FROST & SULLIVAN

INDEPENDENT EQUITY RESEARCH

HOMEBIOGAS LTD

05.06.2021

INITIATION OF COVERAGE

Stock Exchange
TASE

Symbol
HMGS

Sector
Technology

Sub-sector
Cleantech

Stock price target
NIS 19.7

Closing price
NIS 12.7

Market cap
NIS 248.4 Mn

No. of shares
19.5 Mn

Average Daily Trading Volume
325 stocks

Stock Performance (since IPO)
-20.6%

HomeBiogas LTD. (TASE: HMGS) is an Israeli publicly traded company engaged in developing, manufacturing, distributing, and selling small and medium scale biogas systems that offer a comprehensive solution for waste management, renewable energy creation, clean cooking, fertilizer production, and sanitation.

Market - The cost of handling the organic waste created by the Hospitality and Institutional sectors in the US is estimated at $55 billion per annum. Total global expenditures on wood fuel for cooking are estimated to be around $50 billion.
The anaerobic digestion market is expected to surpass $15 billion by 2025 with a CAGR of 10.62%. The annual market value for new sanitation technologies designed for low-resource settings is estimated to reach more than $6 billion globally by 2030. Key driving trends for small/medium scale systems are policies and regulations for on-site food waste treatment, the cost of handling the organic waste, and the growing demand for innovative solutions to reduce carbon emissions.

Strategy - The company intends to increase its market share in several selected countries, leveraging existing and future agreements with local distributors. In addition, the company plans to offer "Pay as You Go" models, making biogas systems accessible to a larger pool of customers. In the institutional field, the company intends to partner with local partners to offer operators of commercial-size kitchens (such as hotel chains, etc.) an OPEX-based model for having a small-footprint biogas system that saves costs and meets alternative energy targets.

The company's vision is to promote sustainability, improve lives, and positively impact the environment by harnessing its waste treatment and biogas systems expertise. With over 10,000 home systems installed in over 100 countries, the company can become a world leader in the field.

We value HomeBiogas's equity at NIS 383.8; the price target to be in the range of 18.7 NIS to 20.7 NIS with a mean of NIS 19.7.

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Contents

Investment Thesis

Sustainability and environmental trends, combined with maturity of micro-funding models in developing countries, and increasing cost of managing organic waste, are driving commercial adoption of small and medium scale on-site biogas systems.

HomeBiogas LTD. (TASE: HMGS) is an Israeli company that is publicly traded on the Tel Aviv Stock Exchange. The company's vision is to promote sustainability, improve lives, and positively impact the environment by harnessing its expertise in waste treatment and biogas systems.

HomeBiogas provides patent-based small/medium scale anaerobic digestion modular biogas systems that enable people and businesses to turn their own organic waste into self-made clean energy on-site.

The company

- Incorporated in 2012, the company's innovative products won multiple innovation awards, prizes, and grants, including EU's Horizon SME and the Israeli Innovation Authority (IIA).
- Ready to scale and become category leader after demonstrated product-market fit with over 10,000 systems installed in 100+ countries.

Products & segments

- The current line of products for domestic and small farms includes:
    - Three biogas systems of different sizes - HomeBiogas 2, 4, and 7 cubic meters. These systems treat organic waste and turn it into cooking gas and fertilizer.
    - Bio-toilet that turns human waste into biogas.
    - Additional products such as stove, filters and probiotic tablets.
- The company is in the piloting stage of a line of on-site organic waste treatment systems for industrial kitchens of public institutes, companies, hotels, restaurants, and food complexes. The systems use an anaerobic digestion process to decomposes organic waste (up to 1 ton per day) into biogas and organic liquid fertilizer. The biogas is best used for water heating, and the liquid is best used as a bio-fertilizer.

Global markets and opportunity:

- The anaerobic digestion market was valued at $7.5 billion in 2018 and is expected to surpass $15 billion by 2025 with a CAGR of 10.62% over the forecast period. Key driving trends for small/medium scale systems are policies and regulations for on-site food waste treatment.
- Globally, between 2.4 and 2.8 billion people do not have access to clean cooking fuels and technologies. These people use inefficient open fires or simple cookstoves and rely on wood-based fuel, including wood, charcoal, and coal. Total global expenditures on wood fuel for cooking are estimated to be around $50 billion.
- Sanitation is a basic necessity that contributes to better human health, dignity, and quality of life. Over 2 billion people lack basic sanitation services, with 673 million people still practice open defecation, with 91% live in rural areas. The annual market value for new sanitation technologies designed for low-resource settings is estimated to reach more than $6 billion globally by 2030.
- The US Environmental Protection Agency (EPA) estimates 24 million tons of organic wastes are generated annually by the Hospitality and Institutional sectors, responsible for 25% of the food waste. The cost of handling the organic waste in is estimated at $55 billion per annum[1].

Summary

We believe that HomeBiogas is on a path for growth and success on a global scale:

- HomeBiogas' novel platform technology and its unique value propositions present great promise in becoming the future incumbent technology for on-site food waste treatment and sanitation services.
- The company is CE, ISO 14001, ISO 9001 certified and has international product liability insurance. HomeBiogas led to the establishment of a new international standard for household biogas systems, ISO 23590, published in December 2020[2].
- HomeBiogas has received **significant industry recognition**, which speaks volumes about its growth potential; for instance, the company HomeBiogas is a Phase 1 & Phase 2 SME Instrument winner and was recently granted funds for a pilot project of its institutional system with the Israeli Defense forces.
- **The company has partnered with some of the world's most credible organizations**, including USAID, EU, UN, the International Red Cross, and is a member of the Clean Cooking Alliance. Products are sold

[1] https://www.epa.gov/international-cooperation/international-efforts-wasted-food-recovery
[2] https://www.iso.org/standard/76157.html

online to end customers in the developed countries and via a network of 20+ distributors in various countries.

Therefore, we view HomeBiogas as an excellent opportunity for those seeking to invest in sustainable and positively impact the environment while improving people lives. We value the company at NIS 383.8 million.

1. Company Overview

General

HomeBiogas Ltd., headquartered in Israel, is engaged in developing, manufacturing, distributing, and selling small and medium scale biogas systems that offer a comprehensive solution for waste management, renewable energy creation, clean cooking, fertilizer production, and sanitation.

The company was incorporated in 2012 as a private company. Its shares are listed for trading on the Tel Aviv Stock Exchange since 1 February 2021 (TASE: HMGS) after raising approx. 100 million NIS in an IPO.

Distribution of shareholdings includes 37.63% float, institutional 17.51%, and 44.86% interested parties of which main shareholders are Closed-Loop VC with 16.27%, the three founders with 11.73%, Engie New Ventures with 9.47%, and JS Capital with 7.39%.

Vision

HomeBiogas's vision is to promote sustainability, improve lives, and create a positive impact on the environment by harnessing its expertise in waste treatment and biogas systems.

Business Activities and Strategy

The company is developing, manufacturing, distributing, and selling a line of small and medium scale biogas systems for domestic and commercial use that offer a comprehensive solution for waste management, renewable energy creation, clean cooking, fertilizer production, and sanitation. The biogas systems convert kitchen waste, animal manure, and human waste into clean cooking gas and liquid fertilizer.

Figure 1: Feed and output of HomebBiogas systems

The company is active in 3 segments- 1) Biogas systems for domestic use/ small farms, 2) domestic / off-grid sanitation, and 3) institutional kitchens.

To date, the company has sold over 10,000 small biogas systems for domestic use in over 100 countries, demonstrating product-market fit for domestic use in both developed and developing markets. In the coming years, the company intends to increase its market share in several selected countries, leveraging existing and future distribution agreements with local distributors in those countries. In addition, the company explores options to offer "Pay as You Go" models and making biogas systems accessible to a larger pool of customers.

In the institutional field, the company is in the advanced development phase of a system tailored to local treatment of organic waste by turning it into renewable clean energy. In this context, the company intends to partner with local partners to offer operators of commercial-size kitchens such as hotel chains, fast food chains, hospitals, military bases, and others an OPEX-based model for having a small-footprint biogas system that save costs of sending organic waste to landfill, reduce energy costs, reduce carbon footprint and meet alternative energy targets.

IP and Technology

Patents

Patent #1	Patent #2
"Lightweight assimilable appliance and respective method for production of biogas and liquid fertilizer" Description: First-generation system for domestic biogas, with a flexible digestion container, hung from an external rigid scaffolding. Published: International (2014), Israel (2019), USA (2017), Europe (2017), Australia (2016), South Africa (2017), China (2018), Nigeria (2015) Expire: December 2033	"Lightweight appliance with exoskeletal support respective kit-of-parts and method for production of biogas and liquid fertilizer" Description: Second-generation system for domestic biogas, without external rigid scaffolding, but with external flexible casing. Published: International (2019), USA (2019), Australia (2020), China (2019), India (2018) Expire: December 2037

Trademark

The company registered its name and logo in the US as a trademark.

Grants

The Israeli Innovation Authority backs the company since its inception. During the years 2012-2020, the company received a total of $1.3 million.

Recently, in April 2021, the company was granted funds for a pilot project of its institutional system with the Israeli Defense forces.

HomeBiogas is a Phase 1 & Phase 2 SME Instrument winner, supporting the successful commercialization of HBG 7, launched during the SME Phase 2 project. The company was granted €1.6 million by the European Horizon 2020 SME Phase 2 program in 2017 to develop an institutional biogas system. A second project under the Horizon 2020, part of the Consortium program, for granted €167,000 in May 2018.

Safety and Standards

The company is CE, ISO 14001, ISO 9001 certified and has international product liability insurance. HomeBiogas led to the establishment of a new international standard for household biogas systems, ISO 23590, published in December 2020[3].

Prizes

- ✓ Finalist for 2020 "High-Tech for Humanitarian Aid" Prize (2020)
- ✓ Chivas Venture, UK (2020)
- ✓ Vegas hardware retail choice for innovation (2019)
- ✓ National ENERGY GLOBE Awards, Austria (2018)
- ✓ Green Challenge, Netherlands (2017)

Distribution & Partnerships

The company has partnered with some of the world's most credible organizations, including USAID, EU, UN, the International Red Cross, and is a member of the Clean Cooking Alliance (www.cleancookingalliance.org). Products are sold online to end customers in the developed countries and via a network of 20+ distributors in various countries, including India, Kanya, US & Canada, Costa Rica & Panama, Philippines, Nepal, Thailand, Laos, and Brazil.

Offices, Facilities, and Employees

As of the report date, the company has no real estate or fixed assets of material scope and is renting two facilities; one is used for administrative, marketing, and sales purposes, and the other facility is used for storage, quality control, and packing finished products prior to shipment. Workforce is about 70 people.

[3] https://www.iso.org/standard/76157.html

2. Products Overview

Definitions - What is Biogas?

Anaerobic Digestion (AD)

A series of biological processes in which micro-organisms breakdown and digest organic wastes in the absence of oxygen in sealed containers, similar to the process humans and mammals have in their stomachs. The outcome is biogas and digestate (a fertilizer rich in nutrients such as nitrogen, phosphate, and potash). AD is a well-established technology and is at the heart of the circular economy of organic wastes.

Biogas

Biogas is the mixture of gases produced by the breakdown of organic matter in the absence of oxygen (anaerobically), primarily consisting of methane and carbon dioxide, and can be used as a fuel. Biogas can be produced from raw materials such as agricultural waste, manure, municipal waste, plant material, sewage, green waste, or food waste.

Onsite sewage facilities

Onsite sewage facilities (OSSF), also called septic systems, are wastewater systems designed to treat and dispose of effluent on the same property that produces the wastewater in areas not served by public sewage infrastructure. It is a sub-category within the Decentralized Wastewater Systems category (covering small and low-density communities, buildings, and dwellings in remote areas, individual public or private properties).

Product Portfolio

Domestic products

Biogas systems

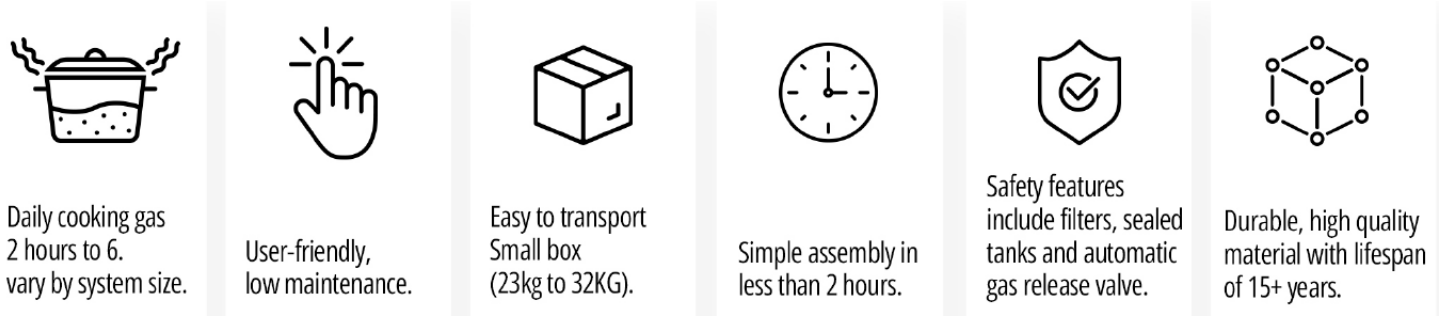
The initial prototype was piloted in 2014. In 2016, the first generation became commercially available.

The current line of products includes 3 biogas systems (HomeBiogas 2, 4, and 7 cubic meters sizes) built from 3 core elements:

1. A welded inner liner designed to contain the gas and digested materials
2. An outer liner specially designed for strength, stability, and UV resistance
3. Injection moldings, including the system's piping, inlet, and outlet

The domestic systems are made of 100% recyclable materials and have a patented mechanical pressure generation mechanism (ensuring that the filtered gas pressure in the storage tank remains constant and controlled).

Key features include:



Bio-toilet

Treating toilet waste, 100% off-the-grid, and only use 1.2 liters of water per flush from a standing source (no electricity is required).

Additional products include cooking stoves, probiotic tablets, and filters.

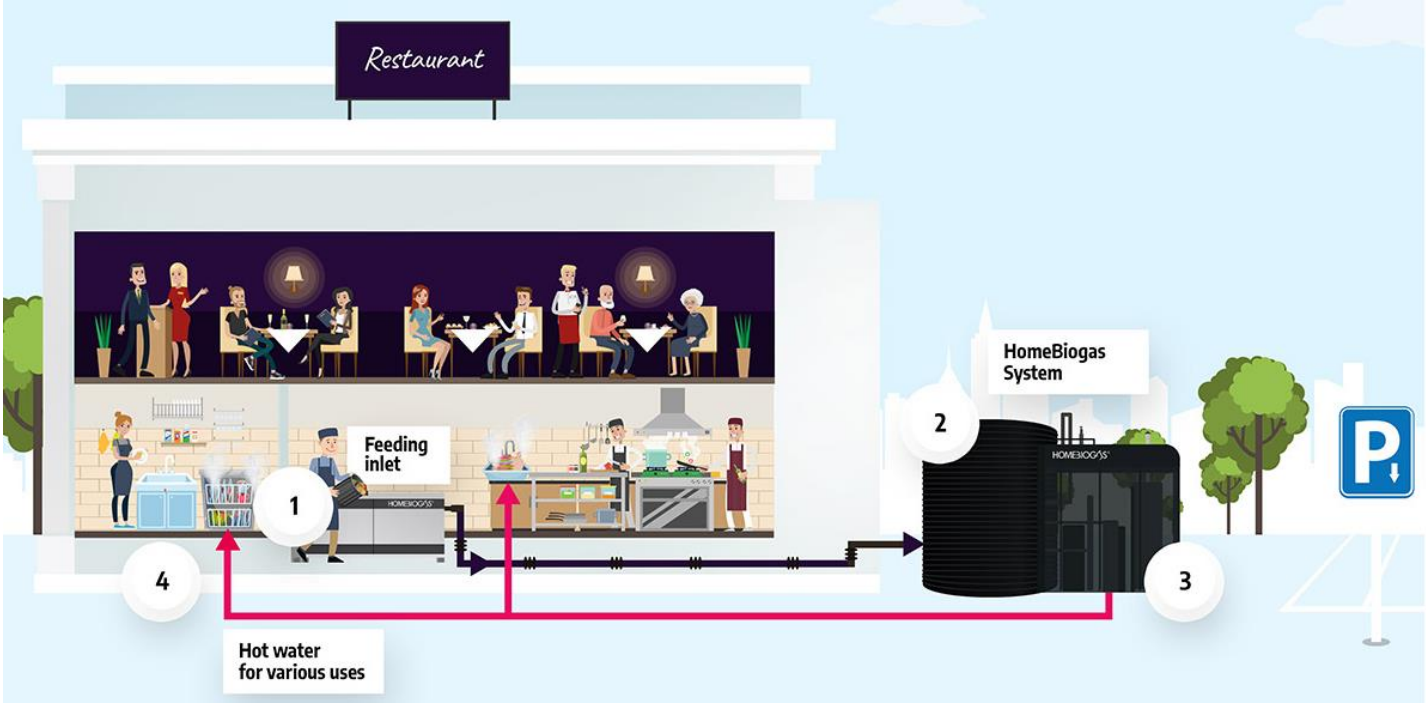
Figure 2: HomeBiogas 2, bio-toilet, stove, prebiotic tables, and filters for domestic and small farm use

Institutional products

The company is developing a line of on-site organic waste treatment systems for commercial and industrial kitchens of public institutes, companies, hotels, restaurants, and food complexes. The systems use an anaerobic digestion process to decompose the organic waste into biogas and organic liquid fertilizer. The biogas is used for water heating, and the liquid is best used as a bio-fertilizer. Please review the video.

Figure 3: System

Figure 4: Process Illustration – how it works?



1) The kitchen waste is fed to the grinding unit and from there transferred to the anaerobic digester container, 2) The waste is broken down in an anaerobic process, 3) The generated gas is converted immediately into hot water, 4) The hot water serves the needs of the kitchen)

Key features and advantages

- Affordable Biogas-as-a-service model: all included per use pricing model, based on monthly payments with no additional fees for installation and services. End-users save on waste management costs and renewable energy generation from the first month of use
- Small footprint (starting at 20 m²)
- A safe and sealed system with no odor
- Fits outdoors under any environmental conditions Internal temperature control system
- Certified technology
- Automated waste sorting
- Easy transportation and installation
- Automatic real-time monitoring and remote control
- Convenient user interface located inside the kitchen

The product portfolio includes a few systems in pilot stages, with scalable volume capacity and size from 100kg per day to 1,000 kg per day, expected to be commercially available during 2022.

3. Market Overview

Global Sustainability Trends

Sustainability Development Goals (SDG's) adopted at the 2015 United Nations Summit provide the principles, framework, and targets for all stakeholders across the value chains to identify key development areas to enhance and seek continual improvement regarding to sustainability, good health, well-being, and climate action.

Figure 5: The 17 United Nations Sustainable Development Goals (SDG's)

All of the 17 SDG's have a strong role to play in ensuring a systemic shift for socio-economic and environmental improvement[4]. HomeBiogas has a strong value proposition matching with 8 of the UN goals, making it attractive and highly-relevant to commercial companies, organizations, banks, and governments.

- GOAL 2: Zero Hunger
- GOAL 3: Good Health and Well-being
- GOAL 5: Gender Equality
- GOAL 6: Clean Water and Sanitation
- GOAL 7: Affordable and Clean Energy
- GOAL 11: Sustainable Cities and Communities
- GOAL 13: Climate Action
- GOAL 15: Life on Land

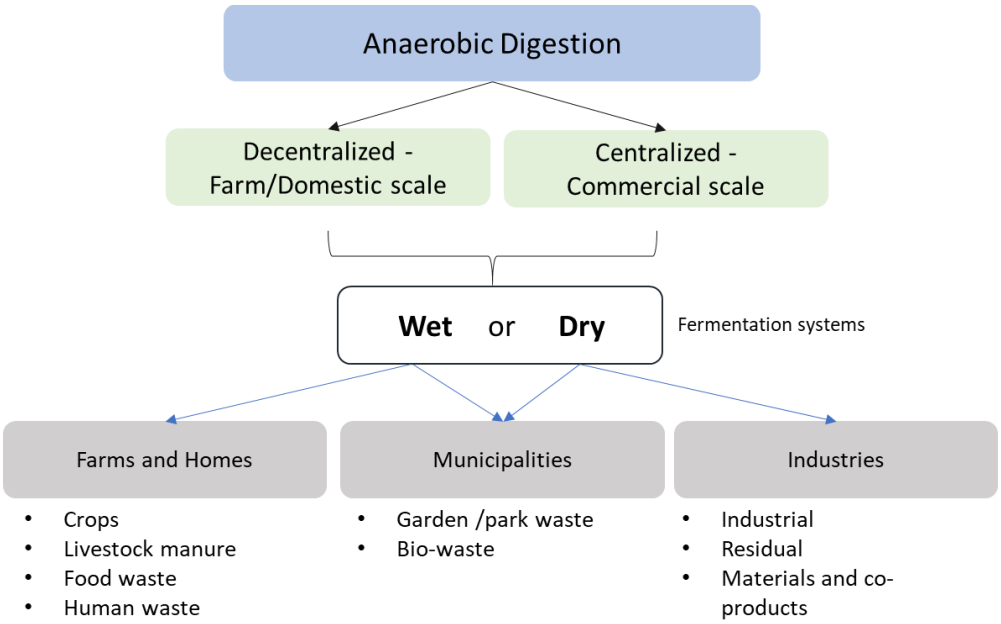
EU Circular Economy Plan

The updated European Commission's Circular Economy Action Plan from March 2019 is committed to the United Nations SDGs. The plan involves the entire value chain and major focus areas relevant to HomeBiogas: Waste reduction at source, Diversion from landfills, and Sustainable business best practices. One of the targets for 2035 is the reduction of municipal waste landfilling volume by 50%.

[4] UN, Department of Economic and Social Affairs, Sustainable Development

Anaerobic Digestion Market

The Anaerobic Digestion market was valued at $7.5 billion in 2018. It is expected to surpass $15.0 billion by 2025 with a CAGR of 10.62% over the forecast period.



According to the American biogas council, investment in new biogas systems in 2018 totaled $1 billion. In recent years, investments in the US biogas industry have been growing at an annual rate of 12%. Although there is already a wide application of biogas technologies worldwide, the industry is still in its initial stages of development. The biogas industry can be analyzed in 3 broad categories: micro digesters using biogas, scale digesters generating electricity, and scale digesters producing biomethane[5].

Micro digesters

Biogas from micro-scale digesters is most often used in stoves for cooking or heating, displacing solid, high emission fuels like firewood and charcoal, and play an important role in developing countries, where they are an integral part of farming, waste management, and energy security.

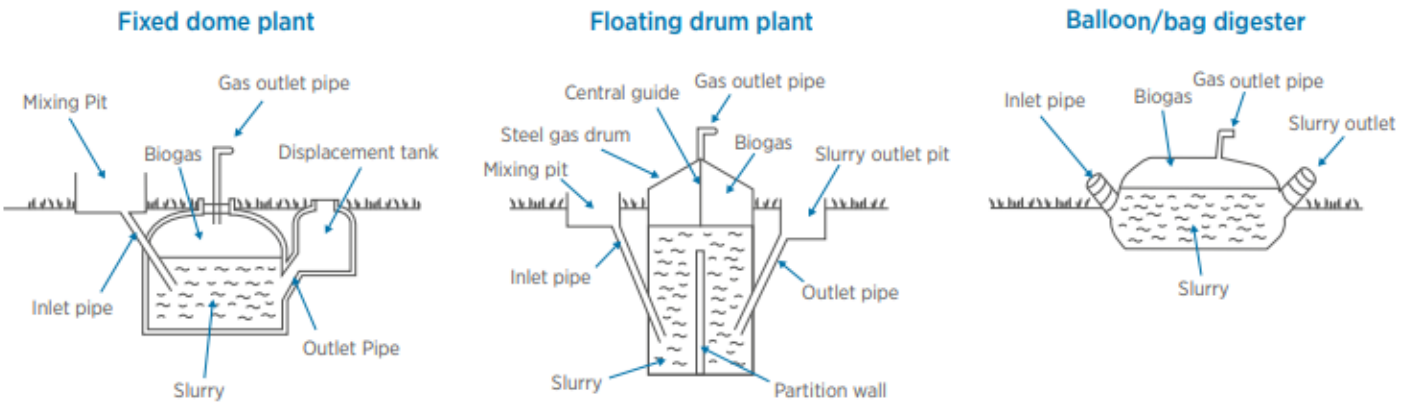
The World Biogas Association estimates that close to 50 million micro-scale digesters are operating worldwide, with 42 million operating in China and another 5 million in India, and some 700,000 installed in the rest of Asia, Africa, and South America[6].

[5] RENA (2017), Biogas for domestic cooking: Technology brief, International Renewable Energy Agency, Abu Dhabi
[6] World Biogas Association, Global Potential of Biogas, 2019

Types of micro digesters[7]:

- Fixed-dome is a biogas system based on digging a deep pit and covering it with a concrete dome. Construction takes about a month and is sensitive to quality problems such as leaks due to cracks in the concrete. The oldest and most commonly are installed in India and South East Asia.
- A floating drum is a biogas system made of rigid materials (such as steel, plastics, and fiberglass). Typically, these products are manufactured, distributed, and installed locally.
- Flexible (balloon/bag digester) systems such as HomeBiogas products are relatively new in the market and have a superior value proposition because it is quick to install (DIY/pre-fabricated), has lower costs and innovative payment models.

Figure 6: Types of Micro-Digesters



Scale digesters generating electricity

Generation of electricity from biogas is an established technology that has been widely implemented worldwide, with over 110,000 biogas systems operating in China, about 18,000 in Europe, and 2,200 in the US.

Medium to large scale digesters upgrading to biomethane

Upgrading biogas to biomethane is a relatively new but proven technology. In 2019, over 700 such plants were mainly in Europe (540), about 50 in the US, 25 in China, 20 in Canada, and a few in Japan, South Korea, Brazil, and India.

[7] Pictures are taken from Sistems.bio publications, Green Leaf Kenya web site and

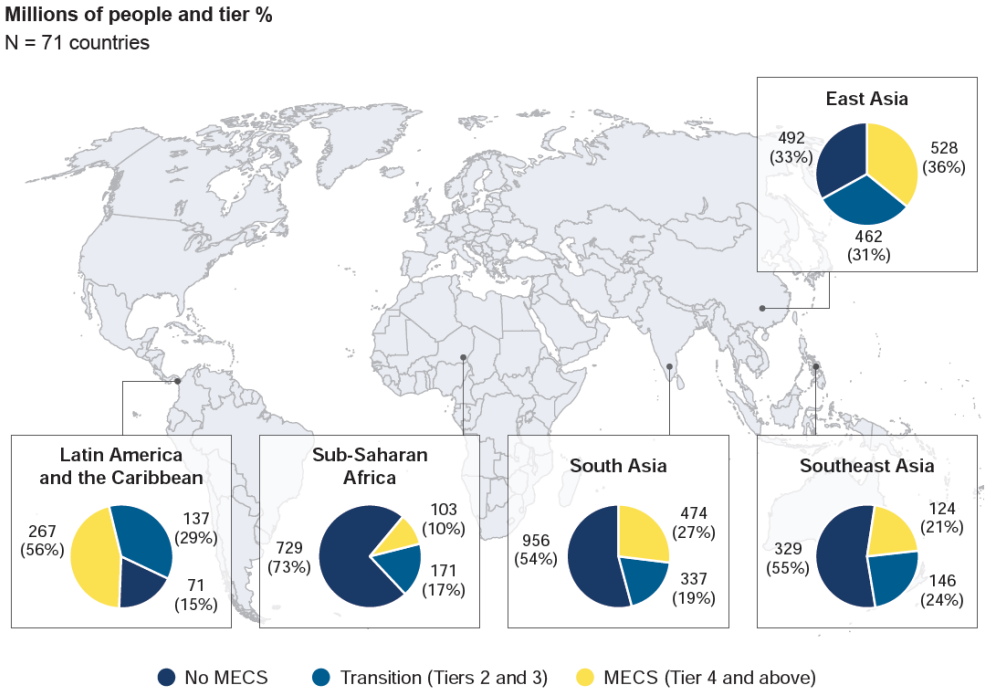
Clean Cooking And Sanitation Market

Clean cooking

According to World Bank, the UN, and the FAO reports, between 2.4 and 3.5 billion people worldwide do not have access to clean cooking fuels and technologies. These people use inefficient open fires or simple cookstoves today and rely on wood-based fuel, including wood, charcoal, and coal, for cooking.

The South Asia region has the highest number of people without access to Modern Energy Cooking Services (MECS), around 950 million people, following by Sub-Saharan Africa with around 730 million, and East Asia with 500 million.[8]

Figure 7: Population Access to MECS, by Developing Region



According to the World Health Organization and the World Bank, 82% of the Sub-Sahara population rely on solid fuels, with only 4% of the rural population having access to clean cooking[9]. As a result, 90% of wood consumed is estimated to be used for wood fuel and charcoal.[10]

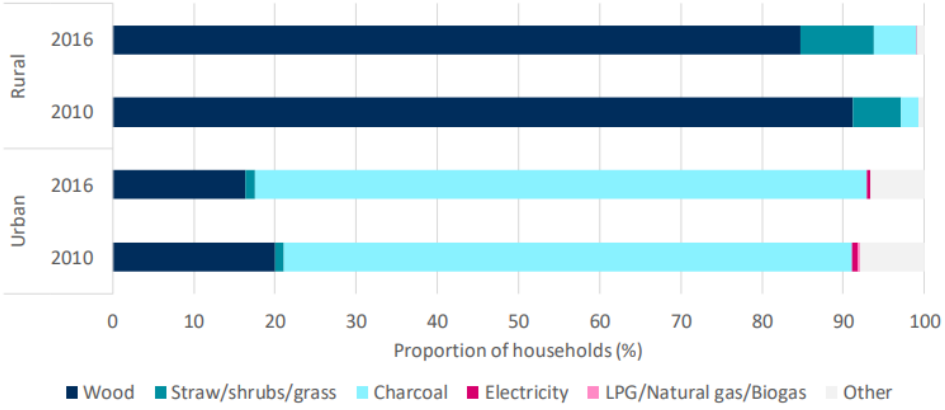
Wood is still the most important single source of renewable energy for households in developing countries. Woodfuels arise from multiple sources, including forests, other wooded lands, trees outside forests, co-products from wood processing, post-consumer recovered wood, and processed wood-based fuels[11].

[8] Energy Sector Management Assistance Program (ESMAP). 2020. The State of Access to Modern Energy Cooking Services. Washington, DC: World Bank.
[9] https://trackingsdg7.esmap.org/
[10] FAO, Sustainable Charcoal Production for Food Security and Forest Landscape Restoration, Feb 2020

Figure 8: Percentage of developing world population relying on solid fuel by region

Sources: WHO Global Health Data Respository, DHS, MICS, LSMS, National Census data; Dalberg analysis
Note: Figures are latest available, roughly equivalent to 2012-2013 average, based on 2005-2014 data for individual countries.

For example, 99% of households in Burundi rely on wood fuels for cooking. The rural population uses mainly wood, and the urban population mainly uses charcoal[12].



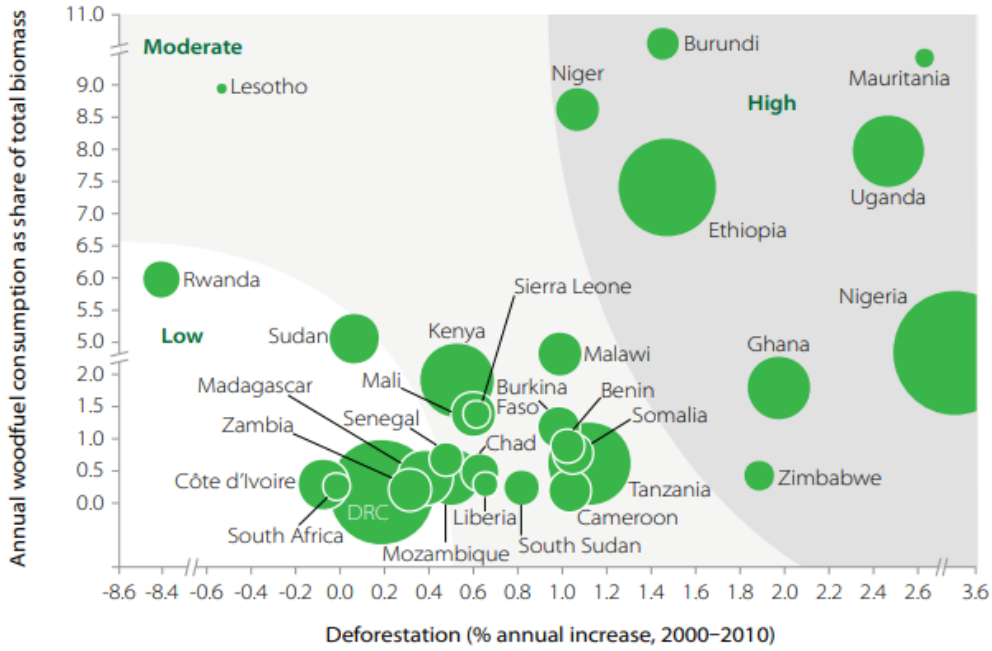
Negative impact

- Environmental
  - Increased GHG emissions due to the use of inefficient fuel production and consumption.
  - Catalytic warming effects of black carbon emissions tied to solid fuel cooking. Cooking on traditional fuels in sub-Saharan Africa accounts for 6% of global carbon emissions.

[11] Food and Agriculture Organization of the United Nation
[12] https://www.lightingafrica.org/wp-content/uploads/2020/07/Burundi-off-grid-market-energy-assessment-EN.pdf

- Forest degradation and deforestation due to fuel collection and production. Kenya, for example, is losing 120,000 dunam of forest each year due to the demand for cooking fuel[13].
- Foregone agricultural productivity due to habitat degradation and combustion of dung as fuel.

Figure 9: Biomass pressure map: solid-fuel cooking in Sub-Saharan Africa[14]



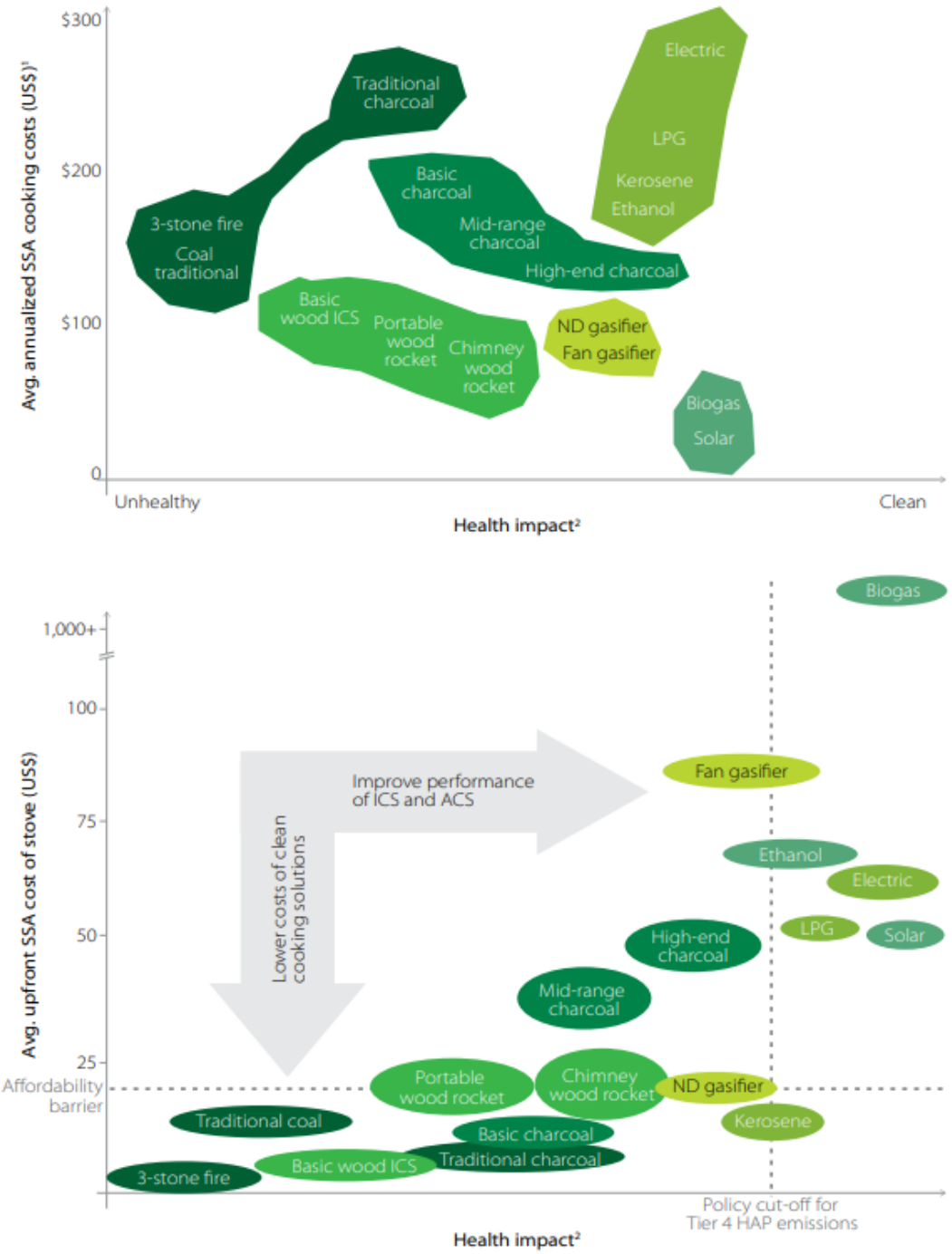
Note: Bubble size reflects size of 2010 solid fuel population; biomass defined as above-ground biomass; woodfuel includes charcoal and firewood.

Sources: Food and Agriculture Organization of the United Nations (FAO) deforestation data; Dalberg global cooking fuel use database drawing on WHO, demographic and health surveys (DHS), Multiple Indicator Cluster Survey (MICS), and Living Standards Measurement Survey (LSMS) data; Dalberg analysis.

- Health
  - A broad range of health conditions is associated with indoor air pollution. Considering that one hour of open fire cooking is equivalent to smoking 400 cigarettes, it is of no surprise that household air pollution is responsible for an estimated 4.3 million deaths each year.
  - Hundreds of thousands of burns, deaths, and injuries are associated with traditional fuels/cooking appliances.
  - Chronic and acute physical ailments due to firewood collection.

[13] https://medium.com/usaid-global-waters/trying-to-solve-sanitation-and-energy-problems-at-the-same-time-55e56d4e41d2
[14] https://openknowledge.worldbank.org/bitstream/handle/10986/22521/Clean0and0impr000a0landscape0report.pdf?sequence=1&isAllowed=y

Figure 10: Relationship between cooking solutions, costs, and health impact[15]



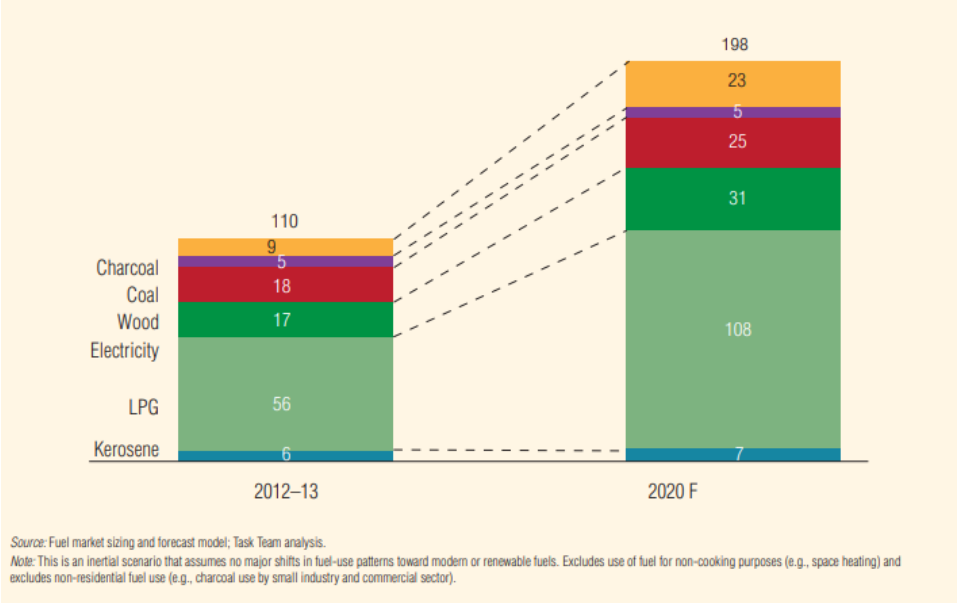
1. Annualized cooking solution costs are based on average fuel costs across Africa, average cooking solution lifespan, and average efficiency.
2. Health rating blends $PM_{2.5}$ and CO emission performance are based on externally validated controlled cooking test and field data for dozens of African stoves, triangulated with performance catalog from Berkeley Air Monitoring Group (2012).

Sources: Africa stove price database; cooking solution performance database drawing on Berkeley Air Monitoring (2012), Jetter et al. (2012), and Grieshop et al. (2011) data; the conceptual layout draws on an analysis from Dr. Kirk Smith et al. (2014); Dalberg team analysis.

[15]https://openknowledge.worldbank.org/bitstream/handle/10986/22521/Clean0and0impr000a0landscape0report.pdf?sequence=1&isAllowed=y

- Economic
    - Avoidable spending on fuel. The total global expenditures on wood fuel for cooking are estimated to be around $50 billion. African households spend between 5% to 20% of their monthly income on cooking fuels.

Figure 11: Global Household Spending on Cooking Fuels, 2015 & 2020F ($, Billions)[16]



Source: Fuel market sizing and forecast model; Task Team analysis.
Note: This is an inertial scenario that assumes no major shifts in fuel-use patterns toward modern or renewable fuels. Excludes use of fuel for non-cooking purposes (e.g., space heating) and excludes non-residential fuel use (e.g., charcoal use by small industry and commercial sector).

    - Lost opportunities for income generation from time spent on fuel collection. Rural households spend 12 to 15 hours collecting firewood each week. The time spent to collect firewood has increased in recent years due to wood shortage, with population growth increasing pressure on natural resources[17].
    - Lost opportunities for income generation due to time spent cooking. Open fire cooking requires a longer cooking time in comparison to gas.

Costs are the main barrier for adopting clean cooking solutions, with current costs range from $50–100 for LPG and electric stove kits and $75–100 for biomass fan gasifier stoves to $500–1,500 for biogas. Kenya's population spends $5-25 per month on cooking energy, while the average monthly income in the Sub-Sahara countries ranges between $50 - $200[18].

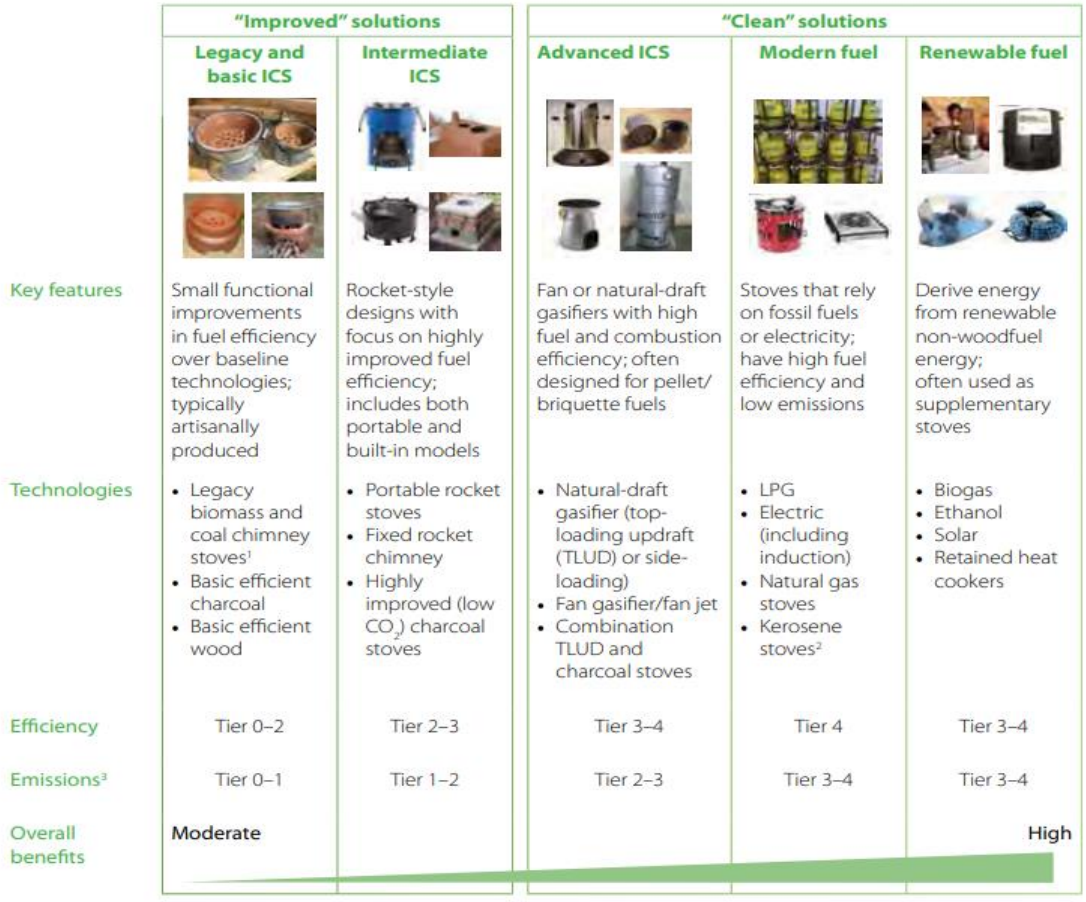
[16] Energy Sector Management Assistance Program (ESMAP), World Bank, The State of the Global Clean and Improved Cooking Sector
[17] https://www.lightingafrica.org/wp-content/uploads/2020/07/Burundi-off-grid-market-energy-assessment-EN.pdf
[18] Clean Cooking Alliance, 2020 Annual Report

The lack of progress in expanding access to clean, modern cooking costs the world more than $2.4 trillion each year, according to a report released in September 2020 by the Clean Cooking Alliance, the World Bank, and the Modern Energy Cooking Services program. The report estimated that US$150 billion is needed annually to reach universal access to modern energy cooking services by 2030.

Reports found that the problem is not a lack of consumer expenditure but the need for business models and technologies that make superior alternatives affordable and accessible. Over the last decade, the industry is transitioning from aid-based to becoming commercially viable. To lower barriers and support the adoption of clean solutions, the World Bank's recently announced $500 million Clean Cooking Fund, housed under the Energy Sector Management Assistance Program (ESMAP)[19].

Key solutions

Figure 12: Relationship between cooking solutions, costs, and health impact[20]



[19] https://www.worldbank.org/en/results/2020/11/10/accelerating-access-to-clean-cooking-the-efficient-clean-cooking-and-heating-program-and-the-clean-cooking-fund

[20] https://openknowledge.worldbank.org/bitstream/handle/10986/22521/Clean0and0impr000a0landscape0report.pdf?sequence=1&isAllowed=y

Sanitation Market

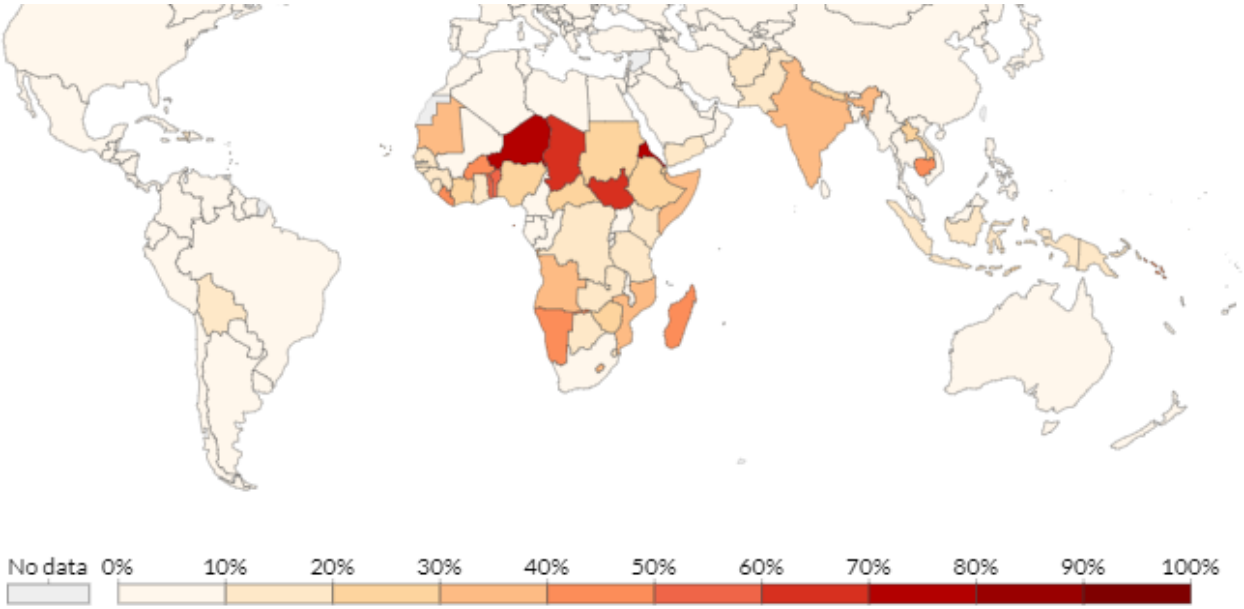
Sanitation is a basic necessity that contributes to better human health, dignity, and quality of life.

The UN's SDG 6 water and sanitation monitoring program reports that in 2017, over 2 billion people lack basic sanitation services, with 673 million people still practiced open defecation, with 91% live in rural areas [21].

The result is that the poor are deprived of decent and dignified lifestyles leading to the deterioration of health, wellbeing, and human environment.

Only 25% of the urban and 4% of the rural population in Sab-Sahara Africa have access to safe sanitation. In Kenya, for example, 35 million citizens have access to safely-managed and basic sanitation, and an estimated 5 million individuals are still practicing open defecation. The Kenyan government estimates that Kenya loses 1-2% of its GDP annually due to poor sanitation. In Ghana, an estimated 20 million do not have a toilet at home; this isn't just a problem at home but in schools, hospitals, and public spaces[22]

Figure 13: Share of people practicing open defecation, 2015[23]



According to the World Health Organization, poor sanitation and hygiene practices contribute to over 820,000 deaths from diarrhea annually. Whereas in developed countries, the death rate is under 1 to 100,000 people, developing countries record much higher rates, with India at 38, Tanzania 85, and Kenya 154[24].

[21] https://www.unwater.org
[22] https://www.wsp.org/sites/wsp/files/publications/Kenya%20Environmental%20Sanitation%20and%20Hygiene%20Policy.pdf
[23] The World Bank
[24] https://www.worldlifeexpectancy.com/cause-of-death/diarrhoeal-diseases/by-country/

Small-scale off-grid sanitation solutions aim to deliver services for the safe disposal of human urine and feces. Off-grid solutions include traditional and improved latrines (various kinds of pits), container-based sanitation (CBS), flush toilets connected to septic tanks, and various wastewater collection and treatment facilities, such as fecal sludge management technologies.

Lack of proper sanitation costs the world an estimated $223 billion every year. It is estimated that the annual market value for new sanitation technologies designed for low-resource settings, such as the HomeBiogas Toilet, could potentially reach more than $6 billion globally by 2030[25]. According to the Toilet Board Coalition, Kenya alone represents a $5.1 billion Toilet economy market opportunity by 2030[26] (for urban and rural, systems and services, monitoring, and more).

Governments in the developing world have policies in place faced with limited funding resources and competing priorities resulting in under-allocation of funds to implement such policies despite the significant positive impact[27].

Food Waste Management

A United States Environmental Protection Agency (EPA) report from July 2020 on Wasted Food Measurements estimated that the Hospitality and Institutional sectors generated 24 million tons of waste in 2016 and is responsible for 25% of the food waste[28].

Waste in restaurants and other food service providers can occur in the kitchen or after food is served. Common causes of waste include overproduction, trim waste, mishandling, excessive portion sizes (on average, diners leave 17% of meals uneaten, 55% of these leftovers stay on the table).

In the US, seven states (New Jersey, California, Massachusetts, Vermont, Connecticut, Rhode Island, and New York) and several cities have already enacted food waste recycling laws. For example, in December 2020, New Jersey established targets to reduce organics in landfills by 75% by 2027.[29]

[25] Bill & Melinda Gates Foundation
[26] http://www.toiletboard.org/wp-content/uploads/2021/03/2020-Sanitation-Economy-Markets-Kenya-2020.pdf
[27] OECD (2019), Making Blended Finance Work for Water and Sanitation: Unlocking Commercial Finance for SDG 6, OECD Studies on Water, OECD Publishing, Paris, https://doi.org/10.1787/5efc8950-en.
[28] https://www.epa.gov/sites/production/files/2020-06/documents/food_measurement_methodology_scoping_memo-6-18-20.pdf
[29] https://www.waste360.com/food-waste/new-jersey-enacts-food-waste-recycling-mandate-implementation-issues-horizon; https://www.njleg.state.nj.us/2020/Bills/A2500/2371_R2.PDF;https://www.waste360.com/legislation-regulation/public-policy-trends-watch-2021

Table 14: US Waste Food Volumes, by Category

Sector/Category	Generation (Tons/Y)	% of total waste
Hotels	1,114,011	1.11%
Restaurants/Food Services	16,886,535	16.89%
Sports venues	38,088	0.04%
Hospitals	288,401	0.29%
Nursing Homes	465,932	0.47%
Military bases	58,944	0.06%
Office buildings	4,004,430	4.00%
Prisons	443,002	0.44%
Colleges & Universities	617,634	0.62%
K-12 Schools	1,162,683	1.16%
	25,079,660	**25.08%**

Potential solutions to process food waste include centralized (such as large AD facilities at landfill locations) and decentralized systems (small-scale systems near the kitchens).

Key drivers and restraints – micro, small, and medium-scale systems

Key Drivers

- **Price increase and limited availability of alternative energy sources** such as coal, wood, gas, and polluting fuels in developing countries. As a result of population growth and the use of cooking means such as coal or wood, the availability of coal and wood sources has declined over the years, and their price has risen.
- **Awareness of the health damage** from using charcoal or wood as a means of cooking and the willingness to adopt innovative technologies have risen over the years.
- **Regulations.** Biogas systems are a green environmental alternative for landfills of organic waste. The global trend is to reduce landfilling and treat waste in environmental ways and more sustainable such as reuse, recycling, and recovery (for energy). As part of this trend, regulatory restrictions are imposed around the world (especially in developed countries), which increase the levies on landfills, and in some cases, even prohibit or restrict the dumping of organic waste. These limitations drive organizations and institutions to look for alternatives to organic waste treatment, in particular, relevancy to the institutional biogas system in development.
- **Support by Government Aid Organizations and Subsidies.** In recent years, a growing number of entities, including the UN, World Bank, and many other NGO and commercial organizations, are supporting the adoption of advanced waste management solutions via grants, funds, and subsidy programs.

- **Price and availability of fertilizers.** One of the important motives for purchasing a biogas system is the organic fertilizer generated in the process. The less available and more expensive the fertilizer sources, the greater the demand for a HomeBiogas system will grow, and vice versa.
- **Solar PV "Pay as You Go" model maturity.** The successful implementation of small off-grid PV solutions in developing countries is paving the way to the same growth and adoption scale in the clean cooking and sanitation domains.

Key Restraints

- **Prices and funding alternatives** are considered to be the main restraint for wide adoption in developing countries. Small systems for domestic use start at $500, a sum that most potential customers are unable to pay. Limited availability of funding alternatives (such as credit) and "pay as you go" models reduce the number of customers that can afford to purchase the systems.
- **Poor operational / logistics infrastructure** is a challenge for delivering systems in rural areas.
- **Local taxes and fees** imposed by the governments increase prices.
- **Limited partners and local talents** are required for demonstrations, installations, and services.

4. Competitive landscape

Competitors

There are hundreds of competitors in the 3 segments that HomeBiogas is active in, mostly very small and local companies. Here are some of the more notable players.

Company	Domestic	Institutional	Sanitation	Units sold
ATEC Bio				1,700
Power Knot				NA
Puxin				NA
QUBE Renewables				NA
SEaB Energy				NA
Sistema Bio				17,000
HomeBiogas				10,000

Short Description of Notable Players

ATEC Bio

ATEC Biodigesters International (https://atecbio.com/), founded in 2016, is an Australian social enterprise that produces, sells, and distributes plastic container-based biodigesters in Cambodia and Bangladesh using a pay-as-you-go consumer finance model. The company sold over 1,700 units. The company recently raised capital to expand farmer's funding.

Power Knot

Power Knot (https://www.powerknot.com), a US company founded in 2009, designs, develops and manufactures onsite food waste digesters for commercial and institutional kitchens. It offers 8 biodigester models that process 10 – 3,000 kg of waste food per day. Customers include the US Army, supermarkets, hotels, colleges, universities, and restaurants. The company has a 2,300 m^2 facility in the US and employs 15 people. Products are high priced ($10,000 to over $100,000) and require the purchase of consumable items in the range of $300 to $7,000. It is an alternative to meet waste regulatiobs but not a direct competitor to HomeBiogas as it does not generate renewable energy but consume energy in its digestion process.

Puxin

Shenzhen Puxin Technology is a Chinese company (www.quberenewables.co.uk), founded in 2001, with a range of AD biogas products including:

- Flexible DIY AD biogas kit priced at $550-750
- Containerized AD treatment systems priced at $37,000.00 - 57,000

QUBE Renewables

UK-based company (www.quberenewables.co.uk), developing AD systems - containerized and flexible. ROI is "less than 6 years".

SEaB Energy

UK-based company (https://seabenergy.com) offering the Flexibuster, a containerized AD biogas system. The fully automated anaerobic digestion process does not require specialist expertise to operate and the modular

design allows scalability by adding modules for larger waste streams. The system can process between 500 - 3,000kg of waste per day. It is available in the UK, EU, USA, Australia, and India. Company estimates payback period of 2-6 years, assuming grants are available.

Sistema.bio

Sistema.bio (https://sistema.bio), established in 2010, provides flexible AD systems for small farms in LATAM, East Africa, and India. Over 17,000 units shipped to date with systems price start at around $550.

Since 2017, the company experienced rapid growth, growing from 40 employees and just over $1 million in revenues to over 200 employees and $9 million by the end of 2020. The company raised $12 million in 2019.

5. Strategy & Growth Opportunity

Product and Market Growth Strategy

- **Product Design and Technology**
  - Reduce product production costs for 2.0, 4.0, 7.0, and Toilet.
  - Expand product offering and differentiation by developing different biodigester models for developing and developed markets.
  - Offer local manufacturing in target countries to decrease costs, increase capacity and shorten supply time. The current annual production capacity is about 20,000 biogas systems.
  - Committing to a clear development roadmap for the institution systems (HBG 300/500/1000) during 2021-2022 to be commercially ready in 2022 and 2023.
  - A “smart home” premium waste to energy solution for houses in developed markets. Completed the POC stage and now in the advanced development stage.
- **Partnership Pathways**
  - Domestic
    - Online sales
    - Corporate social responsibility (CSR) projects
    - Humanitarian aid projects
    - Government-funded projects and subsidies
    - International development projects
    - Add distributors (B2B) in target countries
  - Institutional
    - Government-related projects (military, schools, hospitals, Nursery homes, etc.)
    - Large multi-national companies with multiple locations that have corporate dining and kitchens
    - Food and hotel chains
    - Partnerships with kitchen equipment manufacturers
    - Partnerships with waste management companies
- **Business Approach**
  - B2B2C: recruit local employees to provide full support for distributors and their customers
  - Customized market support strategies

- Pay as you go model in developing countries
- Leverage carbon credit, mainly of the institutional systems, for additional revenues or reduce leasing prices to customers. Each unit saves 1,500-2,000 tons of annual carbon emissions, currently values at around $5,000-10,000.

Customer Types

The HomeBiogas products are targeting 5 types of customers.

Domestic segment customers

1. Consumers in developing countries:
    - Rural households and households with small livestock (small farmers) - families in rural areas and small households of up to 15 animals, mostly relay on open /burning fire for cooking purposes using wood, charcoal, or animal waste and without access to sanitation
    - Suburban households in developing countries where there is poor infrastructure of gas, electricity, garbage evacuation and typically no infrastructure of sanitation.
2. Consumers in developed countries: customers with high environmental awareness from developed countries and/or that are not connected to a central sanitation system.

Institutional/commercial segment customers

1. Biogas and waste management companies with marketing, sales, engineering and support capabilities.
2. End-users / direct customers
    - Government-related projects (military, schools, Hospitals, Nursery homes, etc.)
    - Large multi-national companies with multiple offices and kitchens/cafeteria
    - Food and hotel chains
    - Partnerships with kitchen equipment manufacturers
    - Partnership with waste management companies

Business Models

Domestic products. The company currently offers one-time sale of biogas systems and recurrent sales of perishable items such as filters and probiotic tablets. The company plans to launch a Pay as You Go model in developing countries and one-time sale of a biogas systems and recurrent sales of perishable items such as filters and probiotic tablets (via online) in developed markets.

Institutional systems. The company plans to offer Leasing and Pay Per Use (per volume of waste and energy) models.

Key Success Factors

To accomplish a successful scale and leadership position, HomeBiogas needs to accomplish the following:

- Meet local standards and regulations
- Expand marketing and sales reach
- Reduce costs, increase manufacturing capacity and logistics capabilities to meet demand
- Keep operation efficiency to sustain low-cost products for the developing markets
- Deepens relationships with partnerships with NGOs and governments
- Communicate financial depth and strength to meet requirements of international banks and credit providers
- Identify and partner with capable and committed biogas and waste management companies in the US and Europe for pushing adoption of the institutional systems

Summary of the Market Opportunity

Domestic

- Developing countries – some 250 million families in rural and urban areas that do not have access to sanitation and clean cooking.
- Developed countries – tens of millions of environmentally-sensitive families living in rural areas that are not connected to a central sanitation system.

Institutional

- There are over 500,000 medium and large-scale food service facilities in the US and EU markets, of which 60,000 can be targeted as short-term opportunities, driven by stringent state and local policy and regulations for on-site waste management.

6. Valuation Method & Approach

Valuation of a start-up company in its early stages can be challenging due to limited cash flow (if any) and uncertainty regarding the future. As part of a Discounted Cash Flow (DCF), the accepted method used in financial valuations, there are several modifications to a start-up company's valuation. In general, there are four primary methods within the DCF method:

1. Real options – this valuation method is designated for pre-clinical and early-stage clinical programs/companies where the assessment is binary during the initial phases and based upon scientific-regulatory assessment only (binomial model with certain adjustments).
2. Pipeline assessment – a valuation method used for early-stage companies before the market stage where time-to-market may be a few years for full operations. The company's value is the total discounted cash flow for its products/signed agreements plus unallocated costs and its technology platform assessment.
3. DCF valuation - this method applies to companies with products that have a positive cash flow from operations.
4. Market benchmark – this method is based on recent deals (M&A and/or fundraising) within the company's domain and market multiples.

HomeBiogas is a publicly held firm, thus a late-stage firm from a financial aspect. Yet, the company is at the stage of sales ramp up. Therefore, our valuation is based on a market benchmark approach.

Company Financial Overview[30]

HomeBiogas' total revenue for 2020 amounted to NIS 3.2M (NIS 2.8M from system sold, and the rest from additional products include cooking stoves, probiotic tablets, and filters), compared with NIS 5.1M in 2019. The company's backlog as of December 31, 2020, was approx. NIS 6.8M. As of March 24, 2021, the company's backlog was estimated at approx. NIS 5.5M.

As of December 31, 2020, the company had NIS 22M in cash and an insignificant amount of loans; the company equity was NIS 20.5M; net loss in 2020 was NIS 13.6M, compared to a loss of NIS 6.9M in 2019; tax loss carryforward balance was about NIS 31.3M.

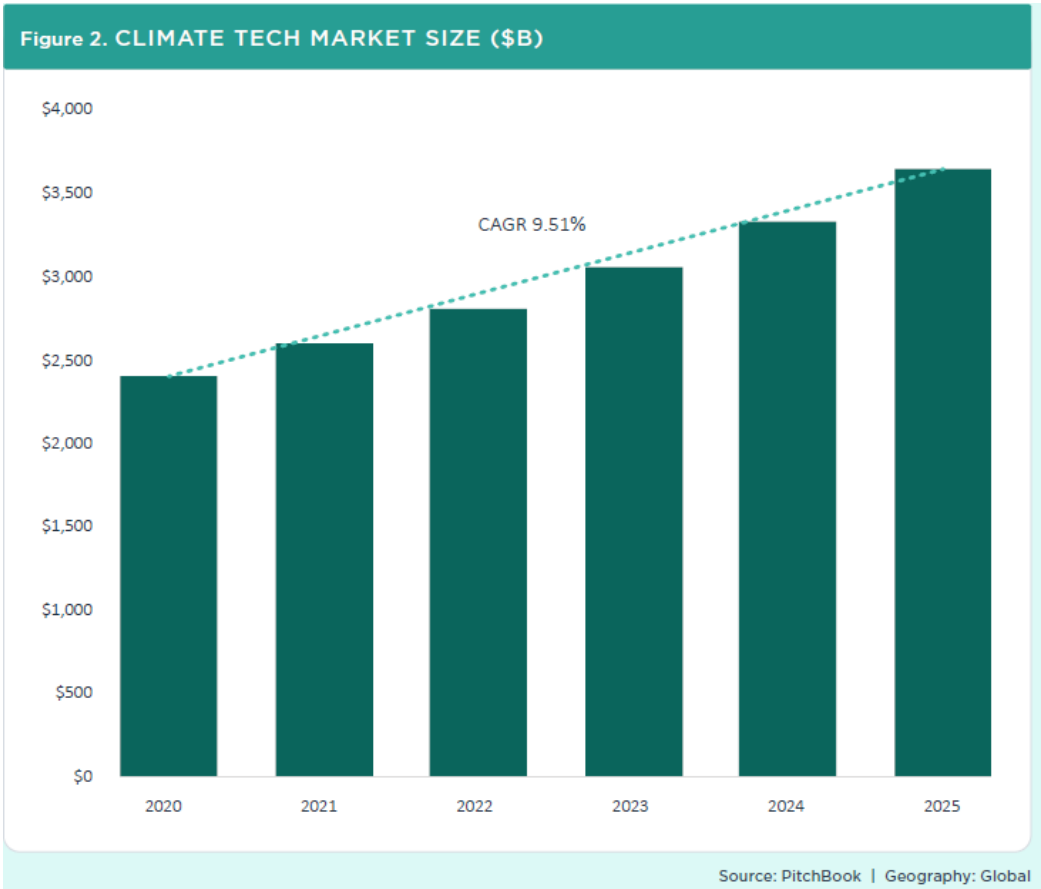
In Jnauary 2021, HomeBiogas closed its TASE listing, raising NIS ~95.5M (after deducting issue expenses).

Financial Overview - Climate Tech

The climate tech sector has gained significant momentum in the past decade. The growing global urgency and technological breakthroughs suggest that now may be the time for investors to confidently commit to the impact investments that will shape the future. Although the COVID-19 pandemic has temporarily redirected resources toward finding a vaccine and weathering economic shutdowns, it has also reminded nations about the value of international collaboration in solving problems of such immense magnitude and complexity. In the past six months, several governments have committed to act on climate change. The Prime Minister of Japan vowed to be carbon neutral by 2050, Xi Jinping pledged to make China carbon neutral by 2060, and in the US, Biden plans to invest trillions into a clean-energy transition targeting net-zero emissions by 2050[31].

Climate tech represents a vast and extensive opportunity that currently amounts to a $2.5 trillion market encompassing energy, transportation, agriculture, buildings, industry, climate adaptation, and materials & resources. In terms of startup investment, the energy sector leads the way with $7.2 billion of capital invested as of October 30, 2020. Developments in this sector are powering innovation across the ecosystem, as participants in the transportation, industrial, and agriculture sectors develop electrified products and processes helping decarbonize the planet.

[30] As of December 31, 2020, based on HomeBiogas financial statement.
[31] https://pitchbook.com/



As of October 30, 2020, deal value remained strong for Climate Tech companies with $11.4 billion invested across 354 deals, compared with $10.9 billion invested across 454 deals during the whole year of 2019. Key investors in Climate Tech from 2018 to 2020 were: SOSV, Breakthrough Energy Ventures, CPT Capital, and EIT Innoenergy among others.

The average deal value for 2020 was $32.2M. Therefore, we estimate the average implied post-money valuation to be in the range of $161M-$215M (assuming 15%-20% of acquired share on average funding round).

Recent Deals as a Valuation Benchmark

We also estimated HomeBiogas' value based on similar competitors benchmarking using Pitchbook data.[32]

We based our valuation on a top-down market benchmark analysis. Observing HomeBiogas market positioning, we identified 101 similar companies in terms of activity and growth stage. We also screened companies based on their last financial deal type (omitted accelerator, incubator, and angel rounds) and excluded outliers from our sample. **The average post-money valuation for these similar deals is $147.6M** (See appendix 1 for the entire data set, n=101). Below we present a sample of the top 10 deals:

Company Name	Description	Last Known Valuation ($M)	Last Known Valuation Date	Last Known Valuation Deal Type	HQ Country
Scandinavian Biogas	Scandinavian Biogas Fuels International AB is a producers of biogas. It sells renewable energy based on compressed biogas and liquid biogas, as well as several related services.	1,145	16-Dec-2020	IPO	Sweden
Bingo Industries	Bingo Industries is Australia's leading construction and demolition, or C&D, waste management company.	1,137	13-Nov-2019	Secondary Transaction - Private	Australia
Tomra Systems	Tomra Systems ASA provides sorting and recycling solutions to better equip customers for handling waste. It operates two primary business segments: collection solutions (a majority of total revenue) and sorting solutions.	1,113	28-May-2020	Secondary Transaction - Private	Norway
Ramky Enviro Engineers	Provider of environmental management services.	850	10-Feb-2019	Buyout/LBO	India
Waste Management and Advanced Disposal	Advanced disposal and waste management assets.	835	24-Jun-2020	Corporate Asset Purchase	
Rubicon	Developer of sustainable waste and recycling technology designed to make a cleaner and safer environment.	824.4	28-Aug-2017	Later Stage VC	US
Terrapure Environmental	A solid waste and environmental solutions business unit in Burlington, Canada.	734.2	15-Mar-2021	Merger/Acquisition	Canada
GFL Environemental	Provider of waste management services based in New York.	725	13-Feb-2020	Merger/Acquisition	US
PSC Environmental Services	Provider of hazardous waste management services.	462.5	06-Apr-2020	Merger/Acquisition	US
Der Grüne Punkt	Provider of waste management services.	460	30-Jan-2005	Buyout/LBO	Germany

The Company is considered from a financial aspect as a small cap firm in relation to the similar deals we explored. Thus we discount the average deal size by 20%.

We present another benchmark to HomeBiogas' equity value by pointing to specific deals we identified as highly relevant to it:

[32] https://pitchbook.com/

- In January 2020, Safaricom announced a $22 million investment into the U.K firm "Circle Gas," which runs M-Gas in Kenya and Tanzania, to launch prepaid gas service for Kenyan households. In the same month, Circle Gas acquired Tanzania's KopaGas for a cash deal worth $25 million to gain access to pay-as-you-go (PAYG) technology, advanced manufacturing capabilities, and positions in key LPG markets in East Africa, which then led to its Kenyan launch[33]. Compared with HomeBiogas, Circle Gas's geographical reach and proposed solutions are considerably smaller.
- A.H.T. Syngas Technology N.V. designs and implements synthesis gas power and gas production plants for the generation of electrical and thermal energy and the separation of synthesis gas components such as water or carbon (H2, CO, CH4). As of May 30, 2021, the company's market cap was €33.6M.
- BioLite Provider of off-grid energy products intended to reduce smoke emissions. The company's products include an advanced, affordable, clean-burning stove technology that combines unprecedented emissions reductions with electricity generation use the fire's waste heat to generate electricity to charge external devices like cell phones or LED lights, enabling users to enjoy indoor and outdoor cooking while maintaining air quality and smokeless environment. The company raised $7.5 million of Series D venture funding from Emerson Collective and KawiSafi Ventures on June 18, 2018, putting the company's post-money valuation at $50 million.[34]
- Sierra Energy is a privately owned waste-to-energy gasification company. The company claims that its FastOx gasification technology can take virtually any trash and turn it into clean energy without burning. Sierra Energy is a division of Sierra Railroad. On July 29, 2019, Sierra Energy announced that it closed a $33 million Series A funding led by breakthrough energy ventures[35]. Our team estimates Sierra Energy's post-money valuation at $220M.

Valuation Summary

In our view, HomeBiogas has the potential to become a key player in the growing emerging market of on-site waste to energy (biogas). The company has the products and technology needed and a model compatible with massive scaling.

Based on the aforementioned data and analysis, we evaluate the company's equity value at NIS 383.8M ($118.1M). We estimate HomeBiogas' price target to be in the range of NIS 18.7 and NIS 20.7, with a mean of NIS 19.7.

[33] https://techmoran.com/2020/05/01/safaricom-confirms-it-acquired-18-96-stake-in-circle-gas-for-22m/
[34] https://pitchbook.com/
[35] https://www.prnewswire.com/news-releases/sierra-energy-closes-33-million-series-a-funding-led-by-breakthrough-energy-ventures-300891935.html

Appendix 1: Deals Sample

Company Name	Description	Last Known Valuation	Last Known Valuation Date	Last Known Valuation Deal Type	HQ Country
Scandinavian Biogas (STO: BIOGAS)	Scandinavian Biogas Fuels International AB is a producers of biogas. It sells renewable energy based on compressed biogas and liquid biogas, as well as several related services.	1,145	16-Dec-2020	IPO	Sweden
Bingo Industries (ASX: BIN)	Bingo Industries is Australia's leading construction and demolition, or C&D, waste management company. With origins in C&D waste collection, Bingo has achieved full vertical integration within the C&D waste stream in the Sydney metro market via the acquisition of strategic waste management assets over the fiscal 2011-fiscal 2019 period. The exposure to C&D post-collections activities was significantly bolstered by the acquisition of Dial-a-Dump Industries in fiscal 2019. While currently small relative to its C&D collections business, Bingo also undertakes collection of commercial and industrial waste in the Sydney metro market.	1,137	13-Nov-2019	Secondary Transaction - Private	Australia
Tomra Systems (OSL: TOM)	Tomra Systems ASA provides sorting and recycling solutions to better equip customers for handling waste. It operates two primary business segments: collection solutions (a majority of total revenue) and sorting solutions. The company produces, sells, and services automated recycling systems, including data administration systems that monitor the volume of collected materials. It manufactures reverse vending machines to collect empty beverage containers. The empty beverage containers are gathered and processed into reusable molds. Tomra services the machines and provides replacement parts to ensure optimal performance. Food sorting solutions inspect individual pieces and stop resources from going to waste. The majority of revenue comes from customers in Europe and North America.	1,113	28-May-2020	Secondary Transaction - Private	Norway
Ramky Enviro Engineers	Provider of environmental management services. The company engages in offering environmental management services with the help of a team of skilled professionals in its research and development facility, enabling clients to receive reliable services within a stipulated time and budget.	850	10-Feb-2019	Buyout/LBO	India
Waste Management and Advanced Disposal (Assets)	Advanced disposal and waste management assets.	835	24-Jun-2020	Corporate Asset Purchase	
Rubicon	Developer of sustainable waste and recycling technology designed to make a cleaner and safer environment. The company's technology is offered in a cloud-based enterprise resource technology platform which provides a portal to manage and track waste and recycling across multiple locations and its website and mobile application connect local waste haulers and recycling businesses to customers who need their services, enabling customers to find a cheaper and efficient way to clean the environment.	824	28-Aug-2017	Later Stage VC	United States
Terrapure Environmental (Solid Waste and Environmental Solutions Business)	A solid waste and environmental solutions business unit in Burlington, Canada.	734	15-Mar-2021	Merger/Acquisition	Canada
GFL Environemental (Trash Operations in Virginia and Pennsylvania)	Provider of waste management services based in New York. The company is engaged in hauling, recycling and trash management services in and outside New York.	725	13-Feb-2020	Merger/Acquisition	United States
PSC Environmental Services	Provider of hazardous waste management services. The company provides industrial services, environmental services, transportation and container services throughout North America.	463	06-Apr-2020	Merger/Acquisition	United States
Der Grüne Punkt	Provider of waste management services. The company provides take-back systems and services for end-consumer, which includes collection, sorting, deposit clearing of electrical and electronic equipment and recycling of sales packaging, enabling to conserve natural resources and avoiding greenhouse gases.	460	30-Jan-2005	Buyout/LBO	Germany

ASCO Group	Provider of outsourced supply chain management and logistics services intended for the energy industry. The company's focus lies in coordinating the delivery and return of goods and materials destined for oil rigs and platforms in major oil producing regions around the world, along with offering oilfield waste management and initiation global movement of specialist oil and gas equipment from various logistics hubs.	395	01-Dec-2011	Buyout/LBO	United Kingdom
Yido. Co.	Provider of waste management services based in Seoul, South Korea. The company provides waste management and integrated environmental management services to maximize resource value while minimizing impact in order to further both economic and environmental sustainability and it also leads ESG management in the fields of infrastructure, golf courses and real estate as well as eco-friendly, including new and renewable energy businesses.	387	21-Apr-2021	Buyout/LBO	South Korea
American Waste (Michigan)	Provider of solid and liquid waste management services headquartered in Kalkaska, United States. The company offers services including curbside pickup, extra item pickup, drop off disposal, disposal pricing, and yard waste services.	380	01-Feb-2020	Buyout/LBO	United States
Tervita (TSE: TEV)	Tervita Corp is engaged in providing waste management service. The reportable segments of the group are Energy Services, Industrial Services and Corporate, of which a majority of the revenue is derived from the Energy services segment comprising three service lines: energy marketing, facilities, and onsite. These service lines provide services to the oil and gas sector including treatment, recovering, and disposal of fluids; energy marketing; processing and disposal of solid materials used in, and generated by, natural resource and industrial production; and disposal of oilfield-generated waste, among others. The Industrial Services segment provides environmental solutions through the operating segments of waste services, metals recycling, rail services, and environmental services.	377	09-Mar-2021	Merger/Acquisition	Canada
ecoATM	Developer of automated self-serve kiosk systems to evaluate and buy back used electronics. The company's kiosks evaluate the worth of used mobile phones, tablets and MP3 players, providing consumers fast, convenient and safe ways to sell their used mobile devices through its automated ecoATM kiosks in retail locations across the United States.	350	02-Jul-2013	Merger/Acquisition	United States
Suez RV Osis	Provider of industrial maintenance and cleaning based in Joué-lès-Tours, France. The company specializes in the maintenance of sanitation networks and infrastructure and on-site industrial services.	350	18-Aug-2020	Merger/Acquisition	France
Cambi (OSL: CAMBI)	Cambi ASA is a provider of thermal hydrolysis, advanced anaerobic digestion, and biogas solutions for sewage sludge and organic waste management. The services of the company include Engineering Design, Installation, Sample Testing, Commissioning, and Digester Ramp-Up among others.	269	09-Feb-2021	IPO	Norway
Elemental Environmental Solutions	Provider of hazardous waste treatment services, based in Gum Springs, Arkansas. The company provides treatment of spent material from aluminum smelting operations and other liquid and solid waste treatment.	250	03-Feb-2020	Merger/Acquisition	United States
Labrie Enviroquip Group	Manufacturer of waste management equipment based in Levis, Quebec. The company is engaged in developing standard-setting technology through design and research and focuses to offer greener and safer equipment intended for the clients that range from small to large, private entrepreneurs in the waste hauling sector to national waste management service providers and hundreds of small towns and counties, as well as, major municipalities and cities in the region.	246	01-Sep-2020	Buyout/LBO	Canada
Roadrunner Recycling	Provider of commercial waste management services intended to help businesses to generate significant savings on their recurring waste costs. The company's commercial waste management services use logistics technology that cuts fuel costs and carbon emissions and extracts the maximum value from recyclable materials, enabling other businesses to earn money from their waste and recycling streams.	235	22-Sep-2020	Later Stage VC	United States
Adler & Allan	Provider of oil and environmental services based in the United Kingdom. The company's wide range of environmental risk reduction services includes spill response, fuel services, industrial water jetting and cleansing, fuel and tank installation, waste management and separator and interceptor services, enabling customers to receive quick and efficient clean-up services for environmental restoration.	234	27-Nov-2020	Buyout/LBO	United Kingdom
ESG Cheongwon	Provider of waste management services based in South Korea. The company specializes in sewage and wastewater treatment, excrement, and disposal of construction and demolition waste.	152	01-Jan-2016	Buyout/LBO	South Korea
Gradiant	Provider of technology-driven water services designed to enable industrial growth in harmony with nature. The company's services include gas extraction systems, desalination technology, brine minimization systems, and disinfection products, enabling clients to promote safe water disposal and industrial wastewater treatment in a sustainable way.	150	27-Apr-2018	Later Stage VC	United States

PRTI	Developer of waste management technology designed to recycle waste rubber and rubber tires. The company fractionalizes rubber and waste tires into valuable commodities that meet the purity standards, enabling clients to generate additional revenue by saving time, energy and money.	125	08-Nov-2019	Later Stage VC	United States
American Waste Services	Provider of waste management services. The company offers waste management services like disposal, recycling and other environmental services to industrial, commercial and government clients.	122	18-Jun-1998	Merger/Acquisition	United States
Antony Waste Handling Cell (BOM: 543254)	Antony Waste Handling Cell Ltd is a provider of full spectrum of municipal solid waste services which includes solid waste collection, transportation, processing and disposal services across the country, catering to Indian municipalities. The company undertakes municipal solid waste collection and transportation projects, municipal solid waste processing projects and mechanized sweeping projects. It undertakes projects for Municipal Corporation of Greater Mumbai, the Navi Mumbai Municipal Corporation, the Thane Municipal Corporation, the North Delhi Municipal Corporation, the Ulhasnagar Municipal Corporation, the Mangalore Municipal Corporation and the Greater Noida Industrial Development Authority.	121	01-Jan-2021	IPO	India
Fowler Welch	Provider of supply chain services based in Spalding, United Kingdom. The company's services include inbound logistics, warehousing, distribution, transportation, packaging and waste management related for ambient and temperature-controlled products.	120	01-Jun-2020	Merger/Acquisition	United Kingdom
Company Shop Group	Distributor of surplus food and household products catering to retailers, manufacturers, foodservice and logistics providers. The company specializes in collecting, processing and redistributing surplus like production overruns or trial products for sale through its network of membership-based outlets, thereby helping companies in finding solutions for tricky surplus challenges and protecting brands.	114	25-Feb-2021	Merger/Acquisition	United Kingdom
Unieco Ambiente	Provider of waste treatment and disposal services based in Reggio Emilia, Italy. The company offers services such as industrial waste treatment and brokerage whereby taking care of disposal services of special hazardous and non-hazardous waste mainly of industrial origin, implementation of remediation and safety measures for polluted sites and abandoned areas, using techniques such as soil-washing, biopile, diaphragms , bioventing, MPE, assisted biodegradation the company additionally also offers landfills and final plants and integrated municipal waste services.	100	19-Jun-2020	Merger/Acquisition	Italy
TerraCycle	Operator of a waste management firm. The company offers various recycling services to convert non-recyclable waste, which include chip bags, coffee capsules, cigarette butts and other waste streams, into raw materials in order to help manufacturers to create new durable and reusable packaging products while maintaining environment balance.	100	07-Oct-2016	Corporate	United States
County Waste of Virginia	Provider of waste management and recycling services. The company provides residential, commercial, industrial and construction and demolition waste collection services.	94.1	02-Jan-2020	Buyout/LBO	United States
Strad	Strad Inc provides rental equipment and matting solutions to oil, gas, and energy infrastructure sectors. The company also focuses on upstream oil and gas which involves drilling and completions, and energy infrastructure which involves pipelines, power transmission, and facilities construction. The solutions provided by the company are surface equipment, environmental and access matting, solids control and waste management, drill pipe, ecopond, and matting manufacturing. The operations of the company are focused on Canada and United States with the majority of revenue coming from Canada.	92.2	21-Apr-2020	Merger/Acquisition	Canada
Deep Isolation	Developer of a nuclear waste disposal platform designed to dispose of nuclear waste safely. The company's platform uses mature drilling technology to place canisters containing nuclear waste in deep horizontal drill holes thereby creating a natural, protective barrier system for the disposal of nuclear waste, enabling factories to dispose of the waste safely and at a low cost.	90.0	24-Nov-2020	Early Stage VC	United States
Meridian Waste	Provider of waste management services. The company offers integrated, non-hazardous solid waste collection, disposal and recycling services.	90.0	20-Apr-2018	Buyout/LBO	United States
WISErg	Developer of a harvester technology designed to solve the problems of food waste management and continuing sustainable growth in agricultural production. The company's technology recovers the nutrient value from food scraps by converting discarded food into concentrated nutrient feedstocks for agriculture and other industries, enabling farmers to get fertilizers that increase crop yields and advance soil health in a sustainable and cost-effective way.	79.2	03-Jan-2018	Later Stage VC	United States
Compology	Developer of camera-based IoT and artificial intelligence technology intended for waste dumpster monitoring. The company's offerings include software-connected and camera-based dumpster sensors systems that capture high-resolution photos of dumpsters and continually track the precise coordinates and records, enabling clients to move raw materials, finished	77.2	25-Jul-2019	Later Stage VC	United States

	goods and waste with a reduced footprint.				
Biogen (UK)	Owner and operator of anaerobic digestion and composting plant. The company's anaerobic digestion plant include the recycling of food waste to generate renewable energy and biofertilizers for farmlands in the United Kingdom, enabling commercial and industrial inhabitants to get clean energy and valuable bio-fertilizer for farmland, significantly reducing greenhouse gas emissions.	76.0	01-Jan-2012	Merger/Acquisition	United Kingdom
Afresh	Operator of a fresh-first supply chain platform intended to handle the complexity of perishable categories for brick and mortar retailers and wholesalers. The company's platform brings artificial intelligence and machine learning to forecast ingest millions of data points to provide accurate item-level predictions of future demand to replenish recommendations that account for supply chain constraints and optimize for margin, enabling clients to minimize waste, maximize freshness and multiply business profitability.	70.0	19-Nov-2020	Early Stage VC	United States
Code Chain New Continent (NAS: CCNC)	Code Chain New Continent Ltd focuses its business on two segments: coal wholesales and sales of coke, steels, construction materials, mechanical equipment, and steel scrap (Rong Hai); and mobile game development, Internet of Things (IoT), and electronic tokens (Wuge). It derives maximum revenues from the Rong Hai segment through the sale of Fuel materials.	65.6	24-Jul-2015	IPO	China
Zweckverband Abfallverwertung Südwestpfalz (Waste to Energy Plant Located in Pirmasens, Germany)	Waste to energy plant located in Pirmasens, Germany. The plant generates 16 MW of power and 17 MW of heat, which is fed into Stadtwerke Pirmasens' district heating network.	58.2	03-Dec-2020	Corporate Asset Purchase	Germany
Recycling Technologies	Developer of a technology designed to recycle residual plastic waste into feedstock for new plastic production. The company's technology can be installed at existing waste sites, enabling users access to a chemical recycling technology that offers an alternative to landfill and energy from waste incineration for residual plastic waste.	55.8	09-Mar-2020	Later Stage VC	United Kingdom
Equilibrium Capital (Renewable Natural Gas Facility)	A renewable natural gas (RNG) facility based in Boardman, Oregon. The facility reduces greenhouse gas emissions from agricultural waste and wastewater, while also displacing the fossil fuel used in transportation by producing RNG that meets California's low carbon fuel standards.	55.0	31-Mar-2019	Joint Venture	United States
BioForceTech	Provider of biosolids and organic waste solutions intended to eliminate organic waste while generating valuable by-products. The company specializes in a self-sustained and automated system that generates renewable energy and upcycles any organic waste into high-carbon and fine-grained residue, enabling clients to get sustainable and affordable waste management services.	54.0	16-Jun-2020	Later Stage VC	United States
Solar Outdoor Media	Developer of solar powered smart waste management solutions intended to promote a healthy community connection between residents and cities. The company offers a range of smart city solutions including data driven smart eco recycling stations, enabling residents and cities to handle and manage a range of waste management services simultaneously.	53.1	26-Apr-2021	Seed Round	Germany
Simply Waste Solutions	Provider of waste management services based in High Wycombe, England. The company's industrial and commercial waste collections of more than 20,000 collections a week, managing more than 100,000 tonnes of waste per year, with a fleet of 50 vehicles and a team of more than 100 waste professionals, helping effectively manage customers' waste streams.	51.5	09-Oct-2020	Merger/Acquisition	United Kingdom
Phenix	Developer of an online platform intended to reduce waste and social and environmental impact. The company's platform provides an alternative to landfills and incineration, finding the appropriate value chain for unsold products, promotion on short-term products, donations to charity, animal feed and recycling, enabling clients to connect with receivers and improve corporate social responsibility.	50.9	10-Feb-2020	Later Stage VC	France
Bodine Services of the Midwest	Provider of waste management services and related environmental services created to serve industrial and governmental customers. The company's services include waste disposal, waste minimization consulting, plant maintenance, environmental contracting and consulting services.	45.5	01-Mar-2016	Merger/Acquisition	United States
Human Unitec International (6 Grone Plants)	Six GRONE plants are used for the recycling of solid waste management.	43.0	11-May-2020	Corporate Asset Purchase	United States

DataProse	Provider of billing statement presentment and direct mail services. The company offers billing statement design, print, mail and electronic presentment and payment for municipal and private utility, financial services, cable, telecommunications, home security and waste management companies.	39.0	30-Apr-2008	Merger/Acquisition	United States
Kom-Eko	Provider of solid waste collection and disposal services based in Lublin, Poland. The company provides resource management services to residential, commercial, municipal and industrial customers, primarily in the areas of solid waste collection, transfer, disposal and recycling services.	38.1	23-Oct-2018	Buyout/LBO	Poland
Nicollin Group	Provider of waste collection and management services. The company offers waste collection, recycling, urban cleanliness and industrial cleaning services for household and industrial waste management sectors.	37.8	07-Nov-2013	Secondary Transaction - Private	France
Eco Baltia	Provider of environmental management services intended to offer waste management service. The company's services include municipal and sorted waste removal, construction waste and bulky waste management, roads and areas cleaning, greening, sanitation and other services, enabling households to get rid of wastes which are recycled later by the company.	36.1	24-Aug-2015	Later Stage VC	Latvia
OLIO	Developer of a food sharing application designed to unlock the value of food that is wasted in the home and the local community. The company's application connects neighbors with each other and food waste hero volunteers with local businesses, to share food (and other things) rather than throw them away, enabling neighbors and local retailers to overcome the problem of food waste and transform the 'throw-away society' into a 'give-away society'.	35.8	31-Jan-2020	Early Stage VC	United Kingdom
Pyrogenesis Canada (TSE: PYR)	PyroGenesis Canada Inc is engaged in the design, development, manufacture, and commercialization of advanced plasma processes and systems. The company provides technical & manufacturing expertise, cutting-edge contract research, and turnkey process equipment packages to the defense, metallurgical, mining, additive manufacturing (including 3D printing), oil & gas, and environmental industries. Its Product categories include Aluminum & Zinc Dross Recovery, Plasma Atomized Metal Powders, Waste Management, Innovation / Custom Process Development, and Plasma Torches. Its geographical segments are Canada, United States, Europe, Mexico, Asia, Israel, Saudi Arabia, China, Australia, South America, and Africa.	33.2	13-Apr-2017	Merger/Acquisition	Canada
Simam	Provider of environmental and industrial management services based in Ancona, Italy. The company offers a full range of environmental and engineering services which include water treatment, waste management, energy and engineering consulting services, research and development intended for both government (public) and industrial clients.	32.7	07-May-2020	Merger/Acquisition	Italy
MacRebur	Operator of a waste management company intended to recycle selected plastics taken from old rubbish. The company's services include recycling and reusing selected plastics from waste which are added to the road for strength and durability, enabling road construction companies to reduce the use of oil-based bitumen.	31.8	24-Mar-2021	Equity Crowdfunding	United Kingdom
Baswood	Provider of sustainable wastewater services intended for industrial and municipal waste water systems. The company's services include effective BOD (biological oxygen demand) removal, bio solid reduction and water reuse, enabling clients to get a cost effective solution when treating municipal, agricultural and industrial waste streams.	31.4	03-Aug-2016	Later Stage VC	United States
LSS Waste Management	Provider of waste and recycling services based in the United Kingdom. The company provides supply skips, mobile compaction, recycling services and nationwide hire services to domestic and commercial customers alike thereby, leading, strong, sustainable, innovative, technologically advanced and forward-thinking waste management and skip hire business, which puts the customer at the forefront of everything it does.	29.0	09-Sep-2020	Buyout/LBO	United Kingdom
Sanergy	Provider of sanitation and waste management services intended to offer sanitation services in cities. The company's services involve building a repertoire of low-cost, high-quality sanitation products and services for residents living in urban non-sewered areas, safely removing all of the waste generated by the customers and transporting it to the central processing plant for treatment and up-cycling into high-quality agricultural inputs, enabling residents in undeveloped regions to get an affordable and effective alternative to sewer services	28.9	31-Dec-2020	Later Stage VC	Kenya
Apex Environmental	Provider of waste disposal services. The company handles municipal solid waste, construction and demolition waste, oil and gas waste from the nearby Utica and Marcellus shales and provides service to short and long-haul waste trucks and waste-by-rail capabilities, allowing the landfill to access waste volumes from significant distances.	28.6	30-Oct-2015	Buyout/LBO	United States
United Rotary	Manufacturer of rotary brooms created for street sweeping, road maintenance, facilities management and airport runway maintenance. The	26.0	01-Sep-2008	Buyout/LBO	United States

Brush	company offers custom engineered brushes used in the metals processing, automotive, food, plastic, cement and solid waste management industries. It provides abrasive and nonabrasive filaments in natural fiber, synthetic nylon or polypropylene and wire content.				
Transmutex	Developer of clean nuclear energy designed to efficiently reduce the stockpile of existing nuclear waste while producing carbon-free energy. The company offers to couple a particle accelerator to a thorium fission reactor to transmute the most dangerous nuclear waste into stable elements for producing electricity and hydrogen.	24.7	30-Nov-2020	Early Stage VC	Switzerland
Everest Labs	Developer of robots intended to be installed at sorting stations to recover valuable recyclables. The company offers a robot that can be customized to pick and sort various types of recyclables from municipal solid waste and single-stream recycling operations, enabling waste management companies to increase the quality of marketable recyclables and reduce dependency on human labor.	23.5	30-Mar-2021	Seed Round	United States
I. Blu	Provider of environmental services based in Pasian Di Prato, Udine. The company specializes in marine and terrestrial pollution, the use of energy resources and fossil fuels, the decarbonisation of industrial processes.	23.3	12-Aug-2020	Merger/Acquisition	Italy
Scanship	Vow ASA designs, engineers, and provide solutions for waste management and wastewater purification to markets worldwide. The company offers solutions such as wastewater purification, food and industrial waste processing, production of renewable materials and products, molecules, and fuels from organic waste and biomass, valorization of non-recyclable plastic and polymers, sterilization of food and electrified high-temperature processing of minerals. Its solutions convert biomass and waste into valuable resources and generate clean energy for marine applications and land-based industries. The company's operating segment includes Projects; Aftersales and Landbased. It generates maximum revenue from the Projects segment and Geographically from Europe.	22.9	05-May-2017	Merger/Acquisition	Norway
NuVision Engineering	Provider of nuclear and environmental engineering services intended to improve nuclear safety and stabilize waste treatment. The company's nuclear and environmental engineering services include commercial nuclear and power plant services, nuclear decontamination, engineering design and analysis, power fluidics, hazardous waste management and environmental clean-ups, enabling US Federal Government, public utilities, international governments, domestic and international clients to create a sustainable and pollution free world by effectively working on waste remediation process.	20.0	04-Aug-2017	Merger/Acquisition	United States
Tom White Waste	Provider of waste collection and recycling services based in Coventry, England. The company focuses on recycling and diversion from landfill, the company has a facility to separate waste into recyclable and reusable elements, material that cannot be recycled, residual waste, is then processed and prepared for use as refuse-derived fuel.	19.1	06-Mar-2020	Merger/Acquisition	United Kingdom
Green Remedies Waste and Recycling	Provider of solid waste management and recycling services in Elon, North Carolina. The company offers services in order to generate cost savings, provide risk management support and develop environmentally responsible solutions for its clients.	18.5	19-Oct-2020	Merger/Acquisition	United States
Maes Recycling Group	Provider of waste management services intended for the construction industry. The company offers a broad range of services including container rental over waste transport, collection and processing of construction and demolition waste with sites in Tessenderlo, Vilvoorde, Tienen, Waremme, Herenthout and Geel and other related services, enabling its clients to deal sustainably with waste flows.	18.1	22-Dec-2020	Buyout/LBO	Belgium
WasteZero	Provider of waste reduction services intended to reduce waste, promote recycling, and protect the environment. The company's services include analysis of the waste situation of a city and designing of waste reduction programs for improved impact, thereby enabling businesses to manage their waste and save money in the process.	17.0	27-Dec-2017	Later Stage VC	United States
Sabre Manufacturing	Manufacturer of specialized tanks for liquid storage and containment solutions for petrochemical, waste management and oil and gas drilling industries. The company primarily focuses on manufacturing hydraulic fracturing systems, waste water tanks, frac tanks, gas buster tanks, vacuum containers and weir tanks. It also provides design engineering, welding and repair, custom fabrication, steel grit blasting and coating services.	14.0	19-Aug-2013	Merger/Acquisition	United States
Solmetex	Manufacturer and supplier of amalgam separators and other waste compliance products to the U.S. and Canadian dental industries. The company specializes in water chemistry, process engineering and chemical separation science and offers waste management products and services through a series of specialized processes and systems that cost-effectively remove mercury from the waste stream, enabling its clients to rely on a trusted source for comprehensive environmental solutions for their dental waste needs.	13.5	06-Dec-2007	Merger/Acquisition	United States

Biohm	Developer of plant based concrete and future living materials designed to create natural construction materials. The company's platform offers bio based materials and biomimetic construction systems and combines ideologies of the circular economy and human centered design with innovative technologies, materials and manufacturing methods, enabling customers to get regenerative alternatives for waste management, manufacturing and building.	13.3	28-Jul-2020	Equity Crowdfunding	United Kingdom
Environmental Waste International (TSX: EWS)	Environmental Waste International Inc designs, develops and sells environmentally sound devices utilizing its patented Reverse Polymerization process and dealing with environmental waste disposal, including the development, advancement, licensing and sale. Its system is divided into Tires, Biocontainment, and Medical Waste. The firm has its presence in Canada and the United States generating, a majority of its revenue from the United States.	13.3	01-May-2017	PIPE	Canada
VYTAL	Developer of a digital reusable packaging system that offers its users, restaurateur, supermarket, and delivery service an inexpensive and sustainable alternative to disposable and plastic waste. The company's platform offers its users freshly washed reusable bowls, leak-proof and heat-insulating food packaging for takeaway and delivery meals which can be returned back to the canteen or to another partner, helping users to reduce plastic waste.	13.1	10-Feb-2021	Early Stage VC	Germany
Circhem (STO: CIRCHE)	Circhem AB is primarily involved in the solvent recycling process which includes recycling and purification of industrial chemicals. It offers solution that enables the industry to reduce its emissions and at the same time increase profitability.	12.3	09-Dec-2020	IPO	Sweden
TreeDots	Provider of a wholesale distributor platform intended to connect wholesalers with retailers. The company's platform facilitates to offload of unsold inventory at discounted prices helping in recovering costs that would have been incurred on unsold products, enabling buyers and suppliers to get cost savings and increased margins while ensuring reliability, consistency and zero hindrance to their business marketplace.	12.2	16-Mar-2021	Early Stage VC	Singapore
Agristarbio	Developer of organic waste management technology intended to produce customized organomineral fertilizer in a closed pressured environment. The company's fertilizer is made from biosolids of livestock or municipal water treatment stations, helping farmers recycle all carbon and nutrients with zero emissions and zero sub-products.	12.0	30-Jun-2021	Early Stage VC	Portugal
Mint Innovation	Operator of a bio-metallurgical firm intended to recover precious metals from electronic waste and other residues. The company's firm uses microbes to selectively and rapidly recover precious metals from various low concentration materials under environmentally benign conditions, providing clients with a low-cost, recyclable and fully scalable technology for recovering value from materials at any scale.	11.6	10-Dec-2018	Early Stage VC	New Zealand
Greyparrot	Developer of AI-computer vision software designed to be deployed in recycling plants to measure 100% of waste flows and provide analytics to increase recycling rates. The company's software leverages intelligent waste recognition while adopting low-cost hardware to ensure its solution can be deployed at scale, enabling companies to automate and improve recycling processes.	10.4	13-Nov-2020	Seed Round	United Kingdom
Borneo Waste Industries	Provider of waste management services intended to process waste with environmentally sustainable technologies to produce useful intermediary products for various industries.	10.4	16-Jan-2020	Equity Crowdfunding	Malaysia
Ambrosia (Environmental Services)	Provider of a waste management platform intended to convert food waste into organic chemicals and materials. The company's platform utilizes existing industrial spaces for food waste recovery that can be further up-cycled into liquid and solid fertilizers, animal feed, organic chemicals, clean energy and streams them into the landfills and bypass the red tape of construction and land, enabling businesses to contribute to the revitalization of the post-industrial area.	10.4	18-Dec-2018	Seed Round	United States
RxDestruct	Developer of a waste management systems designed to allow hospitals and nursing homes to dispose of their pharmaceutical waste safely and conveniently. The company's product helps in neutralizing the active compounds in unused medications so they can be disposed of easily without polluting water supplies, enabling hospitals to ensure pharmaceutical waste stays out of the environment and does not contribute to the current opioid epidemic sweeping the country.	8.5	03-Jun-2020	Later Stage VC	United States
Goodr	Developer of a sustainable food waste management software designed to reduce food waste and eliminate hunger. The company's software offers insights into food waste patterns, real-time donation, tax deduction information and community impact reports, enabling businesses to get a rescue driver to pick up surplus food and deliver the same food to other people and thus foster social change.	7.0	19-Oct-2018	Seed Round	United States

HEPACO	Provider of environmental cleanup services. The company offers a wide range of services including, emergency response, environmental remediation, maritime services, wastewater treatment, industrial maintenance, hazardous waste management and abatement services across a diversified group of end markets including rail, oil & gas, transportation, power & utility and manufacturing. It offers services on both an emergency response and planned basis.	6.5	23-Aug-2016	Buyout/LBO	United States
Focal Technologies	Developer of an instrument designed to address some of the world's most pressing contaminated water environmental challenges. The company's system concentrates the sun's heat and ultraviolet light to remediate and break down harmful compounds and pathogens in water and soils, its patented system uses a large refracting lens to focus available heat and its wavelengths into an integrated receiver, providing industries with initial waste remediation and mobility solutions rapidly and cost-effectively.	6.3		Later Stage VC	United States
Comintel Corporation (KLS: 7195)	Comintel Corp Bhd is a Malaysia-based investment holding company. The business activity of the group is functioned through System integration; Green Waste Management and Conversion of Waste-to-Energy; and Investment Holding segment. The System integration segment is engaged in the provision of turnkey engineering design and integration, program management, installation, commissioning and the provision of electronic systems testing and repair; Green Waste Management and Conversion of Waste-to-Energy segment engaged in engineering, procurement, construction and program management services for green waste management and waste-to-energy solution.	5.5	22-Jul-2020	Merger/Acquisition	Malaysia
George B Wittmer Associates	Provider of environmental waste management services. The company's services include residual waste management, compost manufacturing, petroleum contaminated soil management and spill-site remediation, enabling environmental regulatory agencies and scientist with final processing and residuals to the product.	4.5	13-Nov-2018	Merger/Acquisition	United States
3S	Operator of a portable sanitation and waste management company intended to provide comprehensive earth-friendly waste management solutions. The company's s sanitary facilities offer portable toilets, containerized toilets, handwash stations, urinals, bio-toilets, septic tanks, and desludging services for portable toilets, enabling clients to avail hygienic and eco-friendly toilet systems even in remote areas and villages.	4.3	01-Apr-2009	Later Stage VC	India
Beyond Leather Materials	Operator of a vegan leather manufacturing company created to upcycle food waste into alternative biodegradable materials. The company's leather specializes in creating a biodegradable material comparable to conventional animal leather and is committed to producing quality textiles made in sustainable processes, enabling users to practice waste management and limiting the use of harmful ingredients, affecting agriculture, livestock and consumer well-being.	4.2	01-Jul-2020	Seed Round	Denmark
Waste Recovery Enterprises	Provider of waste management services. The company provides services like waste disposal, organic composting, waste transfer activity, waste collection, wastes recycle for commercial, industrial, institutional and residential sectors.	3.8	28-Oct-2015	Merger/Acquisition	United States
Recycleye	Developer of digital tools designed to detect and provide analytics on waste management. The company's tools specialize in machine learning to enable smarter characterization, ubiquitous tracking, and automated sorting of waste, enabling users to accelerate the transition towards a circular economy.	3.7	15-Dec-2020	Seed Round	United Kingdom
Carbo-Nafta Ecologia	Operator of collection and management of the industrial waste firm in Perugia, Italy. The company provides a variety of services such as reclamation of abandoned tanks and industrial areas, prompt environmental intervention, industrial and civil purge, waste brokerage, consultancy by qualified technical personnel, the supply of materials and containers aiming at betterment in terms of reliability, punctuality and professionalism.	3.5	31-Jan-2020	Buyout/LBO	Italy
KITRO	Developer of an automated management system designed to reduce food waste in a data-driven and transparent way. The company's system provides restaurants and canteens with hardware and software remedies to automatically measure and monitor their food waste, thereby enabling hotels and restaurants to reduce food wastage through long-term data collection and optimized operational practices and save costs while having a positive impact on the environment.	3.5	17-Oct-2018	Seed Round	Switzerland
Ubirator	Provider of waste management service intended to promote environmental sustainability. The company's platform offers on-time services, optimizes the cost of garbage collection, sends closing documents once a month and flexible system of tariffs and payment methods, enabling clients to meet their environmental goals whether that is collection and disposal or industry-leading recycling services.	3.0	01-Jul-2018	Early Stage VC	Russia
Kanin Energy	Developer of an energy efficiency technology intended to help heavy industries to monetize their waste heat and decarbonize their operations.	3.0	22-Jan-2021	Seed Round	United States

	The company's technology monetizes waste heat resources by installing waste heat to power facilities, helping clients to reduce fuel consumption and CO2 emissions by converting waste heat into clean energy.				
rePurpose (Environmental Services)	Operator of a web-based platform intended to help individuals and brands worldwide to go PlasticNeutral. The company's plastic credit platform measures plastic footprint through an interactive calculator and offsets consumption by making a payment to an innovative waste worker organization that will recycle an equivalent amount of plastic, enabling consumers & businesses to join a community of consciousness working toward a brighter future.	3.0	09-Apr-2020	Seed Round	United States
Waste Consolidators	Provider of waste collection services. The company offers waste management services such as trash consolidation, parking lot sweeping, apartment cleaning along with other offerings creating an overall quality of neatness to the property.	2.5	01-Jan-2014	PE Growth/Expansion	United States
Inex Circular	Developer of a waste management platform designed to optimize the management of raw materials. The company's platform provides a statistical and open data native project that can show how much raw materials are needed and how much waste is produced without a companies mobilization, thereby enabling businesses to find local raw materials at low cost to recover these wastes.	2.5	01-Jan-2020	Later Stage VC	France
Aerion Rental Services	Provider of waste management services. The company offers services related to fluid and waste management of effective oilfield services, drilling fluid life cycle and operational performance in U.S.	2.0	24-Jul-2015	Merger/Acquisition	United States
Le Drive Tout Nu	Provider of an online shopping platform intended to offer daily shopping products packed in returnable and reusable containers. The company's platform offers a wide range of food, cosmetic and household products packed in glass jars and canvas bags that are returned to the circuit after each order which assists to reduce the packaging waste, enabling customers to improve their shopping experience while preventing environmental pollution.	1.9	30-May-2020	Early Stage VC	France

Appendix 2: About Frost & Sullivan

Frost & Sullivan* is a leading global consulting, and market & technology research firm that employs staff of 1,800, which includes analysts, experts, and growth strategy consultants at approximately 50 branches across 6 continents, including in Herzliya Pituach, Israel. Frost & Sullivan's equity research utilizes the experience and know-how accumulated over the course of 55 years in medical technologies, life sciences, technology, energy, and other industrial fields, including the publication of tens of thousands of market and technology research reports, economic analyses and valuations. For additional information on Frost & Sullivan's capabilities, visit: www.frost.com. For access to our reports and further information on our Independent Equity Research program visit www.frost.com/equityresearch.

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What is Independent Equity Research?

Nearly all equity research is nowadays performed by stock brokers, investment banks, and other entities which have a financial interest in the stock being analyzed. On the other hand, Independent Equity Research is a boutique service offered by only a few firms worldwide. The aim of such research is to provide an unbiased opinion on the state of the company and potential forthcoming changes, including in their share price. The analysis does not constitute investment advice, and analysts are prohibited from trading any securities being analyzed. Furthermore, a company like Frost & Sullivan conducting Independent Equity Research services is reimbursed by a third party entity and not the company directly. Compensation is received up front to further secure the independence of the coverage.

Analysis Program with the Tel Aviv Stock Exchange (TASE)

Frost & Sullivan is delighted to have been selected to participate in the Analysis Program initiated by the Tel Aviv Stock Exchange Analysis (TASE). Within the framework of the program, Frost & Sullivan produces equity research reports on Technology and Biomed (Healthcare) companies that are listed on the TASE, and disseminates them on exchange message boards and through leading business media channels. Key goals of the program are to enhance global awareness of these companies and to enable more informed investment decisions by investors that are interested in "hot" Israeli Hi-Tech and Healthcare companies. The terms of the program are governed by the agreement that we signed with the TASE and the Israel Securities Authority (ISA) regulations.

For further inquiries, please contact our lead analyst:

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Appendix #.3: Team biographies

Dr. Tiran Rothman is the head of Frost & Sullivan Research & Consulting Ltd., a subsidiary of Frost & Sullivan in Israel. He has over 10 years of experience in research and economic analysis of capital and private markets, obtained through positions at a boutique office for economic valuations, as chief economist at the AMPAL group, and as co-founder and analyst at Bioassociate Biotech Consulting. Dr. Rothman also serves as the Economics & Management School Head at Wizo Academic College (Haifa). Tiran holds a PhD (Economics), MBA (Finance), and was a visiting scholar at Stern Business School, NYU.

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