The Role of Gas in Improving Urban & Indoor Air Quality

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91% of World Population lives in Areas with Unhealthy Air

risis

Size of the Bubble = PM10 Annual mean concentration (ug/m3) 2014-17

Source: WHO & WBG
Gas provides specific advantages for cities ...

**Air pollution**: nearly zero sulphur dioxide, nitrogen oxide, and no particulate matter emissions

**GHG emissions**: 40% less than coal and 20% less than oil

**Heat intensity**: Most heat intensive (and thus highest efficiency) fuel source

**Scalability**: Ease of adding customers to existing networks once infrastructure is developed

... but requires multiple enablers

1. **Infrastructure** investment of $34-55B/yr in gas midstream

2. ** Scaling up consumption** over time, starting with large scale anchor customers in industry and power generation

3. **Technological innovation** to expand gas applications and enable sustainability goals

4. **Government policies** enabling consumption, particularly for reducing air pollution
Gas Adoption is a Key Enabler of Improved Air Quality

Average urban PM 2.5 concentration (µg/m³)

Gas share of energy consumption (%)

1. Includes weighted average of power generation, buildings, and industry sectors; based on 2015 data; 2. Based on cities in the WHO survey database

Source: IEA, World Health Organization, UN Population Division, BCG analysis
Cases in Improving Urban Air Quality Evidence

- **NEW YORK**: NYC converted 30% of heavy fuel burning buildings to natural gas & achieved 69% reduction in SOx concentration within 4 years.
- **TORONTO**: Removal of coal from power generation resulted in reductions in PM10, SOx & NOx of 90%, 91%, & 65% from 2004 levels, and reductions in premature deaths and hospitalization by 76% & 60%.
- **DUBLIN**: Severe pollution problem existed in the 1980’s due to coal use. Increased use of natural gas (75% of residential demand) resulted in 80-90% reduction in PM emissions.
- **ISTANBUL**: Banning lignite coal and gradually replacing it with natural gas for residential heating resulted in reduction of PM concentration levels by 50% and SO2 by 98% (from 220 µg/m³ to 5) in under a decade.
- **BERLIN**: 1990-2012 share of natural gas in city’s primary energy grew from 17% to 41% resulting in reductions in SOx, NOx, and PM10 by 95%, 76%, and 83% from 1989 levels.
Cases in Improving Urban Air Quality

Beijing:
Gas penetration vs. PM 2.5

Urumqi:
PM 2.5 Concentration after Switch from Coal to Gas Heating
Cases in Improving Urban Air Quality

evidence

Krakow: Residential Coal Ban & Replacement Subsidies

Shanghai: Boiler Replacement & Fuel Switch

Santiago: Pollution Controls & Infrastructure Investment

Port of Rotterdam: LNG fuel
IGU 2017 G20 Report on Enabling LNG as Marine Fuel: major opportunity for clean air in ports
A Sustainable Future – Powered by Gas

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