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Circular Economy in the Kingdom of Saudi-Arabia

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1. Executive Summary

In recent years, the concept of circular economy (CE) has gained prominence in Saudi-Arabia, presenting a solution to national challenges. It focuses on promoting solid domestic waste management and antipollution measures as well as recycling measures, which aim to regenerate natural systems. This economic model has the potential to significantly contribute to climate action within specific sectors and across industries.

The Brochure is part of the project to set up a “Circular Economy in the Kingdom of Saudi-Arabia”, of the export initiative of the Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection. The main objective of the project is to support Saudi-Arabia in establishing a Circular Economy and increase awareness of the market potential for sustainable German technologies as well as connecting viable German companies with Saudi research institutions, and the local business community. Within the projects, roundtable discussions have been organized, resulting in a specialized conference, which served as a

natural multiplier. Training sessions following the conference further sensitized decision-makers to Circular Economy concepts.

The project brochure on the Circular Economy in Saudi-Arabia is designed to provide quick and comprehensive insights into the Saudi market, enhancing the visibility of the German delegation’s expertise.

Saudi-Arabia, in its nascent stage of circular economy development, is aiming to shift waste management strategies. According to the 2019-established National Waste Management Center (MWAN) the goal by 2035 is to reduce landfill disposal to only 18% of total waste, with recycling accounting for 42%, composting 35%, incineration 19%, and other methods 4%.¹

MWAN was one of the main partners in all phases of the project.

¹ Unified National Platform 2013

2. Status Quo

In the context of Vision 2030, Saudi-Arabia is undergoing a paradigm shift in urban planning and climate protection measures. The “Green Riyadh” project, for instance, aligns with the national Green Initiative, which aims to plant a total of 10 billion trees across the Kingdom, and is regarded as one of the most significant sustainability projects in Riyadh.² In addition to keywords such as “reduction of desertification” and “emission reduction”, the initiative also aims to elevate the currently low recycling rates to foster the circular economy project in the Kingdom.

Furthermore, Saudi-Arabia aims to establish a CO₂ circular economy, with pilot projects, such as Carbon Capture Technologies. This reflects a commitment to innovative solutions that contribute to sustainability and align with the broader vision for the country’s future.

2.1 Circular Waste Management Targets

By 2035, Saudi-Arabia aims to achieve a net-zero waste management system with SIRC playing a pivotal role. Key waste streams include wastewater, construction debris, municipal waste, and agricultural sludge.

Currently, 94% of waste in Saudi-Arabia ends up on landfill sites.³ The goal is to reverse this trend by 2035, recycling or converting 94% of waste. The focus is on recycling municipal waste (81%), waste-to-energy (19%), and reprocessing construction debris (60%).⁴



² Saudi Press Agency, 2023

³ Arab News, 2022

⁴ Arab News, 2021

2.2 Market Expansion and Private Investment

Saudi-Arabia anticipates the construction and operation of a total of 1,329 new recycling and waste processing facilities by 2035.⁵ The substantial demand for new facilities and the partial establishment of entirely new disposal infrastructure makes the Saudi market for circular economy initiatives particularly more attractive. Waste-to-Energy (WtE) is gaining recognition as a viable solution to reduce greenhouse gas emissions generated by open disposal sites while simultaneously generating energy.

The National Waste Management Center (MWAN) envisions a waste volume of 106 million tons by 2035, encompassing all categories of waste (municipal, commercial, industrial, and construction waste). One of the MWAN's primary tasks is to attract private investors, with a focus on Public-Private Partnership (PPP) projects. The estimated required investment volume for this project is around \$22 billion.⁶

The largest planned standalone project in waste treatment is the Al-Dagham Waste Treatment Facility by the Saudi Investment Recycling Company (SIRC) in Riyadh. Covering a total area of 20 million m², the project includes investments of \$75 million and encompasses the development of landfills, the construction of a medical waste treatment facility, a hazardous industrial waste treatment facility, a sludge treatment facility, and infrastructure works.⁷

2.3 Investment Opportunities in Clusters

The Kingdom of Saudi-Arabia is partnering up with foreign investors in order to drive the development of the recycling sector to set up the circular economy. MWAN has identified and created investment opportunity packages for key clusters in Saudi-Arabia:⁸

⁵ Arab News, 2020a

⁶ GTAI, 2023

⁷ GTAI, 2023

⁸ MWAN-Presentation

25 Geographical clusters identified by MWAN

The Transformation Journey of Waste Management Sector in Saudi Arabia

01 Riyadh	10 Makkah	19 North. Borders
02 Al Kharj	11 Al Qunfudhah	20 Al Jouf
03 Wadi Al Dawasir	12 Al Baha	21 Tabuk
04 Dawadmi	13 Asir	22 NEOM
05 Al Qassim	14 Jazan	23 Umluj (Red Sea)
06 Hail	15 Najran	24 Al Ula
07 Madinah	16 Al Ahsa	25 Yanbu
08 Jeddah	17 Dammam	
09 Taif	18 Hafar Al Batin	



1. Riyadh-Cluster

- 27 investment opportunities.
- Valued at around 80 billion SAR.
- 8 governorates, covering an area of 59,750 km².
- Supporting a population of 6,992,567.
- 2,789 industrial spots and 1,845 km² of agricultural areas

2. Makkah-Cluster

- 20 investment opportunities.
- Valued at around 31 billion SAR.
- 3 governorates across 14,852 km².
- Supporting a population of 2,384,926.
- 510 industrial spots and 793 km² of agricultural areas.

3. Jeddah-Cluster

- 31 investment opportunities.
- Valued at about 50 billion SAR.
- 4 governorates, covering an area of 17,126 km²
- Supporting a population of 4,896,696.
- 560 industrial spots and 672 km² of agricultural areas.

3. Innovative Approaches and Environmental Impact

While being significantly involved in developing a circular economy, Saudi-Arabia's challenges lie in insufficient infrastructure facilities, which includes the absence of appropriate sorting or composting facilities and other forms of solid domestic waste management (SDW). Hence, German companies can strategically position themselves in the conceptualization and implementation to provide the necessary equipment for the nation to achieve its 2035 objective.

The government has launched several projects and initiatives in waste management and recycling to promote waste disposal and enhance aspects related to recycling, reusing, energy recovery, and the promotion of the Circular Economy concept. These projects include:

- Initiative to establish a Saudi Investment Recycling Company (SIRC)
- Modernization of municipal waste management systems
- Waste management initiative in the city of Jubail
- Integrated waste disposal strategy in the city of Riyadh
- Initiative for the recycling of food waste

In 2017 the government founded the Saudi Investment Recycling Company (SIRC), a subsidiary of the Public Investment Fund (PIF) of Saudi-Arabia. In 2019 the government also established the National Center for Waste Management (MWAN), tasked with developing regulations and organizing proper enforcement. Several German consulting and technology providers are already closely collaborating with SIRC.

A significant future challenge encompasses market developments as certain companies currently rely on a single viable business model, which constraints the growth of recycling initiatives. The recycling sectors for chemicals, paper and metals are relatively underdeveloped. The proposed investments of \$80 billion as part of Saudi Vision 2030 signal a substantial opportunity for German companies to increase their involvement in this field.⁹

SIRC is currently working towards completing Riyadh's inaugural construction and demolition waste recycling facility for Construction and Demolition Waste (CDW), while other companies expressed interest in utilizing recycled products and materials. Large construction and demolishing projects generate building materials for various projects to be recycled.

The government is willing to invest in more sustainable solutions and apply cutting-edge technologies.

Some companies currently operate only in fields with viable business models, such as paper, metals, plastics, and other smaller waste streams. What sets Saudi-Arabia apart from emerging economies is its financial capacity to drive large-scale projects. The planned investments of \$80 billion by 2025 and the Vision 2030 plan to build a sustainable economy confirm the high potential. In these contexts, German companies can make a sustainable contribution to environmental protection and the achievement of SDGs in the three selected areas:

3.1 Recycling Facilities

Currently, the Saudi Investment Recycling Company (SIRC) is in the process of completing the first recycling facility for Construction and Demolition Waste (CDW) in Riyadh.

⁹ Expert-Roundtable, Dammam, Oct. 2023

Companies have expressed interest in employing recycled products from this facility. The plant will produce aggregates suitable for the construction of new buildings and converting waste into building materials for road and housing projects.

Another initiative of the project is to expand the facility's capabilities to recycle other types of waste, such as fertilizers, paper, plastics, and metals. It is the first project developed under the memorandum of understanding signed in July 2019 between SIRC, the National Center for Waste Management (NWMC), and the Riyadh municipality to introduce integrated waste management and recycling activities in the capital.

Another example is the initiative for integrated environmental services launched by the Royal Commission for Jubail and Yanbu (RCJY) for the management of remediation projects in the industrial city of Jubail. The primary aim is to make the city waste-free through smart redesign of waste management and disposal, aiming for secure and sustainable waste management. It also aims to improve environmental protection, extend the lifespan of landfills, and activate programs for recycling and converting waste into energy.

The Ministry of Municipal, Rural Affairs and Housing (MoMRA) initiated a Smart Cities program for a number of selected cities, including Yanbu, the first Smart City in Saudi-Arabia. The main goal is effective management of services for efficient resource utilization and improved delivery of urban services. The program includes opportunities in real estate, industrial manufacturing, utilities, waste management, and mobility.

3.2 Food Industry

Saudi-Arabia has a significant agricultural sector, and its waste, particularly from agriculture and food industries, currently ends up mostly in landfills without efficient utilization.

Opportunities for German companies exist in agriculture, such as date production, and in the food industry. Currently, 21.1% of total waste is generated in agriculture as well as through consumption.¹⁰

A 2020 study by the Ministry of Environment, Water and Agriculture revealed that each individual wastes 184 kg of food per year. Flour and bread waste account for 917,000 tons annually, while rice, meat, camel meat, beef, poultry, and fish waste collectively amount to significant figures. Vegetable waste exceeds 335,000 tons per year, with specific vegetables like zucchini and potatoes contributing 38,000 tons and over 200,000 tons, respectively.¹¹

In the context of the Circular Economy, there are initial approaches in Saudi-Arabia related to food recovery. In conjunction with efforts to promote recycling with the food industry and foster a circular economy, the city of Jeddah took a proactive step by implementing dedicated compartments for food waste. Additionally, restaurants and event organizers were mandated to collaborate with recycling companies to manage food waste. To comply with these regulations, businesses

in the restaurant and event sectors had to enter into contractual agreements confirming their commitment to this initiative.

The Eastern Province, in collaboration with the Society for Food Donations and a specialized recycling company, initiated a project to use food waste for conversion into organic fertilizers, aiming to utilize resources and protect the environment.

3.3 Industry Initiatives

Saudi Aramco operates innovative industrial recycling projects, including the recycling of damaged high-density polyethylene from a wastewater evaporation pond into plastic products.

¹⁰ Expert-Roundtable, Jeddah, Sept. 2023

¹¹ Arab News, 2020b

Saudi Basic Industries Corporation (SABIC), a Saudi multinational chemical company, views the Circular Economy as a business opportunity that can strengthen its sustainability commitments. Among its commitments is the investment decision for a mega-project in chemical recycling for mixed plastic waste.

PepsiCo and the Saudi Waste Management Center (SWMC) signed a memorandum of understanding for

waste reduction supporting the Circular Economy development through various projects. The first project under this partnership focuses on providing smart containers for the separation and crushing of plastic bottles, supplied by SMU Cycled. The SWMC stated that this is the first of many similar partnerships focusing on waste reduction and awareness campaigns.



4. Roundtables

During the first phase of the project, roundtables addressing the Circular Economy have taken place in Riyadh, Dammam, and Jeddah with specific themes:

- Riyadh focused on waste management, given the presence of the Ministry of Environment, Water and Agriculture, the National Center for waste management (MWAN), and the Saudi Investment Recycling Company (SIRC).
- Dammam, with its industrial focus, explored Circular Economy topics for industry, involving key players in petrochemicals such as SABIC, SAUDI ARAMCO, SIPCHEM, TANSEE, as well as German companies like Linde and EVONIK.
- Jeddah, known for its food industry, focused on sustainable food production and reducing food waste, involving entities like the Saudi Agricultural & Livestock Investment Company (SALIC).

The Round Tables aimed to collaborate on a potential training/education program that contributes to fostering a Circular Economy in the Kingdom. Hybrid formats allow participation from Germany and provide insights into local developments.

4.1 Jeddah

The Jeddah roundtable mainly addressed food waste management, highlighting the National Center for Waste Management's (MWAN) ambitious plan to recycle 90% of current dumped waste by 2040. The Makkah-Cluster, with 20 investment opportunities of in total 7 bn USD, was also introduced.¹²

The correlation between compost and Environmental Waste Management Treatment Centers emphasizes.

the benefits of placing biogas plants near compost sites to generate renewable energy, thereby enhancing the utilization of bio waste. The developed concept of material and energetic utilization of waste hinders the growth of existing landfills. With immediate environmental benefits and high social acceptance, this approach can be an economical interim solution until comprehensive waste management concepts are implemented over the years.

The focus here is on the energetic utilization of bio- genic residues. Biogas plants have already become an essential component of sustainable climate protection. However, the utilization of otherwise difficult residues or by-products from the food industry or organic waste with a high fiber content requires sophisticated process technology.

The proprietary high-conductivity biogas technology developed for this purpose makes it possible to utilize virtually all organic waste. Modular gas can be used directly, electricity, heat and cold can be generated and fertilizer can be produced. The industrial plants are prepared for the novel production of hydrogen.

The Makkah-Cluster includes two environmental waste treatment centers, seven transfer stations and facilities to treat other types of waste, six composting plants and a hazardous industrial waste treatment center.

Though these projects have not yet been put out to tender. This means that the Mekkah-Cluster primarily offers opportunities in terms of consulting and formulating the criteria for the planned facilities.

¹² MWAN-Presentation



4.2 Riyadh

The Riyadh Roundtable was mainly focused on the domestic waste management strategies where MWAN presented approximately 27 investment possibilities of an aggregated 21 bn USD.

Current State: 5% Landfill Diversion

The current waste management scenario in Saudi-Arabia reveals a landfill diversion rate of 5%. This sets the stage for a comprehensive discussion on the national waste management strategy, including the Cluster Master Plan, encompassing various waste streams.

Notably, construction and demolition waste already have a master plan in place, with published investment opportunities amounting to 7 billion USD, Riyadh alone boasting 27 opportunities.

Open Discussion: Enablers, Impact, and Opportunities

The program concluded with an open discussion touching

on the significance of enablers in waste management. Financial compensation, the Waste Management Fund, and reinvesting in the sector were further explored, alongside considerations for Waste-to-Energy (WtE) initiatives and education. The impact of these enablers on PPP service providers and licensed operators was discussed, focusing on mega projects with a capital expenditure of over 200 million USD.

Further topics for open discussion included the potential implementation of Integrated Producer Responsibility (IPR) and the role of Producer Responsible Organizations (PRO). The discussion revolved around potential models for IPR, with a focus on whether a national entity will act as a private entity or if a tender-based approach is more suitable. The involvement of SIRC and MWAN, including the collaboration between Saudi Public Investment Fund (PIF) and SIRC, was explored, with emphasis on opportunities available through Saudi Invest.

¹³ MWAN-Presentation

¹⁴ MWAN-Presentation



4.3. Dammam

In Dammam, there are 39 opportunities in the waste sector worth 56 billion SAR, covering 9 governorates. This includes 2 EWTC, 3 waste treatment, and 18 composting facilities. The total waste generated annually in Dammam is 3.9 million tons. The plan is to allocate 5% to landfill, with 95% landfill diversion, including 25% for waste-to-energy and 75% for recycling and composting.¹⁵

The recycling of renewable materials is preferred to incineration in the strategic design by MWAN. The competitive situation in waste management was also discussed as there are only a small number of providers of waste management solutions in the market. However, it is important to note that the market is relatively new and still developing to reach its potential. Profitability is limited in these crucial beginning stages.

MWAN's main mandates include their waste management strategies through legislation, awareness, financial sustainability, planning and development, digitalization, licensing, and permits. They have established 16 technical guidelines for different waste streamlines.¹⁶

Currently, their waste management strategy is undergoing the approval process, and they collaborate with Saudi entities like SASO.

MWAN also shared plans for waste management from the Royal Commissions Jubail and Yanbu and emphasized the importance of compliance, with MWAN acting as the regulator. The lack of investment in the Eastern province was further discussed, along with concerns about the insufficient number of waste management solution providers. The German perspective was presented by ECON Industries, focusing on recycling to reduce incineration.

Simultaneously, there still needs to be progress in terms of the circular economy framework conditions. The roundtables highlighted the topics of economic efficiency, legal framework conditions and especially legal grey areas/ not clearly defined areas of waste management as well as missing basic conditions. The various research opportunities and the private sector show that Saudi-Arabia has recognized the importance of the circular economy structure and is acting accordingly.

¹⁵ Expert-Roundtable, Dammam, Oct. 2023

¹⁶ Istitlaa

5. Specialized Conference on the Circular Economy

The conference included German and Saudi experts presenting the latest technologies and innovations to foster the circular economy, focusing on topics discussed during the Round Tables. Approximately 50-80 decision-makers from local ministries, institutions, and business representatives attended.

The National Center for Waste Management (MWAN) recommended to focus on reshaping the institutional framework, with primary mandates including legislation, guidance, planning, and development.

The discussion delved into the diverse types of waste, ranging from healthcare and industrial to municipal solid waste, agricultural waste, and more. MWAN identified 25 geographical clusters, each requiring a tailored approach to waste management.

MWAN envisions a significant impact by 2040, targeting a 90% overall landfill diversion, treatment of 1.2 billion tons of waste and unlocking approximately 420 billion SAR in private sector opportunities with 848 treatment facilities required.¹⁷

Prince Sultan University discussed innovative solutions for plastic waste, emphasizing the development of plastic pavement suitable for extreme weather conditions and heavy traffic. With an estimated 106 million tons of plastic waste by 2035, they explored future investments in plastic waste management.¹⁸

Tadweer addressed the challenges and opportunities in the Waste Electrical and Electronic Equipment (WEEE) sector. They highlighted the growth potential of the Saudi WEEE feedstock market, projected to steadily increase at 7% YoY until 2030.¹⁹ However, challenges such as legislative gaps, infrastructure limitations and public awareness need to be addressed for sustainable growth.

CLEANCO LLC gave a presentation on some key projects of the company in the region and its role within the circular economy. The global medical waste management market is \$17.03 billion in 2022 at a compound annual growth rate (CAGR) of 5.0%. The current geopolitical situation has resulted in a surge in commodity prices, and supply chain disruptions, causing inflation across goods and services affecting many markets across the globe. The medical waste management market is expected to reach \$20.69 billion in 2026 at a CAGR of 5.0%. The market growth is the result of the introduction of new disposable products, implementation of effective waste management and growing government initiative for medical waste disposal.²⁰

¹⁷ MWAN-Presentation

¹⁸ Arab News 2021

¹⁹ Specialized Conference on the Circular Economy, Tadweer, Nov. 2023

²⁰ Globalnewswire 2022

Roland Berger emphasized the importance of transitioning towards a circular economy. They underscored the need to rethink and redesign ownership and materials flows, incorporating biological and technical cycles. The adoption of circular economy principles across value chains, considering product design, resource efficiency, carbon intensity, and recycle efficiency is crucial. Overcoming challenges related to consumer behavior, infrastructure, and technology is vital for successful implementation, especially in sectors like construction and buildings where 40% of annual CO2 emissions originate.²¹

Econ industries rounded off the conference by discussing industrial waste management within the context

of circular economy and climate protection, contributing to the overall discourse on sustainable waste management practices in Saudi-Arabia.

In the realm of waste management, Econ Industries is actively addressing the environmental impact of hazardous waste incineration (HWI). HWI, an integral component of current waste disposal methods, tackles challenges associated with infectious/hospital waste, persistent toxic substances, and mixed contaminated wastes like PPE and paint bins.

Econ Industries proposes a shift towards the recycling of hazardous waste through a blend of technologies.

²¹ World Economic Forum 2021

6. Conclusion: Opportunities for German Companies

The Saudi government's Vision 2030 aims to set up a Circular Carbon economy and prioritizes sustainable solutions, providing significant opportunities for German technical service providers and technology innovators. Based on discussion with the Ministry of Water, Environment and Agriculture, the National Waste Management Center (MWAN) and Saudi Investment Recycling company (SIRC), the Delegation of the German Liaison Office for Economic Affairs for Saudi-Arabia, Bahrain, and Yemen (GESALO) observed a growing demand for innovative technology and know-how transfer in the overall recycling sector.

While on the one hand the Kingdom has identified clusters in the different regions for investors to set up the recycling sectors, the need of technology providers became also very evident during the project.

Three main sectors have been identified offering opportunities for German companies: Food Waste, Industrial Waste and Medical Waste.

The increased investment in the Food Waste Sector due to allocation of new factories and the growing amount of Food Waste presents the need for solutions. Agricultural Waste and Food Waste remain unutilized and pose a large potential for innovative solutions including recycling and converting waste into resources. Regarding Industrial Waste, challenge within the collection process have been identified. Tremendous market growth in the medical waste management and growing government initiatives offer opportunities for innovative solutions in the medical waste disposal.

The respected reputation of German technology in Saudi-Arabia enables German companies to strategically position themselves within those niche sectors and drive sustainable development in the Kingdom.

List of Abbreviations

MWAN	National Center of Waste Management
SIRC	Saudi Investment Recycling Company
WtE	Waste to Energy
PPP	Public Private Partnership
SDW	Solid Domestic Waste Management
CDW	Construction and Demolition Waste
RCJY	Royal Commission for Jubail and Yanbu
MoMRA	Ministry of Municipal, Rural Affairs and Housing
SABIC	Saudi Basic Industries Corporation
SWMC	Saudi Waste Management Center
SIPCHEM	Saudi International Petrochemical Company
SALIC	Saudi Agricultural & Livestock Investment Company
IPR	Integrated Producer Responsibility
PRO	Producer Responsible Organization
PIF	Saudi Public Investment Fund
SASO	Saudi Standards, Metrology and Quality Organization
EWTC	Estimating Water Treatment Costs
WEEE	Waste Electrical and Electronic Equipment
CAGR	Compound Annual Growth Rate
HWI	Hazardous Waste Incineration
BN	Billion

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Pure, Block B, 1st Floor Takhassusi Branch Road,
Al Mohammadiyyah,
Riyadh 12364
Kingdom of Saudi Arabia
Phone +966 92 0005868
LinkedIn @GESALO

Editors/ Contributors

Robert Gehrke
Lisa Walther
Lasse Schoetschel

Contact

Ms. Najah Alkutbi
Head of Market Entry, GESALO

Layout

Mares Kaufmann
Kerstin Steinberg

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