OVERVIEW

Nearly 3 billion people, or 40 percent of the world's population, depend on food cooked using traditional fuels such as wood, charcoal, coal, and kerosene — with the highest percentage in Sub-Saharan Africa where 80% of the total population uses such fuels.

This has negative effects on health, the climate, and the environment. It also has economic implications, with consumers spending USD 20 billion on polluting and inefficient cooking fuels in Sub-Saharan Africa in 2010, a figure projected to rise to USD 47 billion by 2020 [1]. At the household level, families can spend up to 20% of their total income on cooking fuel [1].

A commercially viable and context-appropriate transition to cleaner, more modern cooking solutions could alleviate many of these negative impacts and offer numerous socioeconomic advantages. One such alternative is liquified petroleum gas (LPG). As a cooking fuel for households in low-income countries, its availability and affordability, and therefore use, vary significantly by country. Its success is highly dependent on government policies and subsidies, as well as strong private sector engagement and the business strategies applied by them.

What is LPG?

Liquefied petroleum gas, or LPG, is a hydrocarbon fuel comprised of propane and/or butane and used for heating, cooking, and transport (auto gas) in developing markets. It is compressed into liquid for storage in cylinders and can be easily imported and distributed without complex piped natural gas distribution systems.

LPG is one viable solution in the transition to fully renewable and emissions-free energy solutions; it is likely to continue to gain traction where poverty is declining, financial inclusion is growing, and consumers are urbanizing.

LPG is cheaper cooking substitute available in the current world market and lower CO2 emissions than other energies available making it better choice for the environment.

LPG is a gas and needs to be stored under pressure in a cylinder. Key success factor of LPG industry as a whole in any country is directly related to the **supply management of the LPG and Cylinder together.**

Universal access to modern energy services by 2030 is one of the three goals of the Sustainable Energy for All (SE4All) initiative launched by the United Nations in 2011. After Tanzania joined SE4All in 2016, a stocktaking revealed that Tanzanians relied predominantly on traditional sources of cooking energy. About 84 percent of the population cook with solid fuels (wood, charcoal, or agricultural residue), and 5

percent uses kerosene. Cooking with these fuels affects the health of millions of Tanzanians while causing environmental and social damage.
An estimated 22,700 Tanzanians die each year from air pollution [2]. Meanwhile, wood resources are being depleted faster than they can be replenished.

Switching entirely to LPG for cooking is one way of substantially reducing, if not eliminating, indoor air pollution from household fuel use. However, unlike biomass which may be collected by household members, the use of LPG requires cash outlays, a significant consideration for low income households. These cash outlays include not only the purchase cost of LPG, but more importantly the start-up cost consisting of **LPG cylinder** and **stove purchase**. The start-up cost in turn is a barrier to many low-income households to using LPG. If this barrier of cost of Cylinder driven down its high likely the LPG consumption will accelerate exponentially.

[1] World Bank Group. (2014). Clean and improved cooking in Sub-Saharan Africa: A landscape report. Washington, DC: World Bank. Retrieved March 15, 2019, from openknowledge.worldbank.org/ handle/10986/22521
[2] world bank Tanzania 2019 country Environmental Analysis report

LPG OPPORTUNITY:

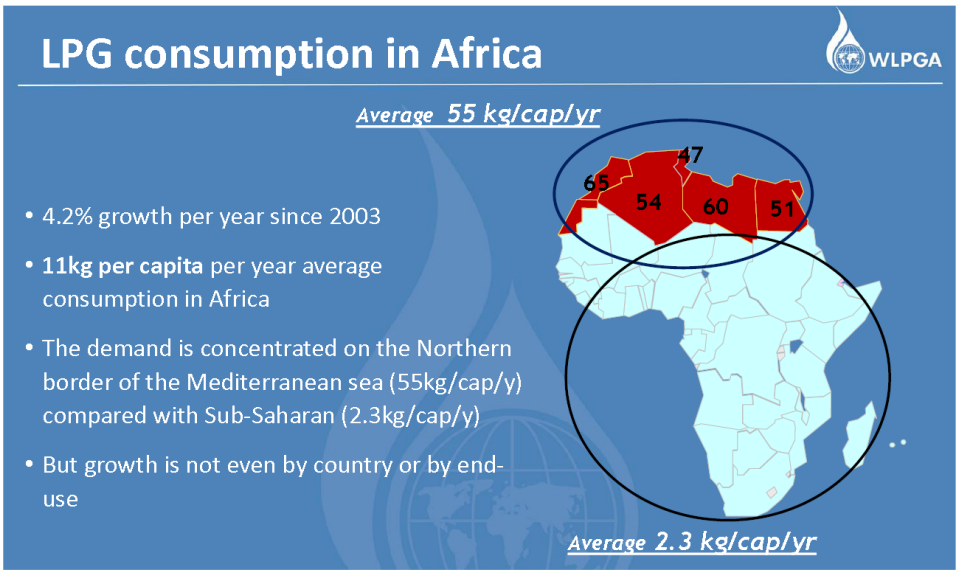
1. LPG CONSUMPTION IN AFRICA

1.1. According to World LPG Association ('**WLPGA**'), global attention is focused on sub-Saharan Africa as **the global LPG opportunity**:

Average annual LPG-use:

- ***55 kg per capita*** *in North Africa*
- ***2.3 kg per capita*** *in sub-Saharan Africa*

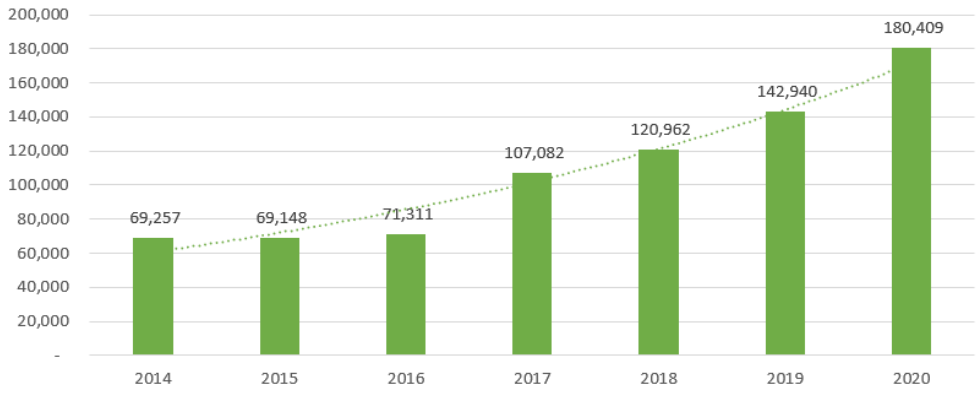
1.1 *EWURA's estimate for Tanzania in 2016 was **1.4 kg per capita** (note that this includes Exports).*



1.2 Historic LPG market growth in Tanzania

As per EWURA annual report LPG imports in 2019 stood at 142,940MT and 180,409MT for 2020*(3)*, which indicating a compound annual growth of 30%. Table A shows the quantity of LPG imported during the last 07 years.

TABLE A:
LPG Import/consumption from the year 2014 - 2020 (MT)



7 years Compound Annual Growth Rate **30%**

The exponential growth of LPG demand in the recent years, and the big gap of Cylinder bottle supplies in the Domestic market and the current Government industrialization policies, encouraging to invest heavily in the manufacturing LPG bottling manufacturing sector.

(3)2020 LPG import volumes are from the TAIFA GAS data as per ships received at TPA

LPG cylinders is an essential item for refilling Liquified Petroleum Gas for domestic and industrial purpose. The ultimate use of the LPG cylinder is for the storage and transportation of gas from one place to another. During the last one decade the consumption of LPG has gone up phenomenally in urban and rural Tanzania and creating a substantial demand for LPG cylinders in the country.

There was not much of LPG (liquefied petroleum gas) available for distribution and hence the need for cylinders was limited. However, the increase in the price of Charcoal, increase LPG distribution network throughout Tanzania by various LPG Marketing Companies, and Government restriction on usage of Charcoal attracting people to use more of LPG. The key factor of price difference between LPG and Charcoal is making things much easier for consumers to switch to LPG. In the year under review, the price of LPG packet in the 15 kgs cylinder ranged between Tsh 42,000 to 50,000 while the price of one sack of charcoal ranged between Tsh 60,000 to 70,000.

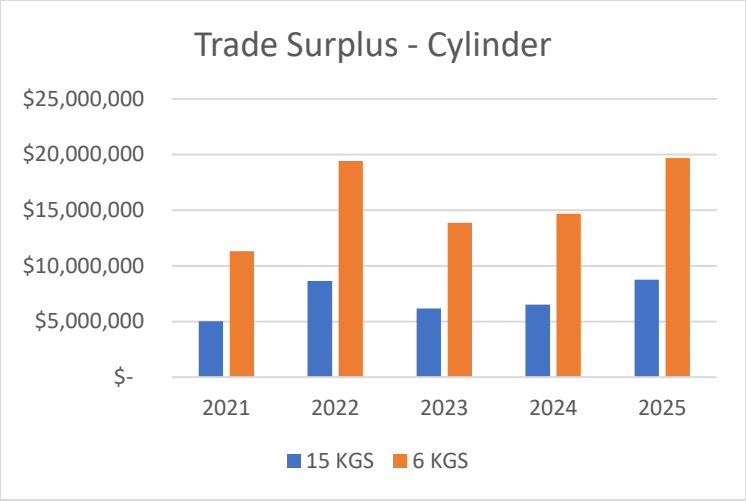
LPG touches our lives in so many ways. From housing to health, from garments to glass, from livestock to hospitality.

All the key LPG Marketing Companies (LMC) in Tanzania importing cylinders mainly from Thailand, China, India and other South Asian countries and approximately annually 2 million cylinders are being imported by all players to capture the LPG growth market available in the country.

TABLE C: Estimated Domestic LPG market growth and future requirement of cylinders for the next 5 years:

TABLE C:

Refrence		Growth	Rate	2018	2019	2020	2021	2022	2023	2024	2025
Tanzania population		Millions	3.1%	56	58	60	62	64	66	68	70
LPG Consumption		Kg/pax		1.51	1.75	2.01	2.56	3.5	4.1	4.7	5.5
LPG domestic *only*		Tonnes	34%	85,041	101,612	120,327	158,003	222,717	268,984	317,907	383,551
Prospective NEW future domestic business		Tonnes					37,676	64,713	46,268	48,922	65,644
No. of New Cylinders Required to cater future domestic volumes:											
KGS	15.00	units(cylinders)	40%				1,004,697	1,725,691	1,233,808	1,304,596	1,750,516
KGS	6.00	units(cylinders)	60%				3,767,614	6,471,342	4,626,779	4,892,236	6,564,436
Cylinder Trade Surplus:											
KGS	15.00	$/cylinder	$ 5.00				$ 5,023,485	$ 8,628,456	$ 6,169,038	$ 6,522,981	$ 8,752,582
KGS	6.00	$/cylinder	$ 3.00				$ 11,302,841	$ 19,414,025	$ 13,880,336	$ 14,676,707	$ 19,693,309
Total Saving							**$ 16,326,326**	**$ 28,042,481**	**$ 20,049,374**	**$ 21,199,688**	**$ 28,445,891**



As demonstrated in Table C in the coming 5 years Tanzania can have a potential Trade Surplus of $114 million exclusively on cylinder by all LPG Marketing Companies, if the Cylinders are manufactured in the country than importing from outside.

The trade surplus working doesn't include the taxes involved and other import charges which are an extra cost for importing cylinders in the country.

There are currently 3.5 to 4.0 million cylinders in Tanzania [3], which have been imported and deployed by various LMC. Once a cylinder enters the market, it returns to the LMC's refilling facility every three to four months, requiring each business to maintain high inventory levels to sustain revenues. Approximately thrice as many cylinders as customers are required to account for typical refilling turnaround times.

The potential LPG future business demands approximately 4.7 million cylinders in 2021 making the total demand in coming 5 years to 33 million cylinders of various packs.

TAIFA GAS TANZANIA LIMITED holding 25% market share in the Tanzania LPG market and growing at 40% Compound Annual Growth Rate (CAGR), significantly faster than Tanzania's 30.8% total LPG market Growth rate. Taifa Gas's potential cylinder requirement is 25% as mentioned in the Table C.

The key point here is: Taifa Gas's Cylinders requirement for the coming 6 years, are far more than the anticipated cylinder production of Cylinder Manufacturing Plant.

The below Table D will demonstrate the cost benefit analysis of the cylinders manufactured in the country Vs imported into the country, the cost benefit excludes other import taxes paid, clearing charges etc.,

Start-up cost consisting of LPG cylinder is the major investment barrier for the new USERS to switch to LPG from Charcoal. The scale up of LPG can be accelerated through reducing the startup back barrier; government subsidies;

TABLE D:

Type of Cylinder Pack	Price $ CIF Dar es Salaam	Price $ Ex-Factory Dar es Salaam	Price Difference ($)
38 kg	60.00	54.00	6.00
15 kg	30.30	25.00	5.00
06 kg	17.00	14.00	3.00
03 kg	15.40	11.50	2.00

3. LPG Cylinders:

3.1 Cylinder types:

Cylinder cost is what makes the start-up and distribution costs of LPG cheaper or higher than for solid or liquid fuels. LPG had the potential of becoming the primary cooking fuel in every part of the sub-Saharan Africa countries if, industry can drive the startup cost of the Cylinder at lower.

Cylinder comes in different packs in different countries. In sub-Saharan Africa and in Tanzania the standard packs of cylinder and their segments are as shown below Table A:

Cylinder Tanks size in Kgs	Segment
03 kgs	Domestic
06 kgs	Domestic
15 kgs	Domestic
38 kgs	Commercial

3.2 Cylinder Manufacturing process:

Cylinder body manufacturing process is common across the world. However, the stay plates (also known as valve protection rings) and base ring (also known as foot ring) designs are different as per the requirements of customers. Normally cylinders are produced in batches of 200 and above. This process starts from raw material.

Steel plates are cut to the required dimensions to produce cylindrical body by rolling operation. Generally, domestic LPG cylinders are in two-piece construction and cylindrical portion does not exist for these cylinders. Valve protection rings (or collars) are fabricated by blanking; rolling and forming operations as shown in the Figure 8. There are no specific guidelines for the shape of valve protection rings as it is not an integral part of cylinder body. Hence, the shape can be differed from different LMC. Valve protection ring for domestic LPG cylinder is fabricated with a circular steel pipe with three stay plates attached to it the domes are manufactured by blanking and deep drawing process. The top dome undergoes trimming and piercing operations for attaching a bung to it. The bottom dome undergoes only trimming operation as shown in Figure 8. The base plates (also known as foot rings) are manufactured by blanking, rolling, welding and forming operations. Similar to valve protection ring, the base ring or foot ring shape is not specified in standard. It can be manufactured as per the requirements of LPG marketing company's specification.

All these components undergo degreasing operation and then welded together to form either a two piece or three-piece cylinders. The complete cylinder then subjected to heat treatment to relieve internal

stresses developed due to welding operation. Welding and heat treatment are critical operation in cylinder manufacturing. The requirements of weld methods and welder qualifications are prescribed in IS 3196 Part1. Similarly, the heat treatment process parameters are particularly important to get required mechanical properties in finished cylinder. Cylinder should be heat treated correctly as per the recommendations of raw material suppliers. Otherwise, the finished cylinder may exhibit tensile strength values above or below stated specifications in Indian Standard and leads to failure in cylinder mechanical properties testing (acceptance testing).

After the heat treatment process, every cylinder is subjected to hydro test. This test reveals leaks, if any in finished cylinders. At this stage LPG cylinder are subjected to test pressure for a specified period to check leaks from body and weld joint. All cylinders produced in a manufacturing location should undergo this test. Hydro test passed cylinders are sent for painting. At this stage cylinder surface is prepared either by shot blasting or grit blasting. Once the surface is prepared, cylinders are powder coated and baked to achieve smooth paint thickness all over cylinder body as per the oil company specifications. The cylinders are then weighed and stamped tare weight on their collars or valve protection rings. Also other details of cylinder like serial number, manufacturing date are punched on cylinder body. The cylinders are then fitted with a valve and tested for leaks, if any once again. LPG cylinder is ready for dispatch, if it crosses all these stages successfully.

In addition to the above, manufacturer should test few sample cylinders from each lot for ISI certification purpose. The tests to be conducted on LPG cylinders for certification are 22 Acceptance tests, Burst test, volumetric expansion test, hydrostatic stretch test, hydrostatic test, pneumatic leak test, radiographic examination, and fatigue /cycle test.

The acceptance test reveals the parent metal mechanical properties and weld mechanical properties. Tensile samples are cut from cylinder body and tested for measuring yield strength, tensile strength, percentage elongation and weld tensile strength. One cylinder should undergo this test for every batch / lot of 203 or above cylinders.

Volumetric expansion test indicated permanent volumetric expansion of cylinder under test pressure conditions. One cylinder should undergo this test for every batch of 403 cylinders. The same cylinder can be subjected to burst test to measure burst pressure and nominal hoop stress in cylinder at burst pressure conditions.

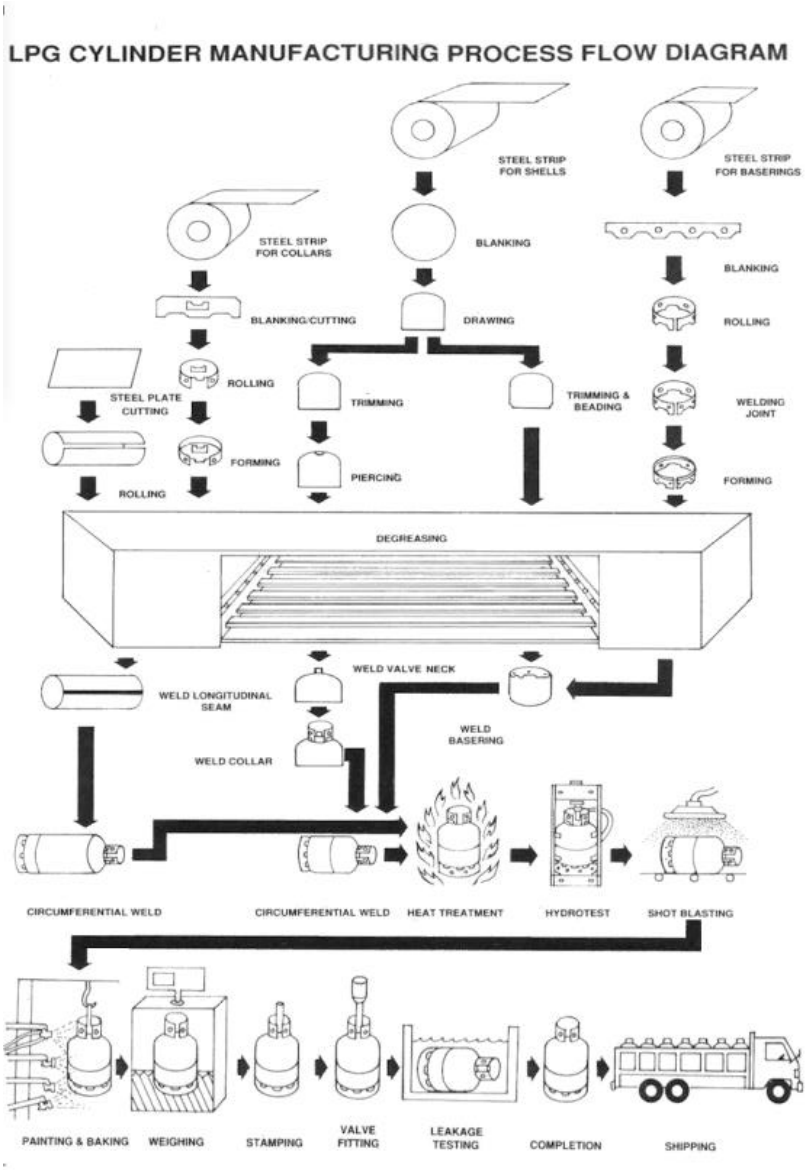


Figure 8: LPG Cylinder Manufacturing Process Flow Diagram

4. SWOT Analysis:

SWOT Analysis	
Strengths	**Weaknesses**
▪ Taifa Gas existing requirement of new cylinders ▪ High possibility of alternate buyer ▪ First mover advantage as no other manufacturing units of this magnitude is existing in the country to support the potential growth available in the LPG cylinder market. ▪ Great development potential market	▪ High labour intensive skilled business. Hence, a lot of training of national staff required ▪ High initial project cost and constant improvement in adding new technologies ▪ Technological Innovation Aimed at Improving Manufacturing Process. ▪ Constant technological know-how requirement from foreign countries.
Opportunities	**Threats**
▪ Increasing demand of LPG due to Rapid urbanization, increasing disposable income, and growing residential sector ▪ Leakage free LPG cylinders with protective packaging and advanced seal are safe ▪ Potential of Job creation and can expand to other geographic, un-grown LPG market of the landlocked Sub-Saharan African countries	▪ The availability of alternatives to LPG cylinders such as induction cookers, air fryers, solar cookers, and biogas ▪ Future chances of less expensive alternative sources, though they are not immediately available. ▪ Falling behind to bring new technologies before the competitors ▪ Uncertain raw material prices can create threat to profitability ▪ Lack of government support with respect to subsidies right from setting up to running the manufacturing units

5. Cost of the Project and means of Finance:

The total project is expected to cost $7.8 million as per below breakdown:

Particulars	Amount	Equity	Debt
Land and permits	550,000	550,000	
Machinery, Laboratory and Steel Structures, Cold Test, Hot Test, Commissioning of the Equipment and trial runs Firefighting & Fire Alarm systems; Security systems; earthing system	4,700,000		4,700,000
Utilities: Generator; Compressor; Chiller; Lighting equipment; cabling; transformer; LPG Tank piping and vaporizer; fuel tanks; water tanks; Buildings (outside civil work): Landscaping, Road and Paving, Drainage system, Fence1	1,100,000	1,100,000	
Buildings, Steel Structure & Covering, Overhead Crain, Ventilation, Concrete work, Store and office Building	1,500,000	1,500,000	
Total	7,850,000	3,150,000	4,700,000
%	**100%**	**40%**	**60%**

The board has chosen the state of art automated machinery from M/s. Rokteknik, made in Turkey.

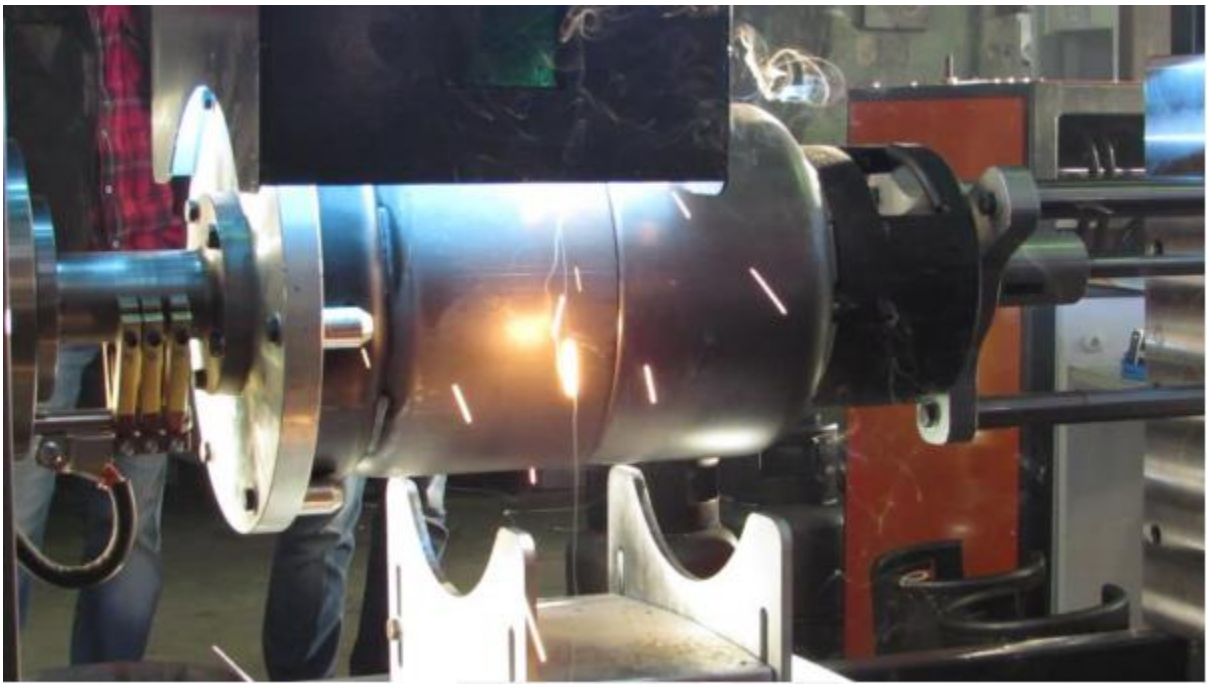
ROK Teknik is a machinery design and production company with 100% export mentality to over 20 countries around the world. The main specialty is Complete LPG Cylinder Production Lines. ROK Teknik is producing all kinds of LPG Production Line machinery with the intention of being efficient. Beginning from giving the shape to the raw material to testing the LPG Cylinder as an end-product, in every part of LPG Cylinder Production they have 40 years of knowledge. From A to Z, ROK Teknik knows industry needs to maintain a successful production environment with client's desired production capacities or with the existing machineries.

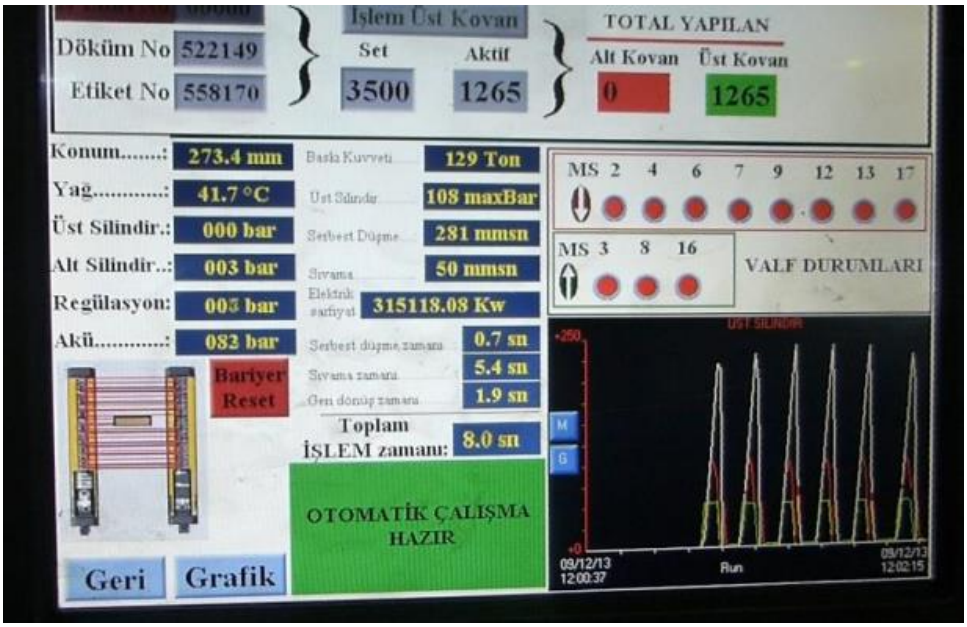
ROK Teknik is located in the second biggest industrial city of Turkey, Kocaeli. Since, Turkey is in a very strategic location for reaching to all Middle East and North Africa (MENA), European, former Soviet Union (FSU), Gulf Cooperation Council (GCC) countries, ROK Teknik acts as a bridge to all these countries.

The total cost of the machinery, utilities and Equipment commissioning is coming down to $4.7 million which includes complete installation, commissioning, training local engineers, welders, support staff. Equity would be 40% and the balance 60% would be long-term debt.

Machinery Details:

A PLC controlled, full automated state of art machinery which can produce 300 cylinders per hour.




Döküm No 522149
Etiket No 558170
İşlem Üst Kovan
Set 3500
Aktif 1265
TOTAL YAPILAN
Alt Kovan 0
Üst Kovan 1265
Konum.....: 273.4 mm
Yağ.....: 41.7 °C
Üst Silindir.: 000 bar
Alt Silindir..: 003 bar
Regülasyon: 003 bar
Akü.....: 083 bar
Baskı Kuvveti 129 Ton
Üst Silindir 108 maxBar
Serbest Düşme 281 mmsn
Sıvama 50 mmsn
Elektrik sarfiyat 315118.08 Kw
Serbest düşme zamanı 0.7 sn
Sıvama zamanı 5.4 sn
Geri dönüş zamanı 1.9 sn
Toplam İŞLEM zamanı: 8.0 sn
Bariyer Reset
OTOMATİK ÇALIŞMA HAZIR
Geri
Grafik
MS 2 4 6 7 9 12 13 17
MS 3 8 16
VALF DURUMLARI
ÜST SİLİNDİR
09/12/13 12:00:37
Run