KUALA LUMPUR 2012 WORLD GAS CONFERENCE

25th world gas conference

"Gas: Sustaining Future Global Growth"

THE IMPACT OF METER READING CYCLES AND ALLOCATION PROCESS ON UFG

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Date: June, 2012

Venue: Room 302/3

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Definition of Unaccounted For Gas

- UFG can be defined as the

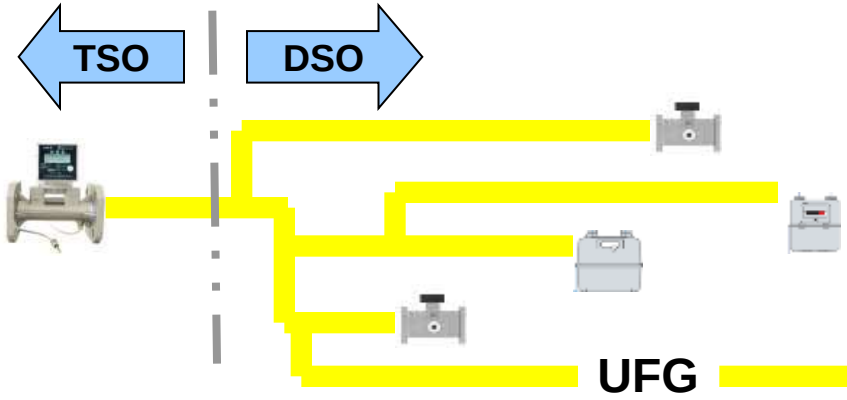
> ***Difference between the gas entering a distribution system at the point of custody transfer and that which can be measured and billed at all delivery points over a defined period of time.***

- UFG is a measurement of global efficiency of operation

- It impacts the overall economics of the business

UNACCOUNTED FOR GAS CAUSES

- UFG has several causes
  1. Physical causes
  2. Accuracy
  3. Consumption estimation errors inherent to the information circuits established

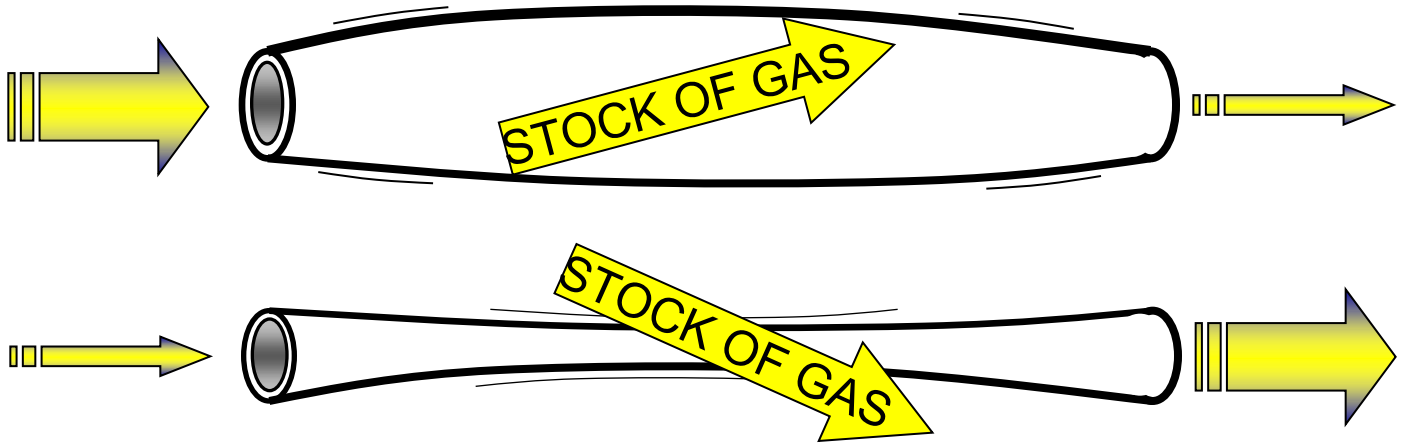


- Leaks
- Commissioning decommissioning of pipelines
- Theft
- Meter accuracy
- Reading mistakes
- Calorific value of the gas

- The lack of timely consumption information to use in the Allocation process will also cause UFG

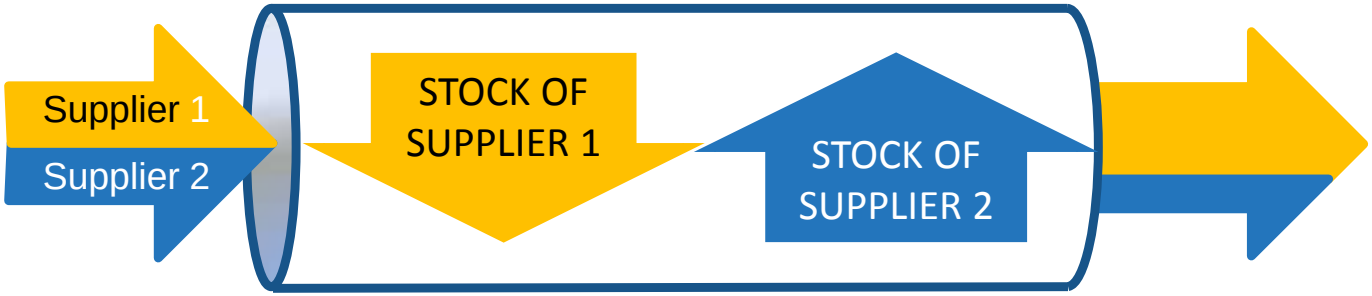
MANAGING BALANCE OF THE GAS SYSTEM

- Transport System Operators (TSO) must keep the balance of transport network
- Unbalances result in pressure variations - Line Pack
- Variations in the Line Pack result in variations of the Gas stock



MANAGING BALANCE OF THE GAS SYSTEM WITH SEVERAL SUPPLIERS

- In Liberalized Markets
  - TSOs do not own gas
  - Stock is divided by the Suppliers according to network usage
  - Individual stock must be kept within defined limits
  - Individual stock changes with the pipeline pressure and inlet/outlet flow



- Stock unbalances must be allocated to each Supplier and settled

The Role of Reading Cycles & Allocation in the Management of the Gas System – a Three Step Process

- The Nomination phase (day D-1)
  - Suppliers inform the TSO about the quantities they will inject in the transport grid to cater for their costumers needs in day D
- Day D
  - TSO measures the actual quantities that entered and left the network
- The Allocation phase (day D+1)
  - DSO allocate the actual quantity of gas delivered to the distribution network to the Suppliers according to the actual consumption of their costumers

Day =>		D-1	D	D+1
Process =>		Nomination (Kwh,m3)	Measurement of the gas at the outlet of transport grid	Allocation (Kwh,m3)
Supllier	#1	x1	Y (Y≠Σx)	y1
	#2	x2		y2
	…	…		…
	#n	xn		yn
		Sum(x1,x2,…xn) =X	Mandatory condition:	Sum(y1,y2,…yn) =Y

THE ROLE OF READING CYCLES & ALLOCATION IN THE MANAGEMENT OF THE GAS SYSTEM – STOCK CALCULATION

- Stock is evaluated for each Supplier
- Nominated (xi) and allocated (yi) quantities are used

		initial stock	Δ stock	final stock
Overall balance		Si	Δ	Sf
Supllier	#1	s1i	δ1=x1-y1	s1f
	#2	s2i	δ2=x2-y2	s2f
	…	…	…	…
	#n	sni	δn=xn-yn	snf
		Sum(s1i,s2i,…sni)=Si	Δ=sum(x)-sum(y)	Sum(s1f,s2f,…snf)=Sf
		Sf=Si+Δ		

- Each supplier's stock must be within limits defined by TSO:

  s#n min < s#n < s#n max

- Penalties apply to non-compliant Suppliers

THE ALLOCATION PROCESS AND IT'S SHORTCOMINGS

- Allocation is a simply process

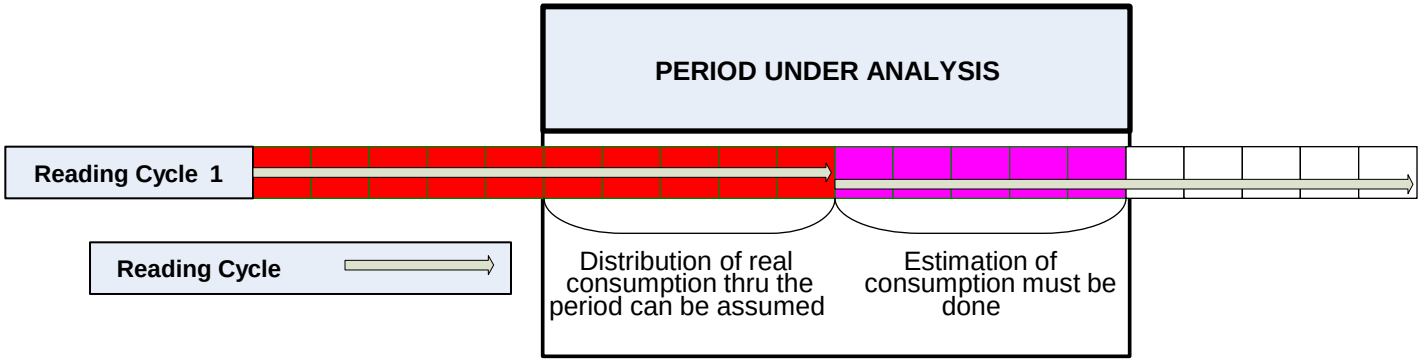
$$\text{Allocation to Supplier x} = \sum_{\text{Client 1}}^{\text{Client n}} \text{Consumption of Client ix}$$

$$\text{Total Gas delivered} = \sum_{\text{Supplier 1}}^{\text{Supplier n}} \text{Allocation to Supplier x}$$

- But have a few problems that must be addressed
  - Consumptions of customers without telemetering are not know on a daily basis
  - In this cases, meters must be read by an operator
  - Reading cycles are not synchronized with the allocation process
- In these cases consumption must be estimated
  - Estimation process brings along errors

THE ALLOCATION PROCESS – ALLOCATION AND READING CYCLES

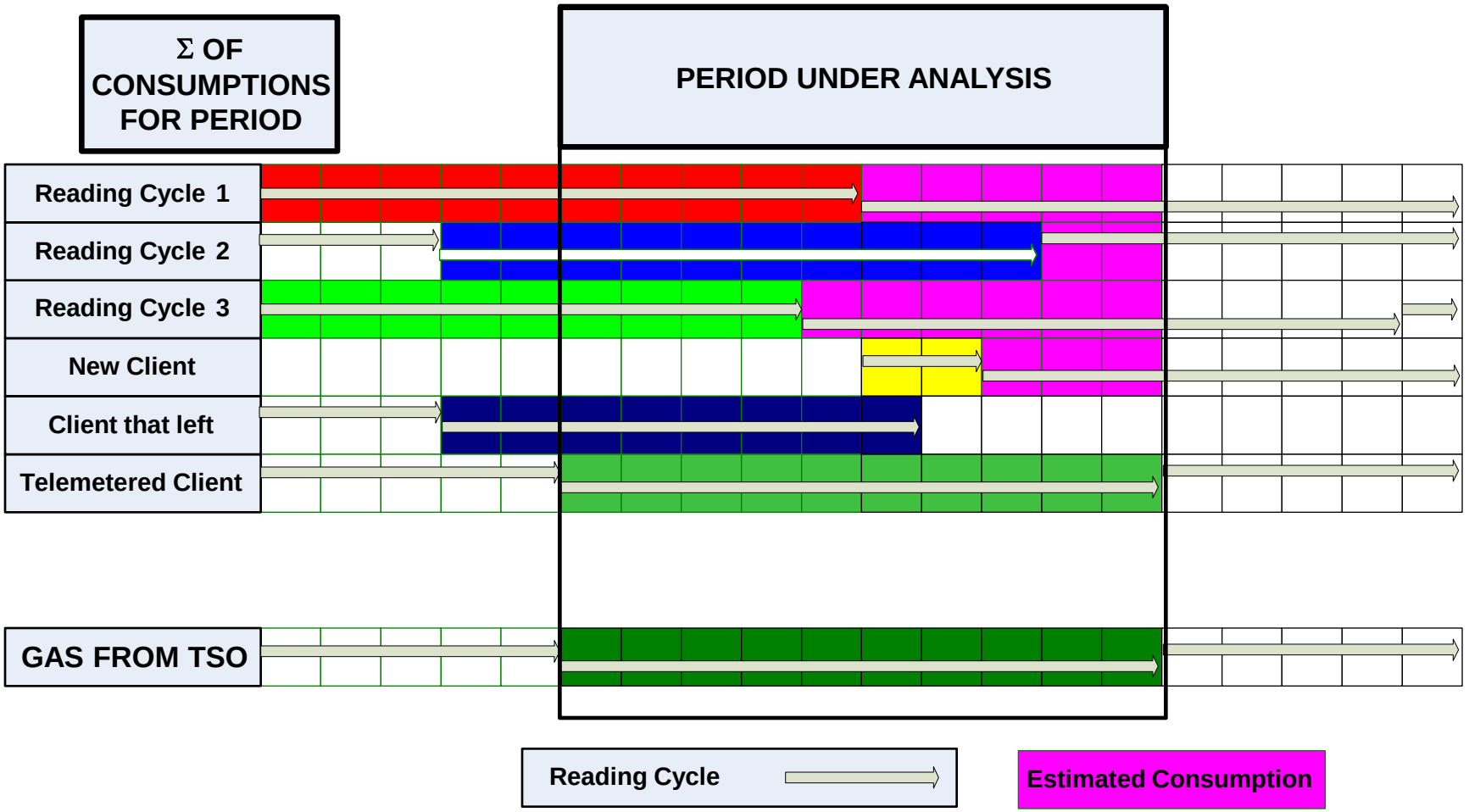
- Magnitude of estimation error depends on consolidated allocation cycle
  - Telemetered costumers will always have real consumption data; but
  - On daily allocation cycles all other costumers will have to be estimated
  - On monthly allocation cycles a mix of real and estimated consumptions will coexist



- Estimation quality depends also on the Reading Cycle
  - The longer the reading cycle, the greater the uncertainty of the estimation

THE ALLOCATION PROCESS – THE GENERAL CASE OF ALLOCATION AND READING CYCLES

- And the picture gets worst if we think about the multitude of superimposed reading cycles…



Dependence of the Allocation Cycle on the Reading Cycle – The Difficulty to Estimate Consumptions

- Allocation requires timely consumption information
- Information is not available for every type of costumer
- Estimation methods are used with an error
- Allocation equation must be reviewed to take this error into consideration
  - No longer ~~Y = Sum (y1, y2, ..., yn)~~
  - But Y = Sum (y1, y2, ..., yn) + error
- Errors are UFG and represent a cost
- Cost will have to be borne by the business players according to regulatory framework

COPING WITH SHORTCOMINGS – TWO LINES OF IMPROVEMENT

- Improve accuracy of consumption calculation
  - Reduce length of reading cycles;
  - Install as much telemetering as possible;
  - Manage reading procedures to enhance results
  - Enforce meter reading on switching and end user contract termination
  - Refine estimation methods

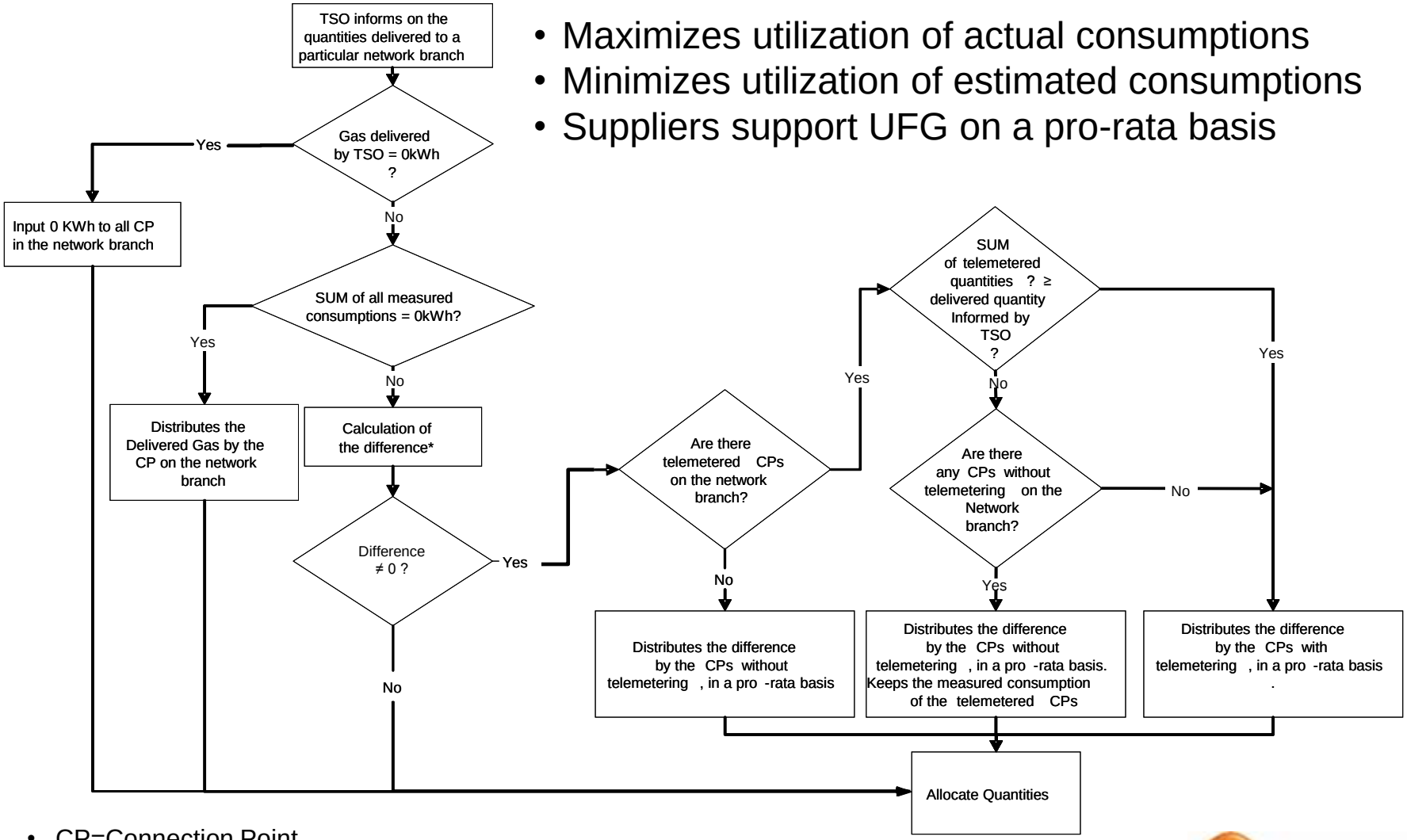
- Develop good allocation algorithms
  - Use as much actual data as possible
  - Access to end user data base information is most important
  - Requires IT developments
  - Requires large number-crunching capabilities
  - Depends on regulatory framework

Coping With Shortcomings – Consumption Estimating Procedures

- Estimation models can be complex
  - Consumption = f(Temperature, Pressure, type of customer, events)
  - Complex models are more difficult to fine tune
  - Individual consumption and a population consumption behave differently
- Practical methods are:
  - **Consumption profile** – For each day of the year according to the costumer type
  - **Corrected consumption profile** – Corrections for ambient temperature, day of the week, atmospheric pressure, etc. – Temperature adjustment is commonly used
  - **Homologue consumption** – Estimate the daily average consumption of the last year, around the same period and assume it will be the same this year
  - **Corrected homologue consumption** – Homologue consumption corrected for atmospheric conditions and sustained differences of consumption habits

COPING WITH SHORTCOMINGS – ALLOCATION ALGORITHMS
THE PORTUGUESE MODEL

- Maximizes utilization of actual consumptions
- Minimizes utilization of estimated consumptions
- Suppliers support UFG on a pro-rata basis



- CP=Connection Point
- Difference=Delivered Gas – Estimated Consumption – Measured Consumption

Coping With Shortcomings – allocation Algorithms
The Portuguese Model

Type of Customers connected to the network branch

Telemetered customers only	Telemetered and non-telemetered customers	Non-telemetered customers only
Pro-rata distribution by telemetered customers	Pro-rata distribution by non-telemetered customers	Pro-rata distribution by non-telemetered customers

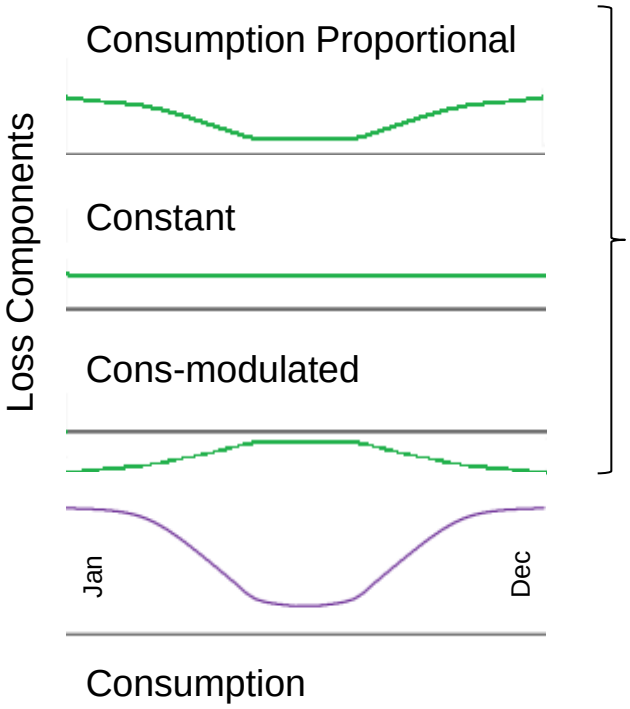
Difference to be distributed

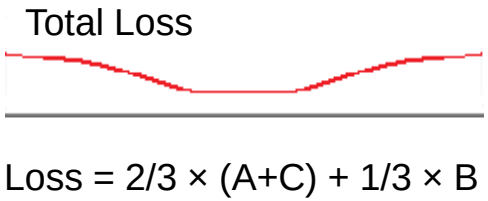
Quantity measured by TSO – measured quantity – estimated quantity

Coping With Shortcomings – allocation Algorithms
The GrDF Model

- GrDF developed a three component “Loss Model”
- Estimates or measures consumptions
- Adjusts the gas balance with a factor F

Energy Supplied - Losses = F x Sum (estimated quantities)
Allocated Quantities = F x Sum (estimated quantities)





Loss = 2/3 × (A+C) + 1/3 × B

- Daily estimation for each customer
- Current account is kept for each customer
- Current account is settled when the customer is read (every 6 month)
- GrDF supports the loss until account is settled (reconciliation)

SUMARY

- Liberalized Gas Markets require timely information on customer consumption for the allocation process
- Meter reading cycles do not match with allocation requirements
- The lack of timely information leads to consumption estimation and inherent errors
- Errors are UFG
- UFG is borne by the business players
- Depending on the allocation algorithm used the burden will rest on the DSO or on the Suppliers side.

THANK YOU FOR YOUR KIND ATTENTION