




Green Technology for Conflict Solid Waste Management in the Arab Region

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**Green Technology Transfer, Adaptation and Investment Required for Implementing SDG 12:
Sustainable Consumption and Production – Amman, Jordan – 30 and 31 July 2019**

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Definitions

Solid waste is non-liquid and non-gaseous materials from residential, commercial, institutional, construction and demolishing and street sweeping

Conflict Solid Waste Management (CSWM) is the safe and reliable collection, transfer, disposal and re-use of solid waste that resulted from conflict situations

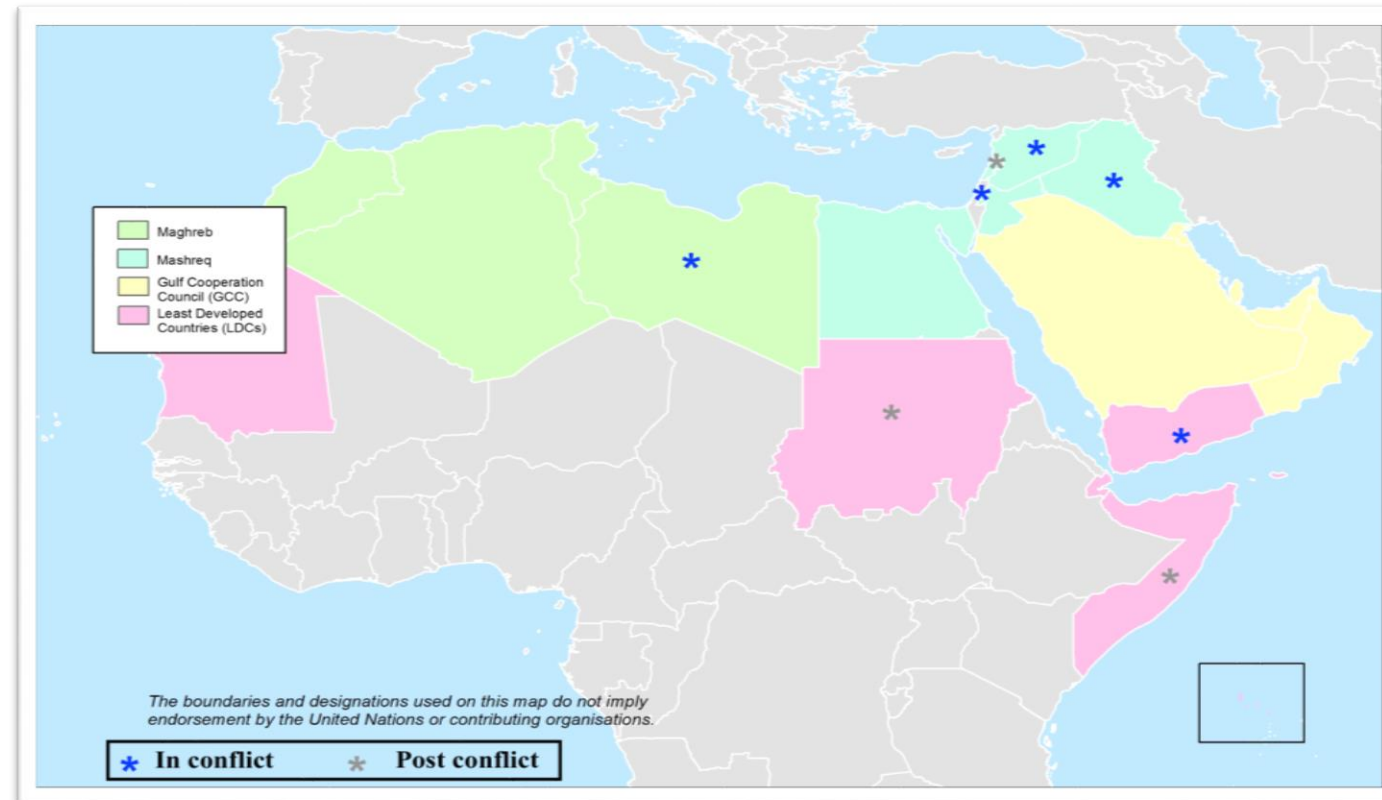
Green CSWM is using sustainable and environmentally-sound technologies and techniques/methods in CSWM

Report Objectives

- Understand the extent of the CSWM issue in the Arab region.
- Describe the main Green technologies used globally to help with CSWM.
- Assess the status of Green CSWM in the concerned Arab countries and perform a gap analysis compared to the rest of the world.
- Address Green CSWM technology transfer mechanisms and opportunities to close the gap between the Arab region and elsewhere.



Scope of the Report



In conflict: Iraq, Libya, Palestine, Syria and Yemen. Are in the midst of an armed conflict and/or occupation and they are suffering from its full impact.

Post-conflict: Lebanon, Somalia and Sudan. Have been out of conflict for enough time to be less impacted by conflict-related solid waste issues. An exception to this is the still-present, although reducing, risk from landmines and Explosive Remnants of War (ERWs).

Focus on the countries that are still in conflict

Setting the Scene – Examples

Lebanon

- During just 34 days of war between Lebanon and Israel in 2006, approximately 30,000 housing units were destroyed or badly damaged and 5.75 million m³ of rubble generated.

Sudan

- UN Mine Action Services (UNMAS) destroyed 10,306 Anti-Personnel mines, 3,257 Anti-Tank mines, and 98,748 unexploded ordnances years after the Sudan conflict was officially over in 2005.

Iraq

- In 2017, the quantity of conflict debris in Mosul was estimated at 11 million tons, equivalent to three times the Great Pyramid of Giza or four times the Eiffel Tower.
- In Ramadi City, 7 million m³ of debris was generated by the conflict between 2013 and 2015 as 80% of the city was destroyed.

Syria

- between 2011 and 2015, more than 52 percent of Aleppo's housing units have suffered partial damage or have been destroyed generating over 14.9 million tons of debris, in addition to Homs' 5.3 million tons. The conflict is still on-going.

Palestine

- In Gaza strip, where between December 2008 and January 2009 over 3,000 sites were impacted by Israeli military actions, about 600,000 tons of debris was generated.

Libya

- Between 2011 and 2017, the debris generated in Libya due to the ongoing conflict was estimated at about 82 million tons.

Lebanon



Iraq



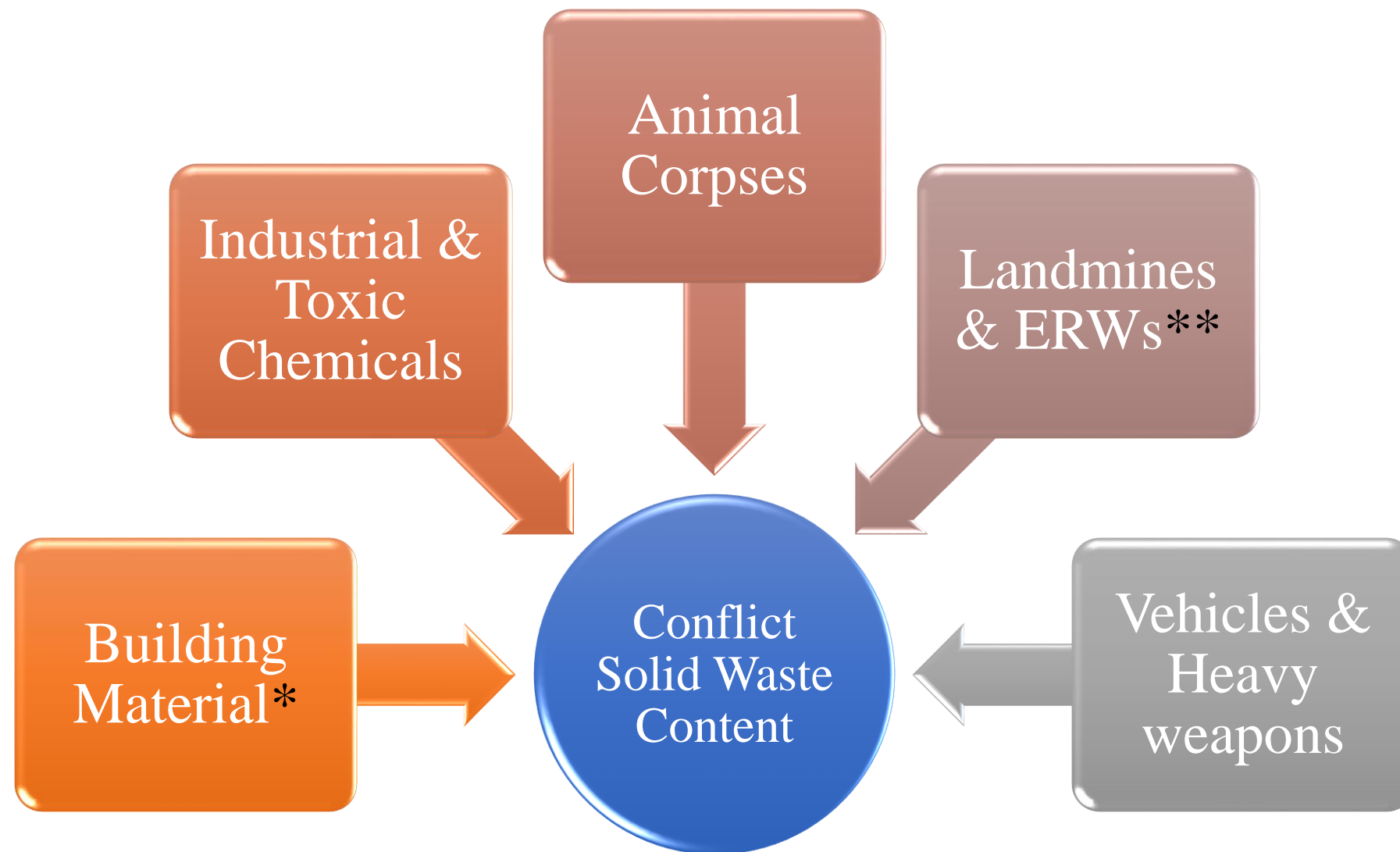
Palestine



Syria



Conflict Solid Waste Elements



***Building material:** Parts of or entire buildings, structures and infrastructure. Can include concrete blocks, bricks, tiles, metal beams and rods, copper cables, timber, plastic, furniture, human bodies, explosive ordnance, personal property and documentation.

****ERW:** Explosive Remnants of War

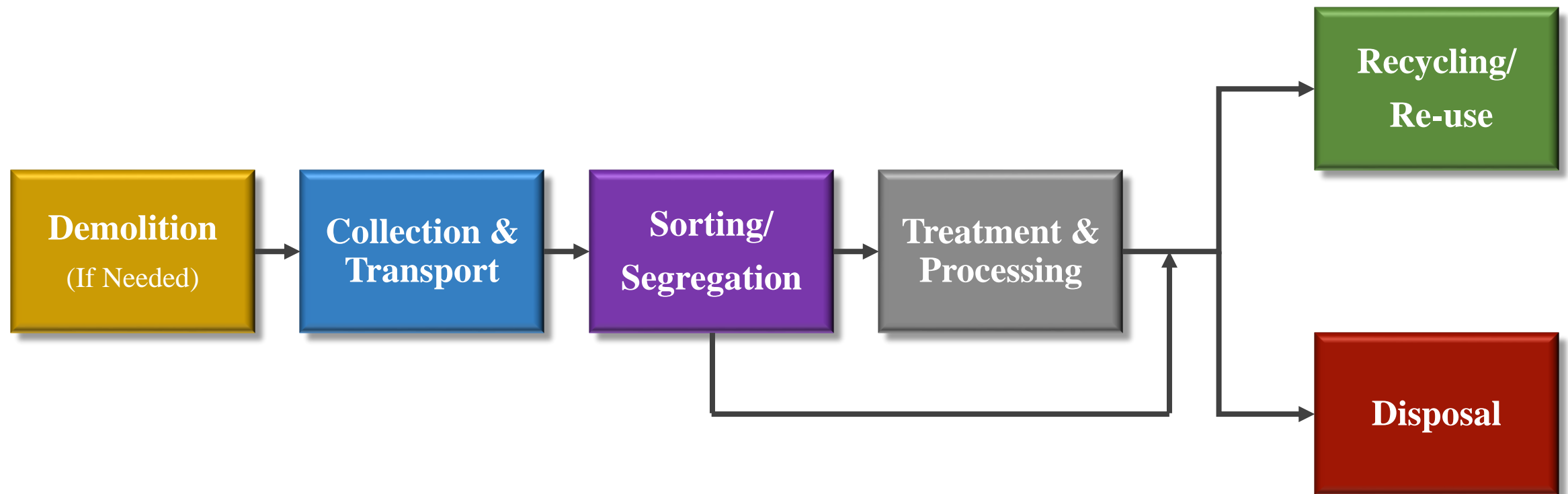
Conflict Solid Waste Impact



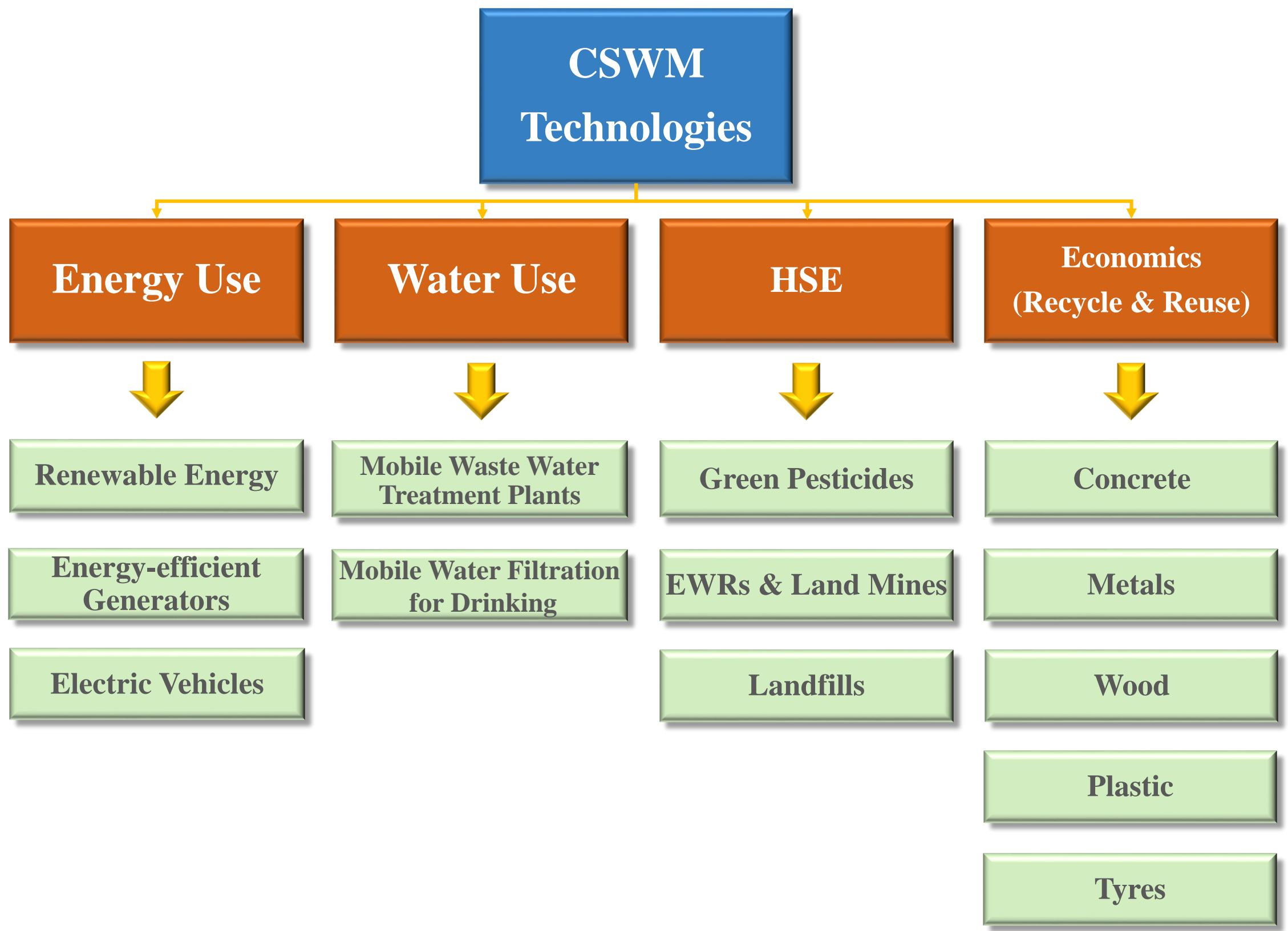
Mosul Debris Challenge (UN Estimates)

- Quantity of debris: **10 million tons**
- Transport (10 km per trip in 10 m³ trucks): **12.5 million km** (travel to the moon and back 16 times)
- Cost:
 - Moving **all debris** outside the city: **USD 250 million**
 - Recycling **50% of the debris** within the city: **USD 175 million**
 - Saving: **30% by recycling 50% within the city**

Conflict Solid Waste Management Phases



Green CSWM Technologies



Job Opportunities from Green CSWM Technologies

Opportunity	Job Type (exact numbers depend on project numbers and sizes)	Sustainability (after cleanup and reconstruction)
Renewable energy: Provision of the solar system, operation and maintenance	Many people (especially technicians) for commissioning then, at each site: manager, technician and 1 or 2 panel cleaners	Even more as share of renewable energy in overall energy mix is increasing
Energy-efficient generators: Buying generators and leasing them to projects, generators maintenance and logistics	Manager and technicians, depending on number of generators and geographical spread. Possible collaboration with logistics companies	Less so but can be used in other sectors/areas as backup power
Electric vehicles: Buying vehicles and leasing them to projects, running charging stations and maintenance shops	Manager, technicians and drivers, depending on number of vehicles and geographical spread	Can be leased elsewhere, e.g. to municipalities, factories and delivery services
Mobile water treatment plants: Provision of the plant, operation and maintenance, including filters and chemicals change/top up	Manager and 1 technician per plant. Opportunity for importing or manufacturing consumables	Even more
Green pesticides: Existing chemicals company or chemistry lab spin-off offering various bio-pesticides	Many positions, including lab personnel, sales people and on-site operators	Can be offered elsewhere, e.g. to municipalities, factories, schools and private homes/gardens
Disposal: Existing or new landfills	Large number at initial construction or upgrade of exiting landfills	Few to operate the facility, number depends on size of the facility
Recycling: Labour-intensive and offers a variety of jobs covering all recycling phases	Huge potential to employ people of all backgrounds and educational levels	Yes but certain categories will reduce whilst others will increase. So, can re-skill people or re-deploy

Current Status in the Arab region

	Renewable energy	Mobile wastewater plant	Recycling (debris)	Disposal	Additional information
Iraq	Not much currently but huge potential	Good experience from the oil and gas sector	Many initiatives taking place at the moment with UNEP support. However, post-piloting phase might have funding issues	Unsanitary dumpsite spread across Iraq. Not enough attention is given to proper disposal, compared to recycling/reuse	<ul style="list-style-type: none"> - UNEP leading efforts to support debris recycling, through specialized workshops, e.g. Mosul, Anbar and Kirkuk - Iraq's Ministry of Health and Environment drafting its guidelines for debris recycling sites, in collaboration with UNEP, and piloting a mobile debris recycling plant
Libya	UNDP installed many small plants, mainly for hospitals	Good experience from the oil and gas sector	C&D waste is currently just dumped or sent to landfills	There are a few sanitary landfills but they are over their design capacities	UNDP supporting solar power installation in Libya through its "Stabilization Facility for Libya" program, especially for hospitals
Palestine	Wide spread of small PV installations but larger ones often blocked by Israel	Good experience but huge issues due to blockade and lack of spare parts	Most debris from demolitions is reused	There are a few sanitary landfills but they are over their design capacities	The blockade by Israel is a major challenge for using technologies, especially those requiring spare parts
Syria	Small number of solar installations but large potential	Small cost efficient mobile wastewater treatment units used in refugee camps	Plans for recycling but nothing concrete yet	Many landfills but none of them with total containment	<ul style="list-style-type: none"> - The Syria Recovery Trust Fund (SRTF) offers much support in terms of debris removal but not for recycling - UNDP planning many programmes related to recycling debris, employment, capacity building, rehabilitation of existing facilities and equipment, etc
Yemen	Current conflict in Yemen pushed the use of cheap and simple solar PV systems	No data on mobile systems	Information not available	The existing landfills are badly managed. UNDP intervention hampered by security issues	The security situation in Yemen makes it difficult to support or to have access to information

	Technology available and performing well. Just needs spreading wider
	Technology available/possible but not used/optimised. Potential issues, e.g. funding
	Technology not available/difficult to acquire. Other limitations.

Palestine Case Study – Green Cake




- A 24-year old civil engineer, *Majd Mashharawi*, invented “**Green cake**”, construction blocks made entirely from recycled rubble and ash.
- Won an innovation award in Japan.
- Feed source: Rubble from the Gaza buildings destroyed by Israeli raids and ash from heating, cooking and power generation.
- Created a company to commercialize her innovation.
- Green Cake blocks are already being used to build multi-storey buildings in Gaza.
- Current challenges to business expansion:
 - Frequent power cuts: Solar energy kits could be a solution to this issue.
 - Investors reluctance due to volatile situation in Gaza: Support needed from development and green technology funds.



Availability and Opportunities in the Arab Region

- All concerned Arab countries are working with international organisations, especially UNEP to address their CSWM issues. The support includes funding, technology transfer and capacity building.
- Most of the support offered covers handling the huge amount of debris that resulted from complete cities, buildings and infrastructure destroyed by raids and other attacks.
- It is critical to consider the bigger picture and not design solutions that work only for this conflict phase. Countries should take the opportunity to create sustainable systems that will make the new reconstructed cities greener and more resilient than the demolished ones.
- It is important to have the right policies and incentives.
- It is critical to engage the private sector by providing attractive funding options to individuals and companies as well as other non-monetary incentives.
- The technologies described previously are available in various alternatives and from different sources, including locally in some cases. Hence, not likely to have any IPR issues.
- The capacity building workshops taking part in some countries (e.g. Iraq) are creating a number of local experts in the CSWM sector. This knowledge in itself is very valuable and can be shared with other Arab countries or offered as a business opportunity through advisory and consultancy services locally, regionally and internationally.
- Recycling and reuse is a huge opportunity for all Arab countries, not only the ones in conflict and it should be given priority in policies, strategies and funding.

Country	Access to Technology	Skills	Funding
Iraq	Green	Yellow	Red
Libya	Green	Yellow	Red
Palestine	Green	Green	Red
Syria	Green	Yellow	Red
Yemen	Yellow	Red	Red

-  No support required. Either has the technology, skill and funding or can obtain it
-  Some support required.
-  Major support required.

Technology Transfer Mechanisms (1/2)

<p>Local Within the same country Generally facilitated by Industry or government entities and can come in the shape of Public-Private-Partnerships (PPP)</p>		<ul style="list-style-type: none"> - From local research institutions to Industry as in the case of SME incubation programs and University-based IP commercialization units - Spin-offs and start-ups collaboration with existing companies
<p>Regional</p>	<p>Intra- Within the same region Generally facilitated by both parties' governments or by regional organizations</p>	<ul style="list-style-type: none"> - Example: Licensing Palestine's "Green Cake" technology to other Arab countries - Example agreement: Beirut Declaration
	<p>Inter- Between different regions or countries from different regions Generally facilitated by both parties' governments or by international organizations</p>	<ul style="list-style-type: none"> - Example: Mediterranean countries collaboration projects - Example: China's TT to Arab countries
<p>International At international level Generally facilitated by international organizations</p>		<ul style="list-style-type: none"> - Treaties/agreements, e.g. the Paris Agreement and the Addis Ababa Action Agenda - IP institutions, e.g. JIPA's GTTP and WIPO GREEN - Development banks, e.g. the ADB, the Technology Bank for LDCs and EBRD's FINTECC program - Dedicated international organizations, e.g. UNEP - International organizations dedicated to Waste Management, e.g. IETC. - Some developed countries International Development Agencies/ Departments, e.g. USAID and GIZ

Technology Transfer Mechanisms (2/2)

For an optimum TT, it is important to **include technical support** and **capacity building**. Procuring just the technology leads to sub-optimal results, at best.

Enforcing IP rights is a critical part of TT and cannot be emphasized enough. To benefit from externally-developed technologies, Arab countries must have **legal systems that can adequately protect patents**.

The TT can be offered in the following formats:

Free of charge: Generally offered to developing countries to help them, through customized development programs.

Collaboration: Via joint programs where both parties contribute in cash or in kind.

Business transaction: Simply via buying a needed technology from the owner.

Overall, adopting a **win-win model**, as much as possible, between the provider and the receiver of the technology can make TT easier.

Technology Transfer Opportunities

Name	Description / Support offered	Applicability
UN Programs	UNEP, UNDP and PAGE are great examples of such opportunities. Offer funding to introduce technologies, capacity building, advisory services and networking opportunities.	All that are eligible
SWEEP-NET	Knowledge and experiences sharing network, supported by giz (Germany) and ANGED (Tunisia)	Palestine, Syria and Yemen
FEMIP Trust Fund	Part of the European Development Bank, offering advisory and capacity building to their Mediterranean Partner Countries	Palestine
GTPP	GTPP (Green Technology Package Program) was launched by JIP to facilitate IP licensing. Emphasis is put on the “package” aspect as it includes consultancy, technical support and capacity building, as needed. Terms are agreed on a case-by-case basis. Some financial support might be available to help with license fees for those who cannot afford them	All
WIPO GREEN	Resulted from an agreement between JIPA and WIPO. Described as a marketplace for sustainable technologies, it is an interactive marketplace that promotes innovation and diffusion of green technologies. It does this by connecting technology and service providers with those seeking innovative solutions	All
Development Banks	Many banks such as Islamic Development Bank and The World Bank	All
Country-Specific Support	SRTF (Syria Recovery Trust Fund). Created by many donors to help Syria recover. Offers funding as well as technical support and capacity building in specific sectors	Syria
Green Technology Bank	Launched by China’s Ministry of Science and Technology (MOST) and the Municipal Government of Shanghai, focuses on boosting green technologies and green finance to meet the goals of the 2030 Agenda	All
Technology Bank for LDCs	leverage existing initiatives within the UN system and beyond to implement its programme of work and promote STI in the LDCs.	Yemen
Solid Waste Management Organisations	These are specialized in solid waste management and offer technologies, technical support and capacity building, for example: ISWA (International Solid Waste Association), Waste Concern, IETC (International Environmental Technology Centre, part of UNEP)	Depends on their coverage, for others
International Development Organizations	These are individual countries own international development organizations, such as USAID (USA) and DFID (UK)	All

Technology Transfer Challenges

Financial: Many countries in the Arab region do not have financial resources to pay for the clean technologies. They need either full funding or access to finance with suitable terms.

Legal: Mainly the lack of a legal framework to protect IP in the case of patented technologies. This should be treated as a priority by all countries looking to tap into the latest innovations.

Information and Application: There is not enough awareness by many countries of available TT and capacity building opportunities, in addition to the poor quality of proposals submitted.

Lack of skills and know-how: Given the scale of the CSWM issue, there is a lack of skills and know-how in the Arab region with most relying almost fully on foreign experts. The existing experts, such as in Palestine, are rarely sought for support in other Arab countries. Know-how related to the latest technologies and processes is also missing.

Conclusions

Conflict in populated areas often generates vast quantities of waste that can overwhelm national authorities and lead to disposal practices that are harmful to the environment and human health.

Technologies and best practices for a sustainable CSWM exist but require funding and technical assistance to implement effectively.

In the Arab countries under conflict, waste management is mostly handled by the public sector. No real participation from the private sector.

Most challenges related to CSWM are common to those countries, but collaboration is not fully exploited.

Recommendations

Arab Countries

- Develop the right regulatory environment, with support from organizations such as UNEP.
- Ensure internal and external stakeholders are fully aligned and roles and responsibilities clearly defined.
- Involve the local communities at an early stage and give them priorities for related jobs.
- Encourage the private sector through incentives, less red tape, finance access and Public-Private Partnership (PPP) opportunities.
- Encourage collaboration between Arab companies and governments to increase the scope for economic benefit and to lower the cost through economy of scale.

Organizations

(e.g. ESCWA, LAS, CTCN)

- Facilitate intra-regional networking and knowledge exchange via targeted events.
- Create and keep up-to-date a list of relevant technology transfer opportunities and providers and facilitate South-South and North-South collaborations.
- Compile and disseminate lessons learnt from across the region, especially in Arabic to maximize benefit coverage.
- Support learning and teaching of proposals writing.

ETC

- Champion research into more efficient waste recycling and reuse processes.