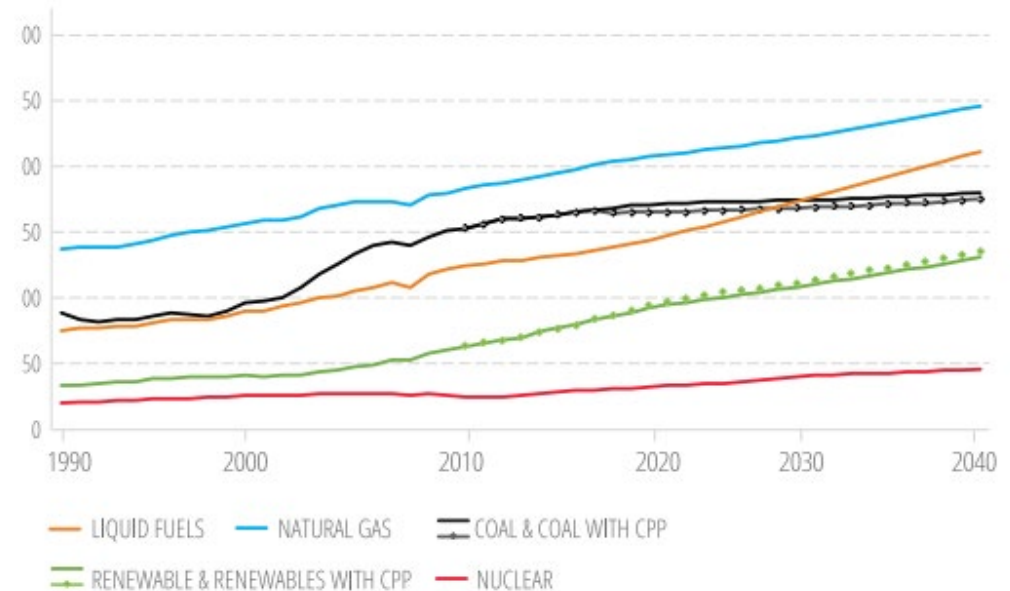
Sigmafine for Gas Transportation & Distribution

Gas industry forecast

Gas is projected to be fastest growing fossil fuel:

- Expected 1.6% annual growth until 2040
- Growth rate doubled in 2017 driven by Chinese economy and the continuing European recovery

World Energy Consumption by Fuel, Quads
(EIA, 2016)



Source: GLOBAL NATURAL GAS INSIGHTS • 2017 EDITION, IGU



Gas industry forecast

Gas is projected to be fastest growing fossil fuel:

- Expected 1.6% annual growth until 2040
- Growth rate doubled in 2017 driven by Chinese economy and the continuing European recovery

Key markets development:

- Economic growth
- Global gas supply
- Government policies

Source: GLOBAL NATURAL GAS INSIGHTS • 2017 EDITION, IGU

Key developments

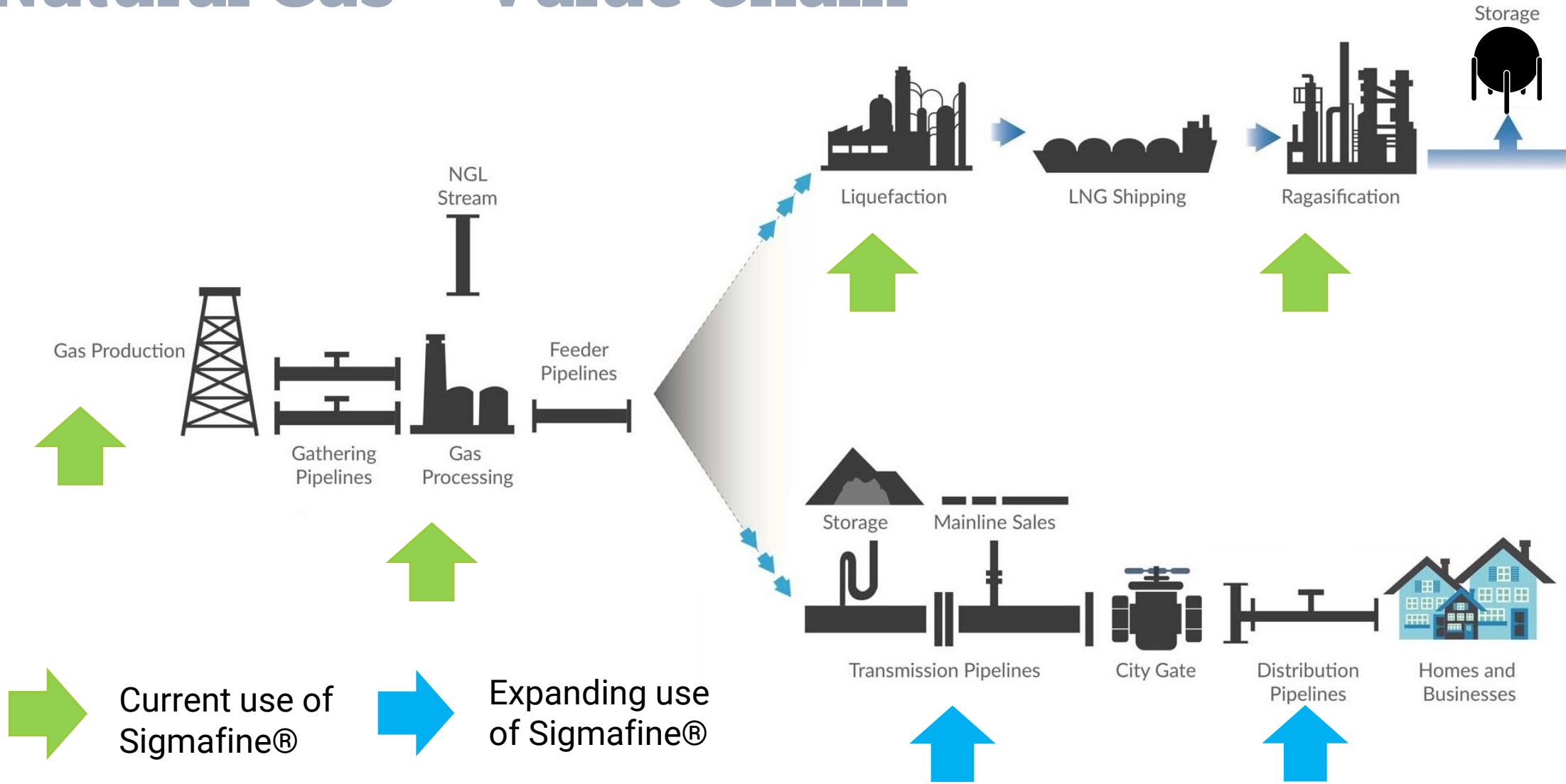
Continued demand and supply growth



- Chinese demand jumps 150% in 2017 - 2018
- China surpasses Japan as the largest LNG importer
- Australia became the largest LNG exporter
- US doubled its LNG exports in 2018
- Southern Gas Corridor: physical connection of Trans Adriatic Pipeline (TAP) and the Trans Anatolian Pipeline (TANAP)
- Natural gas pipeline connecting Russia to China is nearing completion

Source: Norway Diplomatic Forum, Oslo, IGU

Natural Gas – Value Chain





Real time data infrastructure

- Efficient management of the gas network
- Aggregation & analysis of data & information collected from the field
- Easy access to the information by the different stakeholders
- Provide KPIs that can be used across the organization
- Facilitate data & information sharing
- Integration with existing applications (e.g. SAP, ...)
- Scalability & extensibility over time

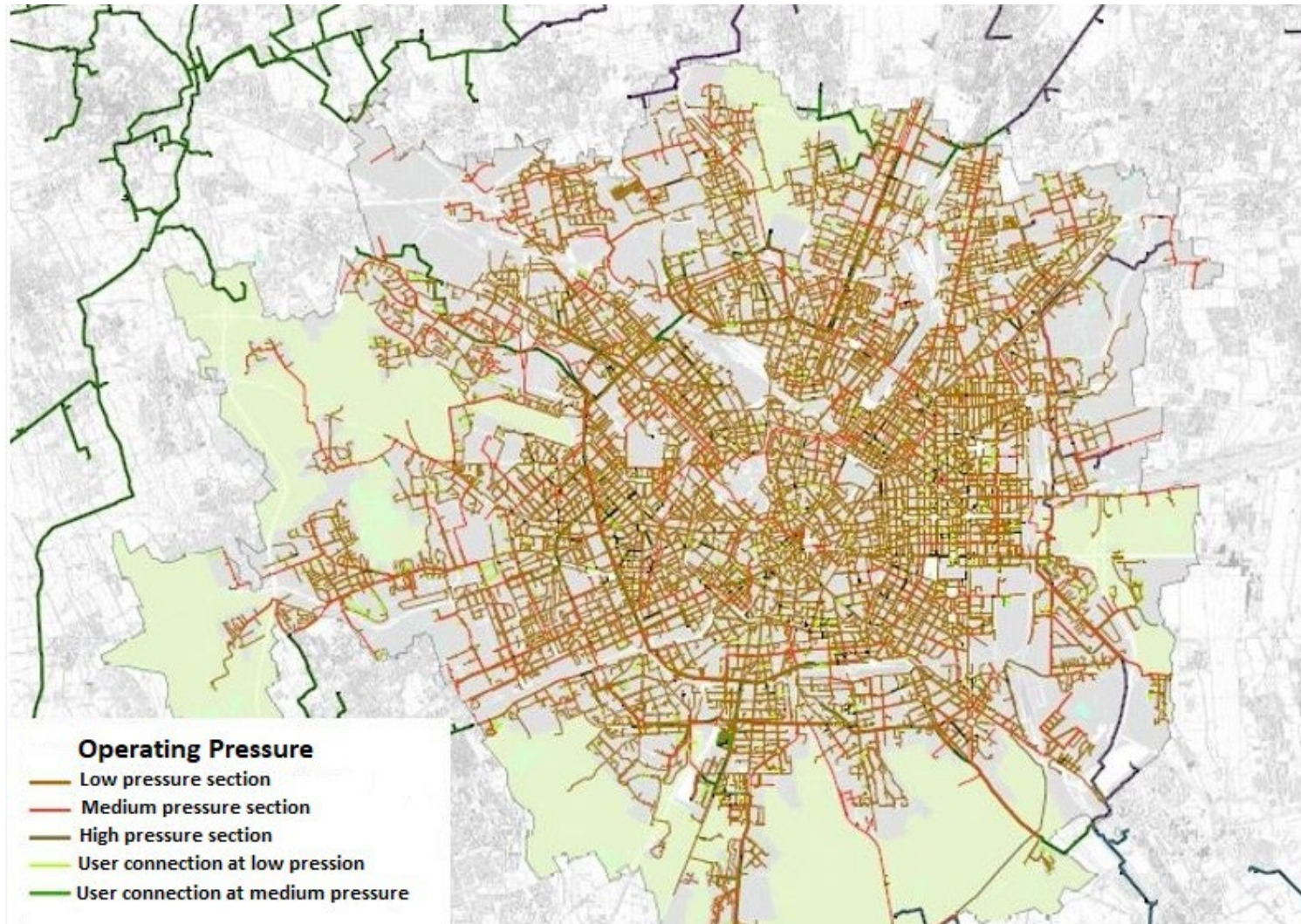
How Sigmafine is applied...

- 1. Create a topological model of the gas network**
- 2. Generate reconciled solution minimizing the overall measurement errors**
- 3. Enabling...**
 - Gas network balance
 - Estimation of unmeasured flow rates
 - Monitoring & estimation of losses
 - Generation of KPIs related to processes, sensors & meters
 - Tracking gas ownership
 - Business process integration
 - Data distribution to third party applications/customers/vendors



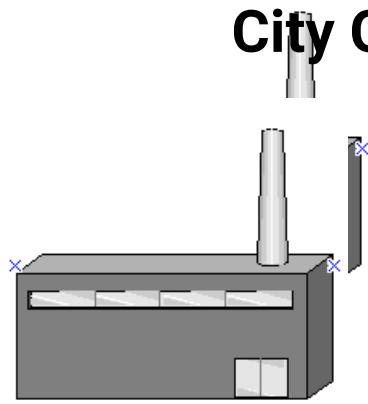
Examples of application

City gas distribution network

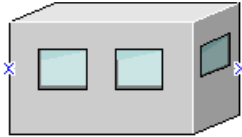


Nodes in the distribution network

City Gas Station



SF_CityGasStation1



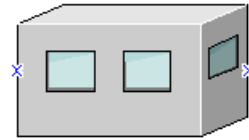
SF_Iri1



SF_Grf1

Filter		
Name	Value	
Category: City Gas Station Room		
Boiler room: closed door	True	
Decompression room: closed door	True	
Electrical room: closed door	True	
Category: Electricity Network		
Battery voltage	0 V	
Power supply from active UPS	False	
Power supply from grid	True	
Category: Gas decompression line		
Pressure: In	45 bar	
Pressure: Out	5 bar	
Relative gas humidity	0 %	
Summer gas line in operation	False	
Temperature In	10.5 °C	
Temperature Out	7.7 °C	
Winter gas line in operation	True	
Category: Odorant		
Daily odorization rate	15.3 mg/Nm3	
Instant odorization rate	16 mg/Nm3	
Odorant tank level	561 mm	
Odorant tank: Last refill date	12/30/2018 2:59:49 PM	
Sistema dosaggio automatico odoriz...	True	
Category: Preheating		
Boiler 1: in operation	False	
Boiler 1: working hours	150 h	
Boiler 2: in operation	True	
Boiler 2: working hours	270 h	
Preheating water temperature	20.3 °C	
Pump 1: in operation	True	
Pump 1: working hours	320 h	
Pump 2: in operation	False	
Pump 2: working hours	290 h	

Intermediate pressure reduction station



SF_Iri1

Filter		
Name	Value	
Category: Gas decompression line		
Pressure: In	5 bar	
Pressure: Out	0.4 bar	
Relative humidity gas	0 %	
Temperature: In	7 °C	
Temperature: Out	6.9 °C	

Pressure reduction station

Final gas pressure reduction station

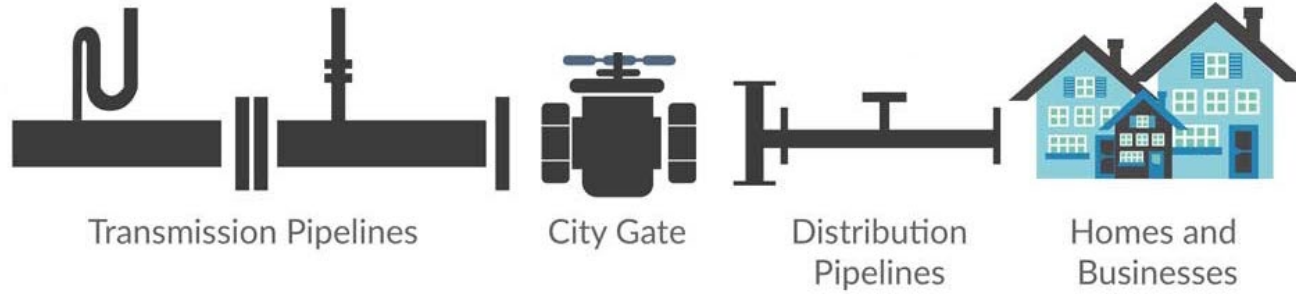


SF_Grf1

Pressure reducti

Filter		
Name	Value	
Category: Gas decompression line		
Pressure: In	0.4 bar	
Pressure: Out	0.022 bar	
Relative humidity gas	0 %	

Gas Distribution Network Balance



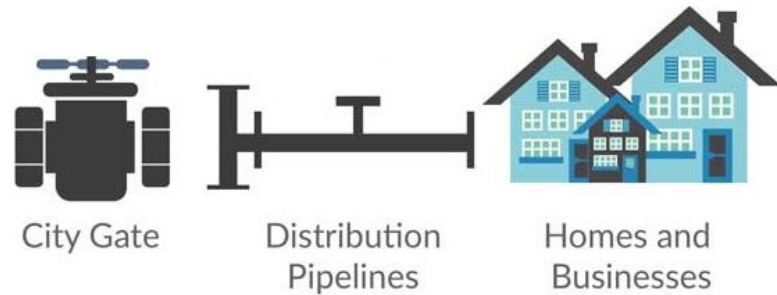
Fiscal measurements:



Non Fiscal measurements installed on the distribution network:



Gas Distribution Network Balance



Gas Network balance equation:

Input (Transmission Pipelines) – Gas Consumption – Output (Final Users) \neq 0



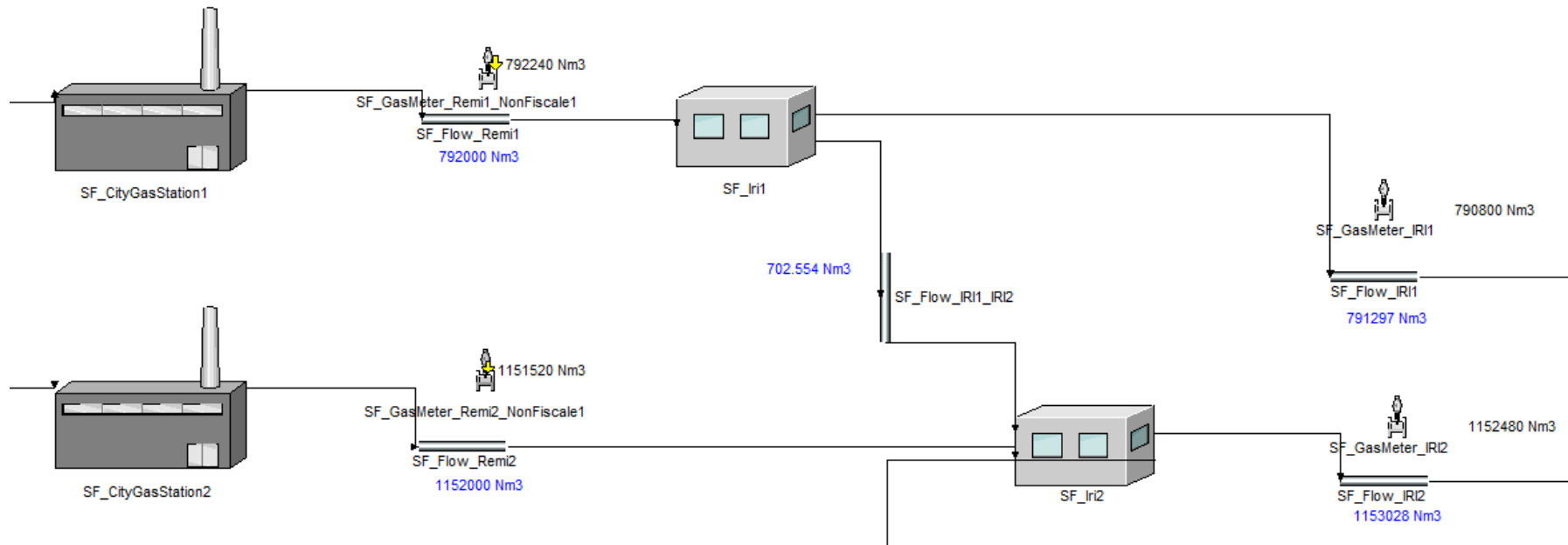
Discrepancies can be due to:

- **Losses**
- **Illegal connections**
- **Meter failures**

Gas Distribution Network Balance

Gas Network balance equation using Sigmafine:

Input (Transmission Pipelines) – Gas Consumption – Output (Final Users) = 0

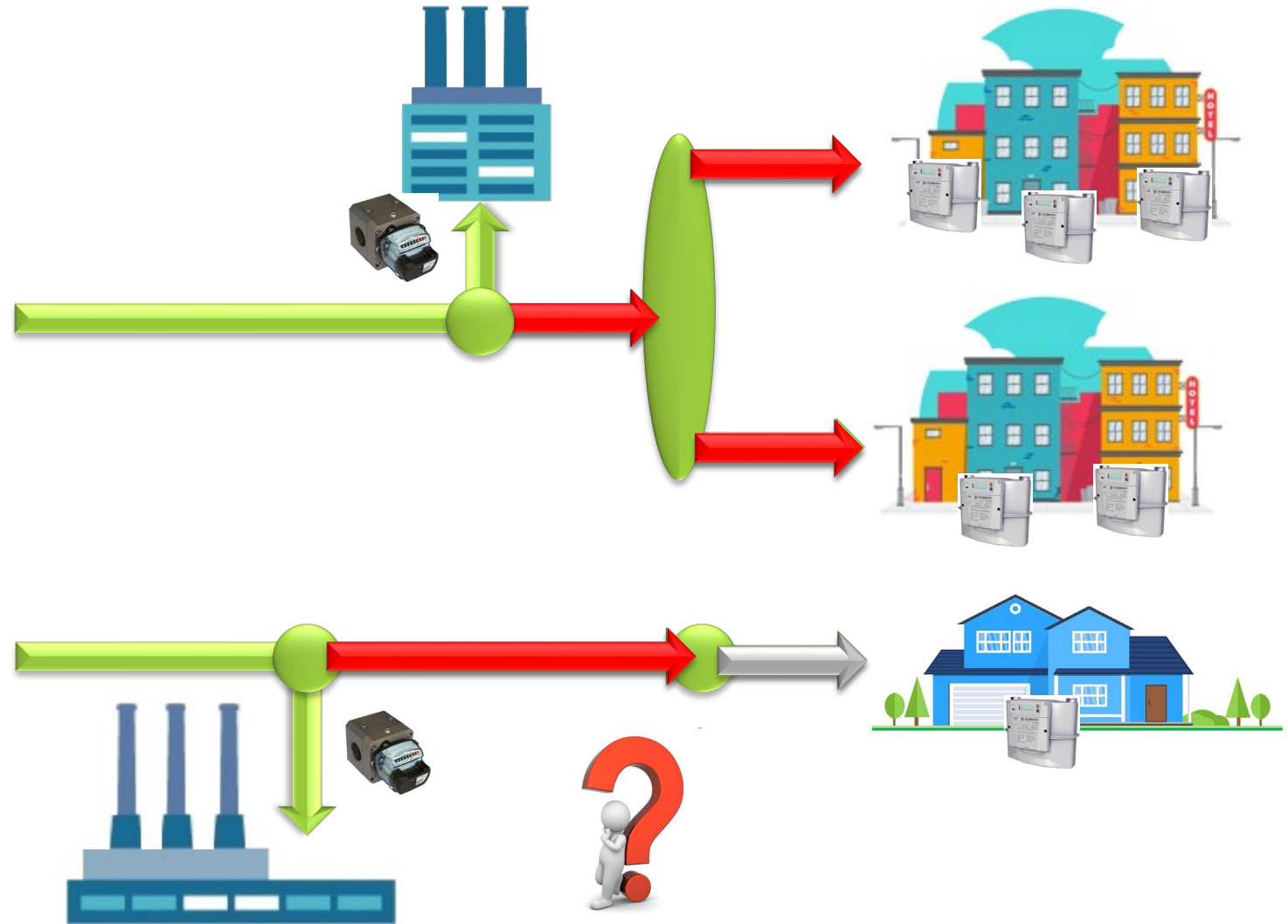


Gas Distribution Network Balance

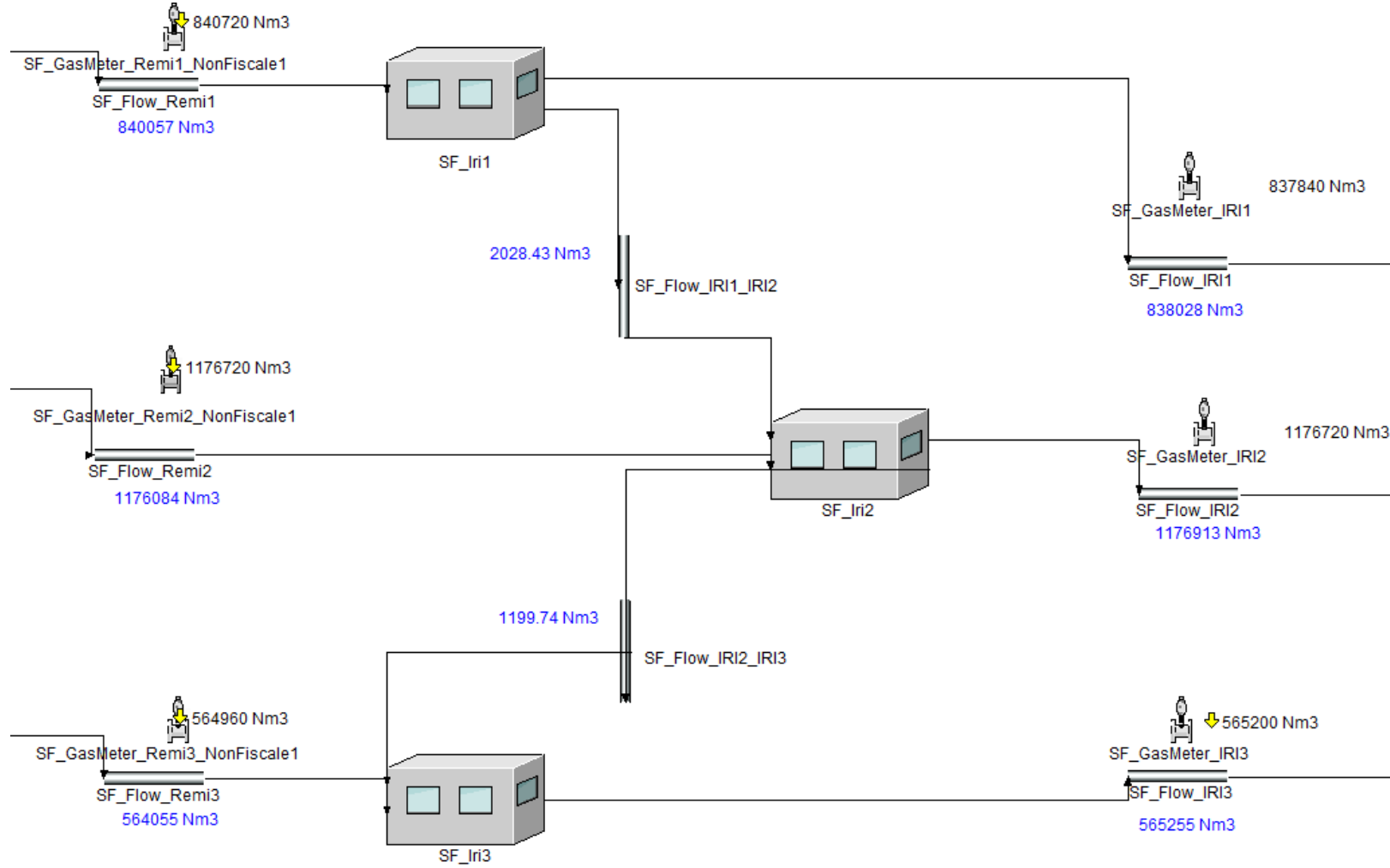
Benefits:

- Distribution of the imbalance based on the meter accuracy
- Frequency of the analysis defined by the user (near real time)
- Identification of the total imbalance
- Identification of the imbalance area where the discrepancy occurs
- Identification of the meter which is failing

Estimation of unmeasured flow rates



Estimation of unmeasured flow rates

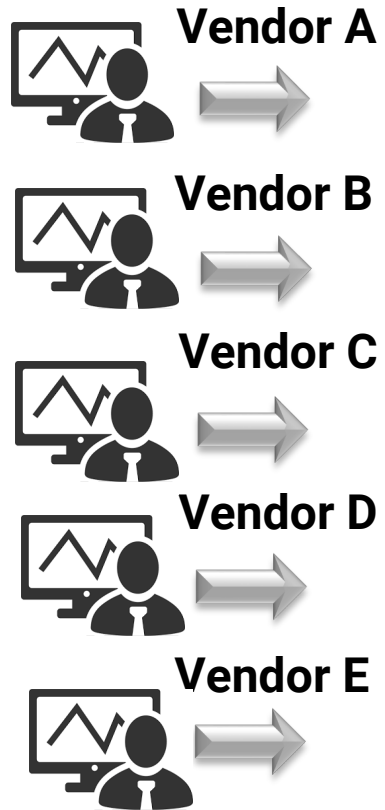


Estimation of unmeasured flow rates

Benefits:

- Knowing the flow rates in unmetered pipelines using boundary measurements
- Economic savings (New meters): purchase, installation, future maintenance, safety, etc...
- Identification of the best location for new meters based on measurements redundancy

Ownership tracking: multiple suppliers to multiple users



User 1



User 2



User 3



User 4

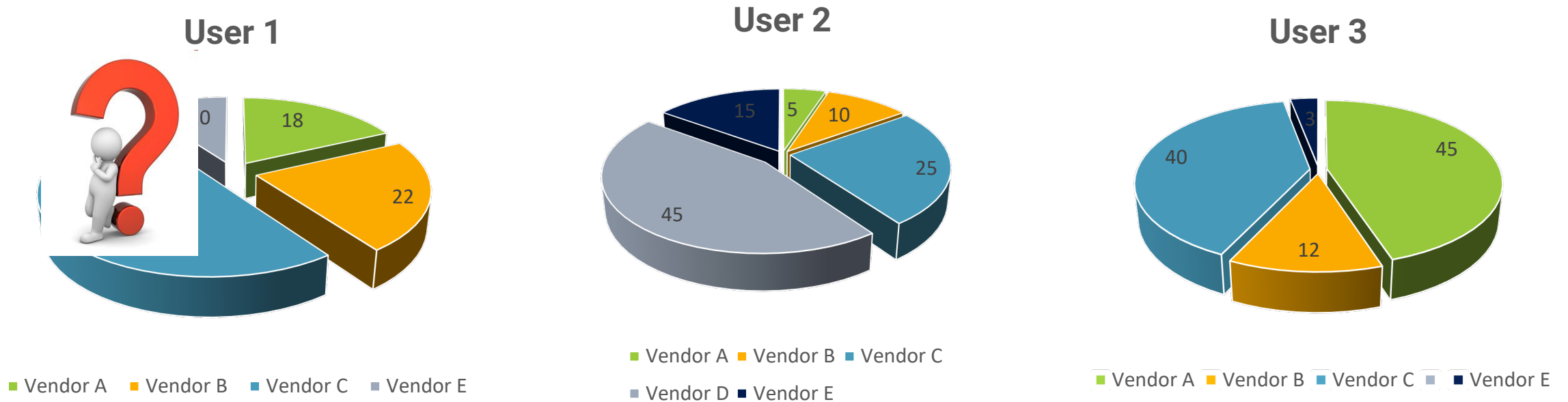


User 5



Ownership tracking: multiple suppliers to consumers

How can I track the ownership of the gas?



Benefits:

- Allows the correct assignment of gas consumption to gas suppliers.



Advantages & benefits

Analysis of near-real-time information based on validated & reconciled data

- Reconciliation period – daily to hourly

Expand the Sigmafine functionalities

- Quality tracking
- Heating value estimation
- Calculation of efficiency of equipment (heaters, pumps, etc.)
- Support condition based maintenance monitoring
- Implement advanced engineering calculations

Corporate dashboard and reporting

- PowerBI, Tableau, etc.

Scalability

- 250 to 25,000 elements



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