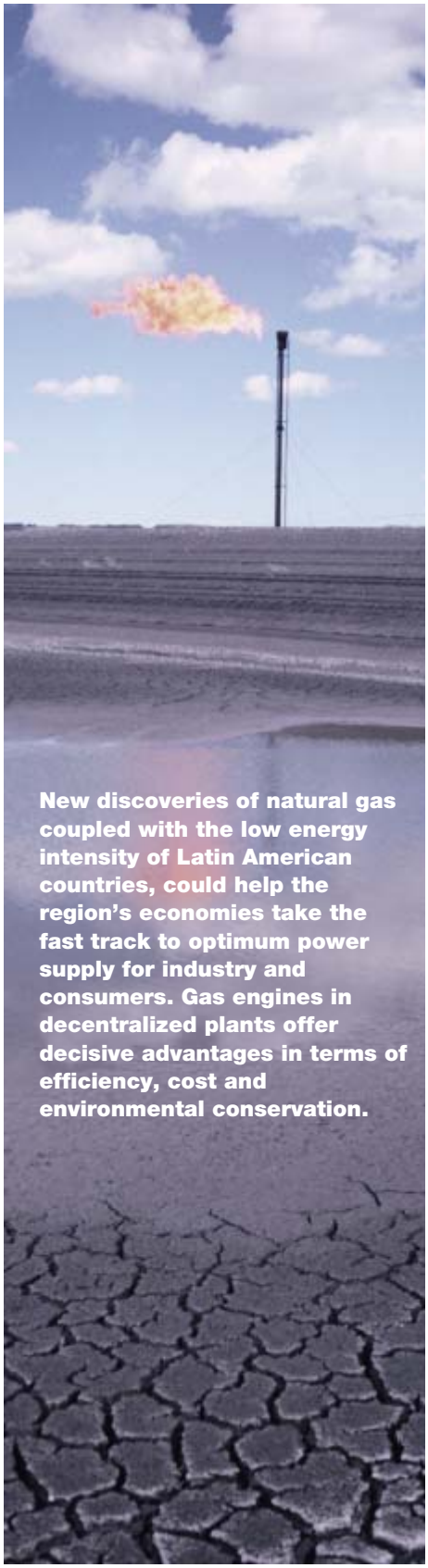
Natural gas in Latin America needs

by Jacob Klimstra, Senior Energy and Engine Expert, Wärtsilä Finland Oy Power Plants



New discoveries of natural gas coupled with the low energy intensity of Latin American countries, could help the region's economies take the fast track to optimum power supply for industry and consumers. Gas engines in decentralized plants offer decisive advantages in terms of efficiency, cost and environmental conservation.

Natural gas is becoming increasingly important as a primary energy source in Latin America. An example is the Camisea gas field in Peru, where roughly 200 billion cubic metres of gas were discovered recently. The application of indigenous fuel will strengthen the economies in Latin America and open up new opportunities for expansion. Natural gas is a flexible fuel that can be used in many applications in an efficient and environmental friendly way.

Average energy consumption per capita in Latin America varies between 20 and 50 GJ/year, depending on the country. That is quite modest compared to the world average of 75 GJ/capita. The average US citizen, by contrast, uses 350 GJ/year. With respect to electricity, the average consumption per person in Latin America varies between 600 and 1800 kWh per year while the world average is about 2500 kWh.

These figures show that energy use in Latin America and consequently its environmental impact are quite low. Yet the gross domestic product expressed in purchase power parity (PPP) is about equal to the world average, which means that the energy intensity of the Latin American economies is rather low as well. That is a good basis for the future since meeting the demand for low emissions of greenhouse gases will be easier and the economies will be less dependent on imported fuels. Increasing the use of natural gas could stimulate the economies while placing a minimum burden on the environment.

Using gas optimally

It is important that the natural gas resources in the region are exploited in an optimum way. The rest of the world has set bad examples in this respect. Much gas has been spilled in installations with unnecessarily low efficiencies. An example may be taken from The Netherlands, where a large gas well of about 2000 billion m^3 was discovered about 40 years ago.

Initially, the policy was to use and sell the gas as quickly as possible since politicians and policymakers predicted that nuclear power would soon displace fossil fuels. After the oil crises at the end of the 1970s, they better understood that fossil fuel is the engine behind the global economy.

Large programmes were then started to improve the efficiency of fuel use. Bearing in mind that separate production of electricity and heat can use up to 50% more fuel than combining electricity production with the recovery and use of the waste heat (cogeneration), local cogeneration became a major tool in the effort to raise efficiency. Thousands of engine-driven cogeneration installations were installed near heat users such as industry, greenhouses and hospitals as a result.

An identical process took place successfully in Denmark. The increased use of reciprocating gas engines also gave rise to the rapid development of engine technology leading to significant advances in efficiency, emissions and reliability. Today around 40% and 50% of the electricity demand are

A gas pipe under construction: its energy transport capacity is 50 times higher than an electric transmission line for roughly the same investment.

gas engines

covered by gas cogeneration plants in The Netherlands and Denmark respectively.

Applying natural gas locally

The experience gained in northwest Europe cannot be transferred directly to Latin America because of differences in climate and economic conditions. However, the benefits of local electricity production certainly apply, as does the possibility to use the heat released by the process in applications such as food drying processes and integrated absorption cooling. Many projects can be foreseen where natural-gas-fuelled engines could play a major role in further enhancing Latin American economies.

If energy is the engine of the economy, electricity is the motor of innovation and improved living standards. A reliable supply of electricity is needed to keep information and communication systems running. Modern production processes fully depend on the constant availability of electricity.

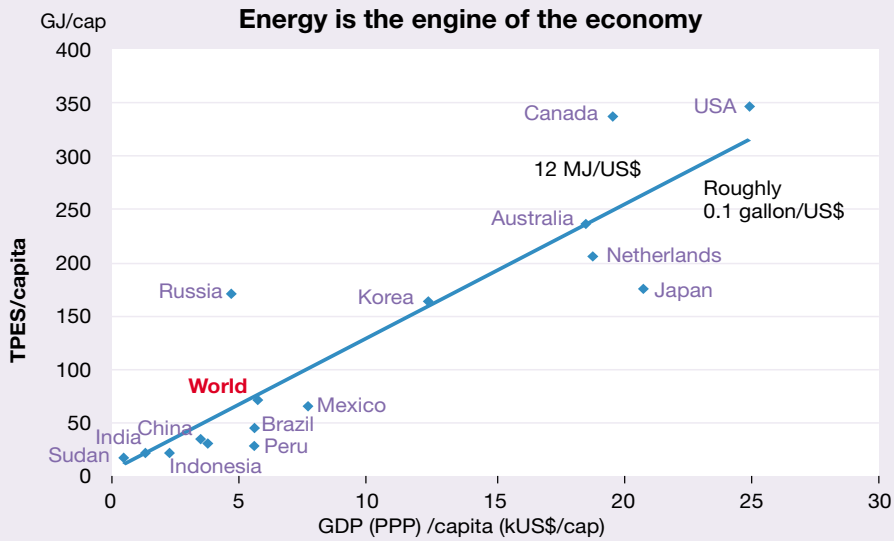
Developing economies should therefore put emphasis on the optimum layout of electricity generation and distribution structures. The traditional idea of building just a few large power plants and then distributing the electricity via long, expensive and vulnerable transmission and distribution lines is not the best approach.

It is much cheaper and more reliable to transport natural gas than electricity. For example, a 60 bar pipeline can easily transport a fuel energy stream of 25 GW for an investment comparable to that of an electricity transmission line able to carry only 500 MW. Moreover, multiple smaller electricity generating units in parallel will offer much better combined fuel efficiency and reliability at lower cost.

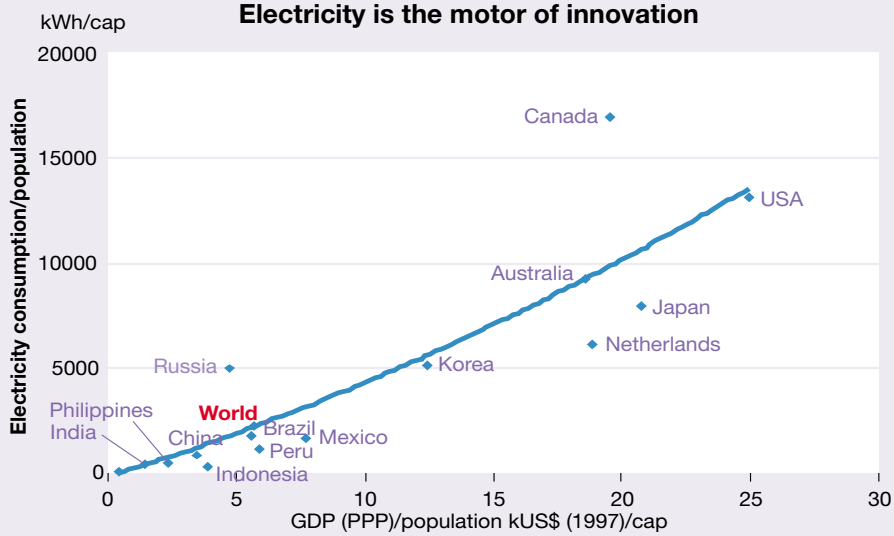
Advantage reciprocating engines

Modern reciprocating gas engines are ideal prime movers for such modular power plants. They can produce electricity and provide heating and cooling as desired for modern applications. If needed, they can also be equipped for running temporarily on liquid fuel in the event of short-term gas delivery problems, as well as for economically shaving peaks in gas demand.

The Wärtsilä 34SG gas engine is the ideal prime mover for such applications. Its maximum electric power capacity per unit is 8.7 MW with a net electrical efficiency of close to 44%. The dual-fuel Wärtsilä 50DF



Energy use and gross domestic product (PPP).



Electricity consumption/population versus gross domestic product (PPP)/population, 1997.

engine has a power capacity of 17 MW with a net electrical efficiency of 45%. In cogeneration applications, such as drying processes, the combined efficiency can exceed 90%. The ambient air temperature and pressure have only a minimal effect on the power capacity and efficiency of turbocharged reciprocating engines.

The power capacity of these engines and the start-up process are such that no major sudden surges in gas pipeline pressure will occur when they are put into operation. Nor do these engines need a high gas supply pressure, as can be the case with gas turbines. Normal industrial supply pressures (up to 6 or 8 bar) are sufficient, which makes vulnerable pre-compression unnecessary.

The NO_X emissions of these gas engines are below 1.4 g/kWh without any additional exhaust gas treatment. This is generally quite acceptable with respect to the environment. Widespread application of efficient and reliable gas engines could help Latin America make optimum use of its natural gas resources with minimum impact on the environment. ■