Gas Pricing in Afghanistan

Gas Pricing Issues

World Bank
May 2005

Objective

- To consider which pricing principles could realistically be implemented in Afghanistan in the near, medium, and long term

Units

Metric	English
1 m^3	35.315 ft^3
30 billion m^3 (CM)	1.06 tcf
\$100/'000 m^3	\$2.83/'000 cf
M	1,000
MM	1 million = 1,000,000
\$100/MCM	\$2.83/MCF ~ \$2.83/MMBtu
1 MMBtu	1.06 GJ, 293 kWh, 252,000 kcal
Afg 1/m^3	\$0.58/MCF at \$1 = Afg 49

Natural gas composition

Methane	Dominant component, gas at room temperature
Ethane	Gas at room temperature
Propane	LPG component
Butanes	LPG component
Water	Should be removed
Nitrogen	
CO_2	Should be removed
H_2S	Should be removed

Energy content

- Basic rule of thumb: 1,000 ft^3 or 1 MCF = 1 MMBtu
- Energy content of treated gas ≠ energy content of produced gas
- Need to know gas composition

Energy content

	Higher heating value (HHV) in MMBtu/MCF
Methane	1.0
Ethane	1.7
Propane	2.5
Butanes	3.2

Example of energy content

Produced gas	
N_2	1.8%
CO_2	4.5%
H_2S	2.7%
Methane	88%
Ethane	2.0%
Propane	1.0%

0.94 MMBtu/MCF

Treated gas	
N_2	1.9%
Methane	94.8%
Ethane	2.2%
Propane	1.1%

1.0 MMBtu/MCF

But 1080 cf of produced gas is needed for 1000 cf of treated gas

Efficiency

- Productive efficiency: products or services of a given standard are produced at lowest cost. Can be promoted through competition, third-party access, and price regulation.
- Allocative efficiency: prices reflect underlying economic costs so that gas is allocated to its highest value use
- Dynamic efficiency: innovation and improvement introduced as improved technologies become available.

Efficient pricing policy

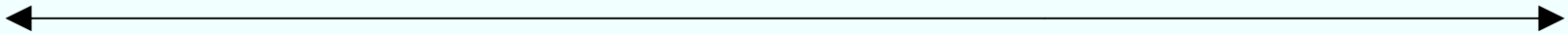
- Separate pricing of production, transmission (T), distribution (D), and retail
- Prices to reflect and enable recovery of prudently incurred costs (next slide)
- Policy ensures quality of service (reliable supply and quality)
- Built-in incentives for efficiency improvement
- Simple and easy to administer

Concepts related to efficiency

- Prudently incurred costs
  No gold-plating (spend more than necessary to meet the target standards)
  No over-investment (example: over-size pipeline in the absence of clear demand)
- Economic purchase obligation
  Bargain for better prices, seek alternative lower cost suppliers, not take excessive risk in price hedging strategy
- Regulatory asset
  Asset recognized for regulatory purposes and excludes costs that are not “prudently incurred”

End-user price

Lower bound — Upper bound



Total unit cost:
Cost of production
+ gas treatment +
transmission +
distribution +
future expansion + depletion premium

Prices of substituting fuels

Ceilings on gas price

- Alternatives for consumers
  - Power sector: Electricity generation from hydro, coal, heavy fuel oil, diesel
  - Energy from coal, heating oil, electricity, LPG, kerosene, purchased wood
- Not fuel price alone
  - Lower working capital because no need for storage
  - Higher efficiency
  - No impurities
  - No expensive pollution control devices

Ceilings on gas price

- Alternatives for consumers
  - Example: Coal at $15/ton is cheaper than gas at $1.50/MMBtu, but coal power plants are more expensive & less efficient, potentially making electricity generated from coal more expensive than that from gas
  - If alternatives are cheaper and their supply is unconstrained, then gas may not be purchased

Examples

- LPG

  $300/ton ⇒ $6.4/MMBtu, $650 ⇒ $13.8/MMBtu

- Diesel

  Afg 10/liter ⇒ $ 4.1/MMBtu,
  Afg 25/liter ⇒ $10.2/MMBtu

- Fuel oil

  $15/bbl ⇒ $2.4/MMBtu, $25 ⇒ $4.0/MMBtu

- Electricity

  2.3 US ¢/kWh ⇒ $ 6.7/MMBtu,
  5 ¢/kWh ⇒ $14.6/MMBtu

Ceilings on gas price

- Competitiveness of end-products
  - Even if there are no cheaper alternatives, if the prices of end products manufactured using gas are not competitive, the manufacturing will not take place in a competitive market

Consider power imports

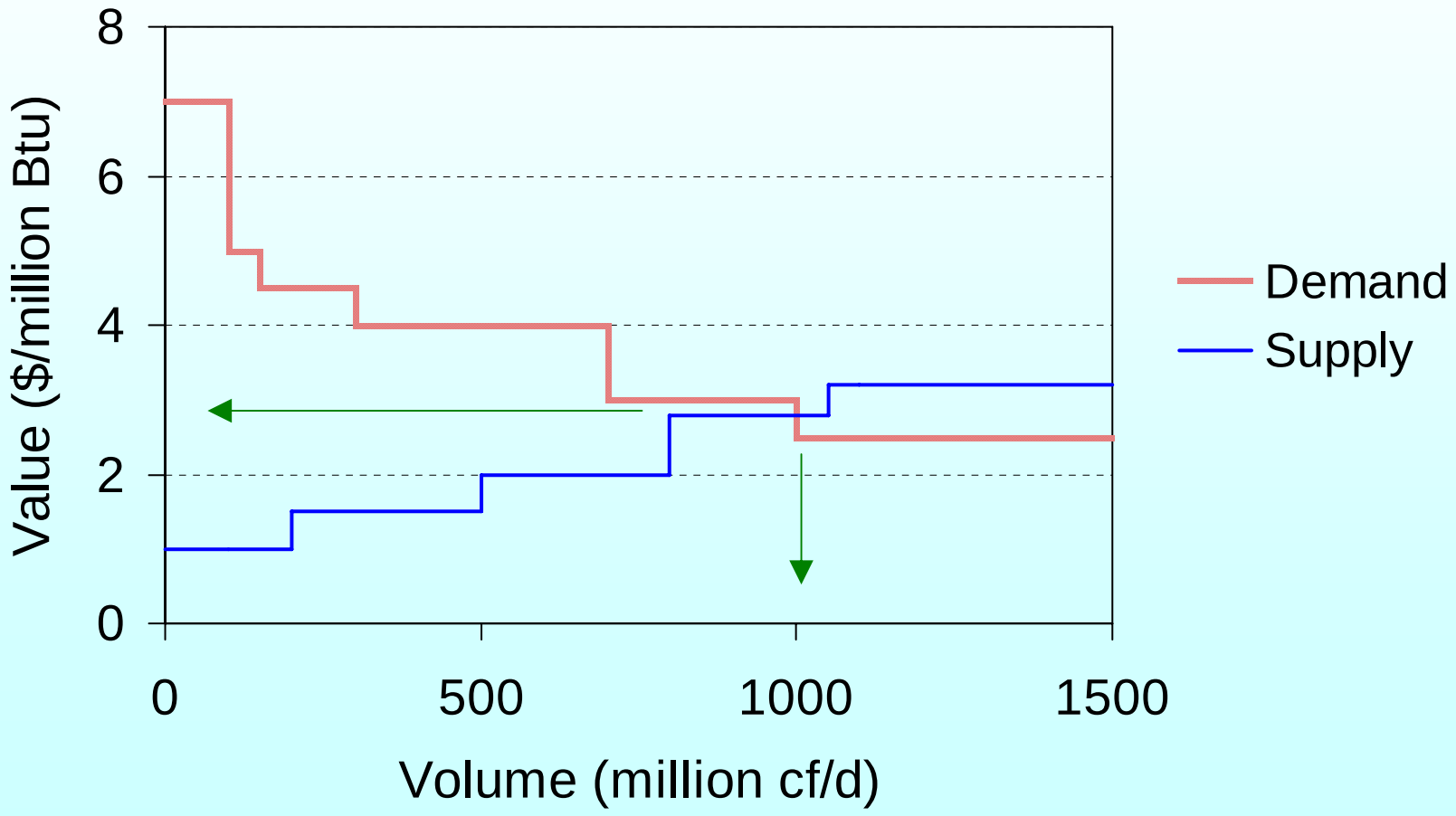
- Electricity at 2.3 US ¢/kWh
- Combined cycle power plant, 50% efficiency

Plant capital	Gas price at plant gate to match 2.3 ¢/kWh	
$/kW	US$/MMBtu	Afg/m³
600	1.5	2.1
800	1.0	1.4
1000	0.5	0.7

Market-based gas prices

- Demand curve: what different categories of consumers are prepared to pay after taking into account alternative fuels and their life-cycle costs
- Supply curve: what suppliers are prepared to sell gas for in an efficient regime (prudently incurred costs, realistic assessment of market demand, etc.)
- Intersection of demand and supply curves

Economic price of gas



Regulating prices

- Two most commonly used mechanisms are RoR (rate of return) and price caps
- RoR allows a predetermined rate of return on capital (Pakistan, US in the past)
- Price cap, or “incentive based”, regulation sets a ceiling on price movements for a set period and allows the firm to determine its own prices within limits (Argentina, Australia, US, UK)

Rate of return

- Based on regulatory asset, capital base that is used for calculating RoR
- Firm sets prices to achieve regulated RoR
- Main benefit: promotes investment
- Main disadvantage: once RoR is set, little incentive to improve efficiency

Price caps

- Usually based on RPI–X or RPI–X–K
  RPI = retail price index
  X = efficiency improvement factor
  K = planned capital expenditure factor
- Annual revenue allowance or maximum prices are set
- Periodic review, 3 to 5 years
- Firm is allowed to keep any additional profits arising from efficiency gains that exceed those assumed
- Consumer share in benefits of efficiency gains
- K factor (example: Argentina) allows for investment, including steps taken to improve system efficiency, safety or reliability and expansion

Direct pricing in downstream gas

- Both require considerable resource commitment by regulator and can impose high compliance costs on regulated business
- If small market, cost and complexity of direct price regulation may not outweigh benefits
- Useful to set up regulatory (as opposed to financial) accounts in all cases

Upstream gas

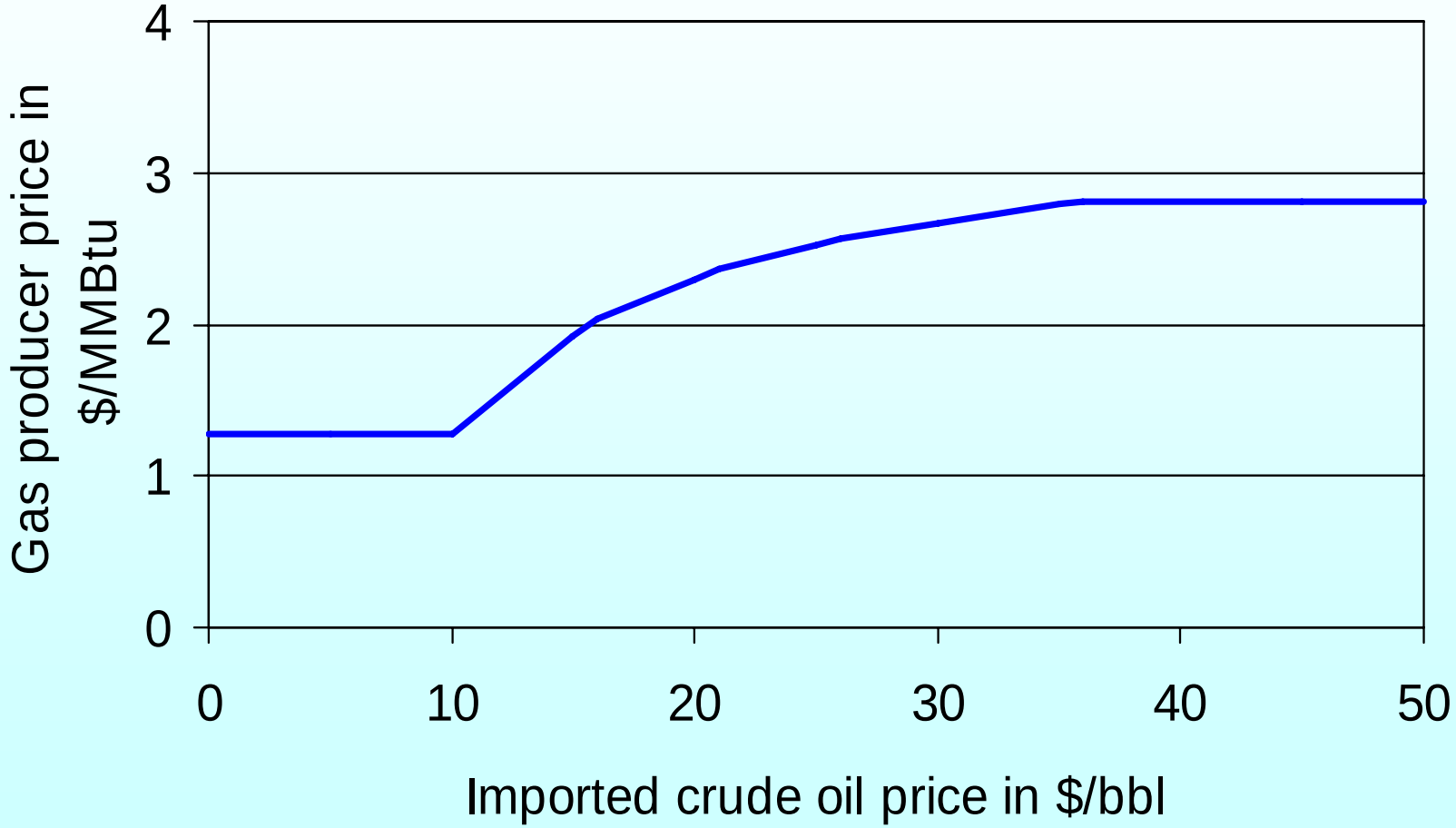
- No need for direct regulation
- Some governments set pricing formulas to attract investors (Pakistan, Egypt)

Wellhead gas pricing: example from Pakistan

- Gas is substituting fuel oil (mainly power generation)
- Gas price based on fuel oil, which is in turn based on imported crude oil price
- Formula: Take 65.5%, 72.5%, or 77.5% of "effective oil price" depending on gas field profitability

Price band ($/bbl)	Effective oil price ($/bbl)
< 10	10, floor price
10–16	same as oil price
16.01–21	16+0.5x(oil price–15)
21.01–26	16+0.5x(21–16)+0.3x(oil price–21)
26.01–36	16+0.5x(21–16)+0.3x(26–21) +0.2x(oil price–26)
>36	22, ceiling price

Gas prices paid to producers in Pakistan



Note: Taking 72.5% of the effective oil price

T&D tariff issues

- Tariffs or their principles require government approval
- Types of tariffs
  - Distance-related
  - Postal stamp (same for all)
  - Zoning
  - Affected by entry and exit points (for a complex network)

Obstacles to investment

- No history of proper payments at prices that enable cost-recovery
- Future demand uncertain and possibly low
  - ➢Analysis of gas market in the north
- Doubts about creditworthiness of major consumers
- Exchange rate volatility
  - ➢Argentina in 2002

Different approaches

- Long-term contracts with take or pay
- Penalties for non-delivery
- All tariffs determined in US$ and converted to local currency when customer is billed

Issues

- Should wellhead prices be left to negotiation or should pricing formulas be set?
- What is the optimal balance between proper economic regulation based on international industry practice and keeping administrative burden to a reasonable level?
- If gas shortage, how should gas be allocated among competing consumers?
- Who are likely creditworthy large consumers?
- How can service be expanded to small consumers?
- How can T&D be best developed?

Immediate issues

- Address inadequate current revenue
  - How much should prices be adjusted upward and on what basis?
  - How can non-payments be addressed?
- Identify one or more creditworthy large-volume consumers with predictable demand
  - Basis of increased gas production
- Incrementally expand supply to other consumers in the north
  - Metering, billing, bill collection