

# Making Right Choices: *A Framework for Sustainability Assessment of Technology (SAT)*

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# Structure of Presentation

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- ❖ **About SAT Methodology**
- ❖ **Key Characteristics of SAT methodology**
- ❖ **Use of SAT**
- ❖ **Key elements**
- ❖ **Methodology / Decision making process of SAT**



# Why integrate 'Sustainable Development' in Technology Assessment?

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- Technology plays an important role in Development
- The dominant system of decision making in technology selection, **focuses on economic considerations** and tends to disassociate social and environmental factors
- **A fragmented approach** in making technology choices has implications on efficiency and sustainability of technology
- Integration of Economic, Social and Environmental considerations **ensures Resource (Economic and Environmental) Efficiency and Social Acceptability**



# Sustainable Assessment of Technology (SAT)

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- SAT Methodology ...
  - ... Integrates Environmental, Social and Economic Considerations
  - ... Focuses on environment and development together and puts them at the centre of the economic and political decision making process
  - ... Can be adapted to country specific parameters and constraints



# SAT – Some Key Characteristics

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- It Undergoes progressive assessment (Tiered) procedure (screening, scoping and detail assessment) thereby optimizing information requirements.
- It operates on strategic as well as operational level
- It is a quantitative procedure allowing objective assessment, sensitivity analyses and incorporation of scenarios
- It incorporates Continuous improvement through Plan-Do-Check-Act (PDCA) cycle
- It is not an automated process thereby making country specific adaptation possible



# Use of SAT

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❖ Policy and Government Level

*For Strategic Planning and Policy making*

❖ Financing Institution Level

*For Assessing projects for funding*

❖ Operational Level

*For assessment of alternative technologies*

❖ Community and Cluster Level

*For assessment and comparison of collective alternative technologies*

❖ Community / Enterprise Level

*For comparing technology options*



# Application of SAT

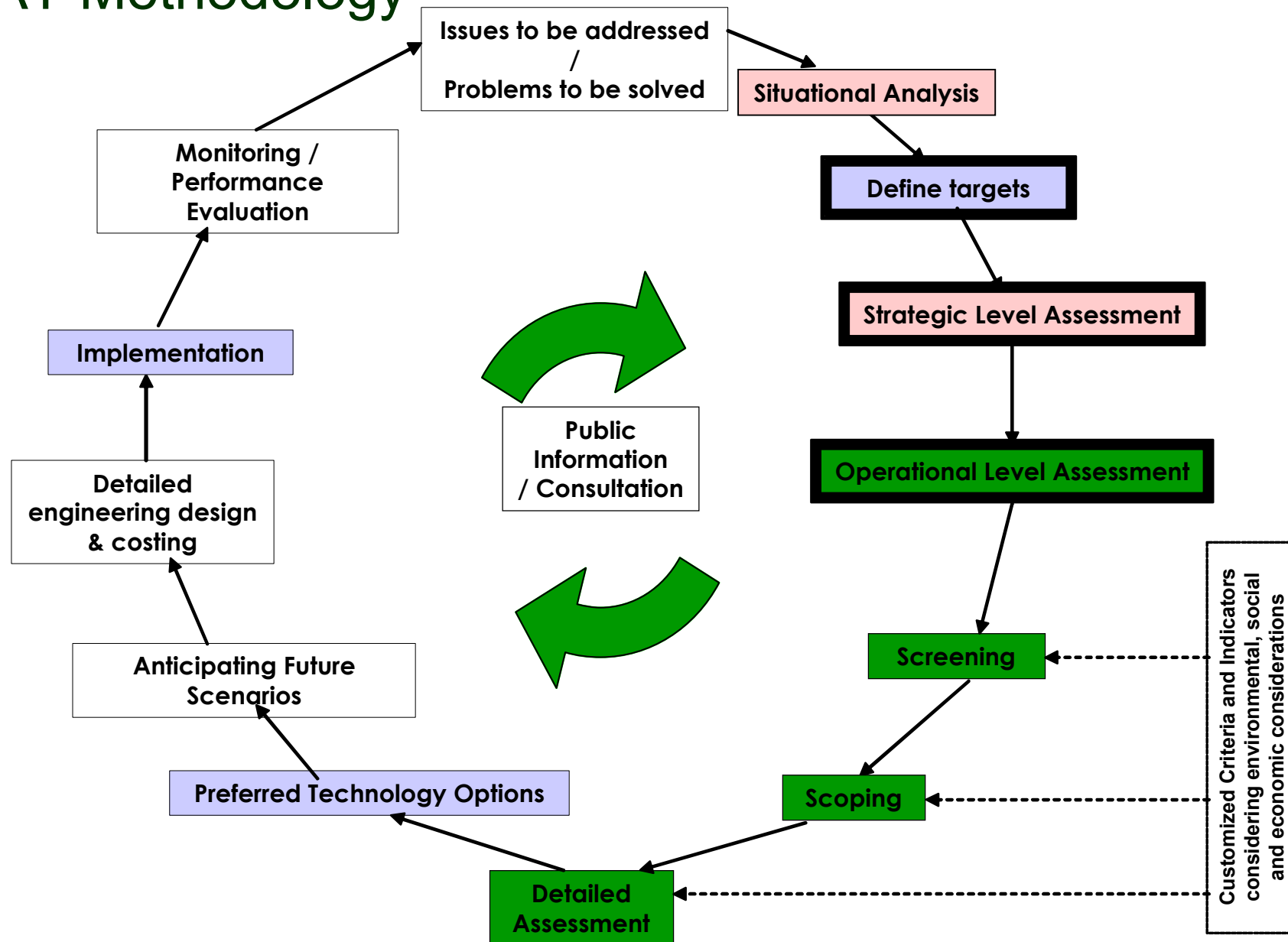
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The application areas include:

- Environment and health related programs
- Provision of basic infrastructure such as roads, power, water etc.
- Bio-diversity management
- End-of pipe water and waste management technologies
- Water and waste recycling programs
- Process technology modernization at shop floors and at industrial clusters



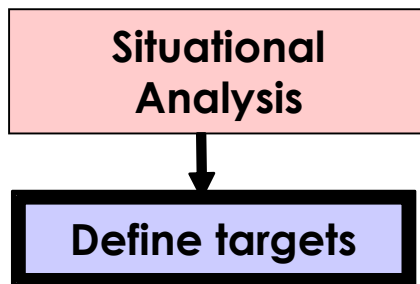
# SAT Methodology



# SAT Methodology – Situation Analysis

## *Situation Analysis and Defining Targets*

The Situation Analysis includes:



- Baseline data collection
- Stakeholder consultation
- Mapping and analyses

These two Steps help to identify issues, assess their significance and leads to setting of targets that should be addressed by proper technology intervention.



# SAT Methodology – Strategic Level Assessment

Strategic Level Assessment

## ***Strategic level assessment***

This is done by planners, decision-makers, elected representatives through participatory sessions

The outcomes are important as it

- Helps to develop customized criteria and indicators for operational level from generic level.
- Facilitates short-listing and identification of suitable options
- Provides leads to future scenario building (e.g. population growth, tighten legal requirement) there by putting more light on technology choice.



# SAT Methodology – Operational Level Assessment

Operational Level  
Assessment

## ***Operational level assessment***

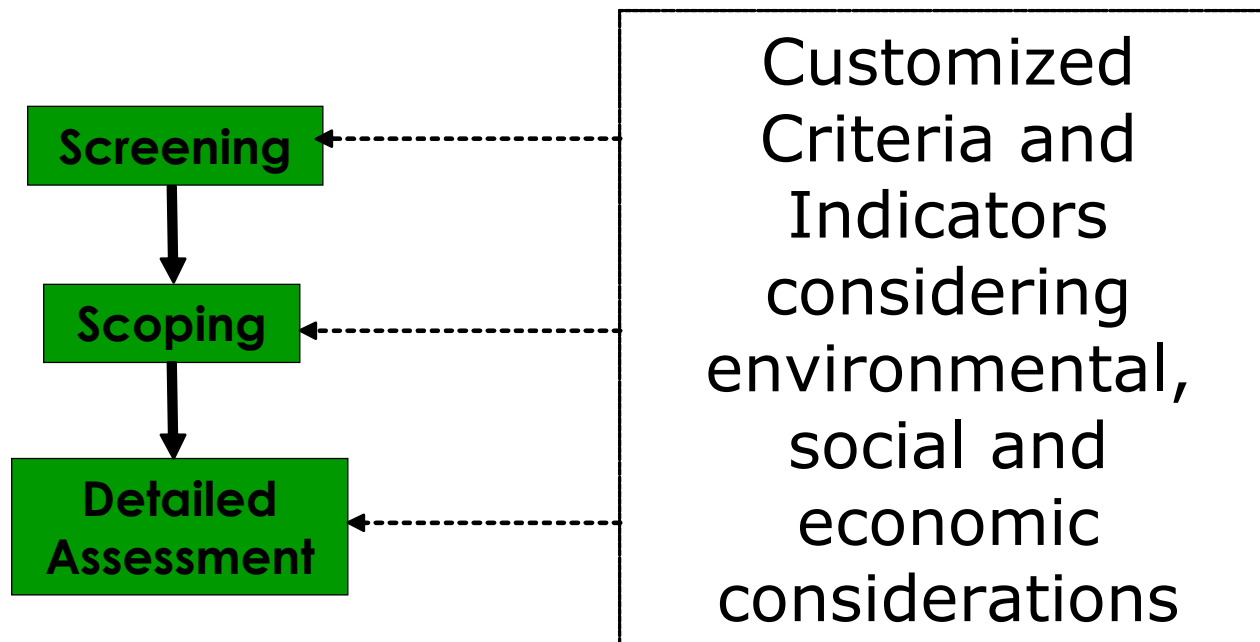
Engineers and technical staff assess the available technology options

In community or enterprise level, operational level assessment can be the first step.

The level of expert opinion and technical information is very important.



# SAT Methodology - Three -Tier Assessment



## SAT Methodology - *Screening*

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In this Step:

- The short listed systems from Operational level Assessment, undergoes objective **YES/NO** type answers
- Options which do not qualify one or all conditions, are directly eliminated.

*E.g.: Compliance to legal requirements or Use of non-hazardous substances*



# Municipal Solid Waste Management: Operational level assessment - *Screening*

Criteria	Mass burn	Modular incineration	Fluidized bed incineration	RD F	Sanitary land filling combined with aerobic composting	Sanitary land filling combined with bio-methanation	Manual land filling combined with vermicomposting
Compliance with local env. Laws	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Compliance with national env. laws	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Compliance with MEA's	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Safe to Use	Yes	No*	Yes	Yes	Yes	Yes	Yes
Provides savings on resources	Yes	Yes	Yes	Yes	Yes	Yes	Yes

\* There has been widespread concerns over the consistency and adequacy of air pollution controls.

## SAT Methodology - *Scoping*

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- It is a Comprehensive and Qualitative type (High/Medium/Low) assessment
- Various technology options are assessed against generic or customized criteria and indicators with use of computational methods such as:
  - ***The weighted sum technique***
  - ***Sensitivity analysis***
  - ***Multi Criteria Decision Making (MCDM): By 'Expert choice', a software using Analytical Hierarchy Process (AHP) to carry out MCDM***





## MSW: Operational level assessment - *Scoping*

<b>Rank Number</b>	<b>Score</b>	<b>Technology system</b>
<b>1</b>		<b>Sanitary land filling with bio-methanation</b>
<b>2</b>		<b>Manual land filling with vermicomposting</b>
<b>3</b>		<b>Sanitary land filling with aerobic (windrow) composting</b>
4		Fluidized bed incineration
5		RDF
6		Mass burn

The first three ranks of technology systems are short listed for Detailed Assessment

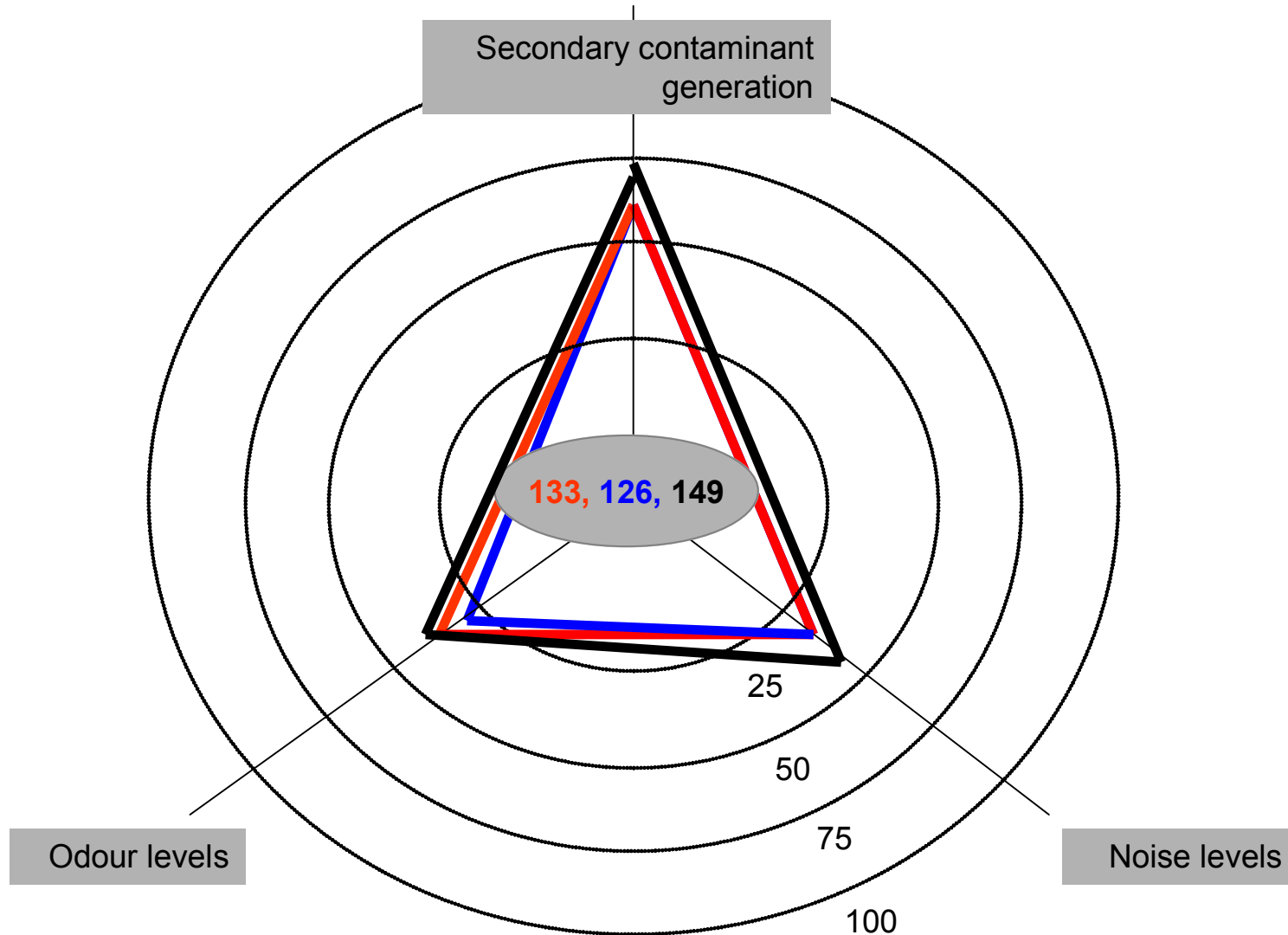
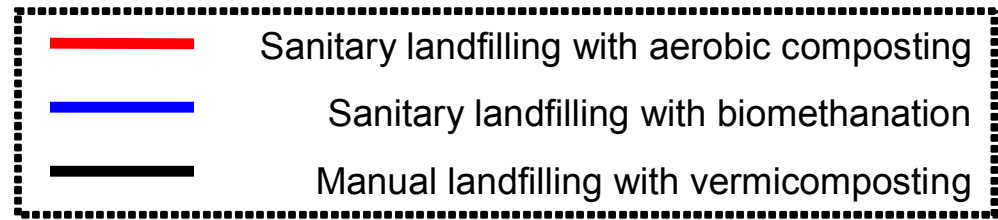
## SAT Methodology - *Detailed Assessment*

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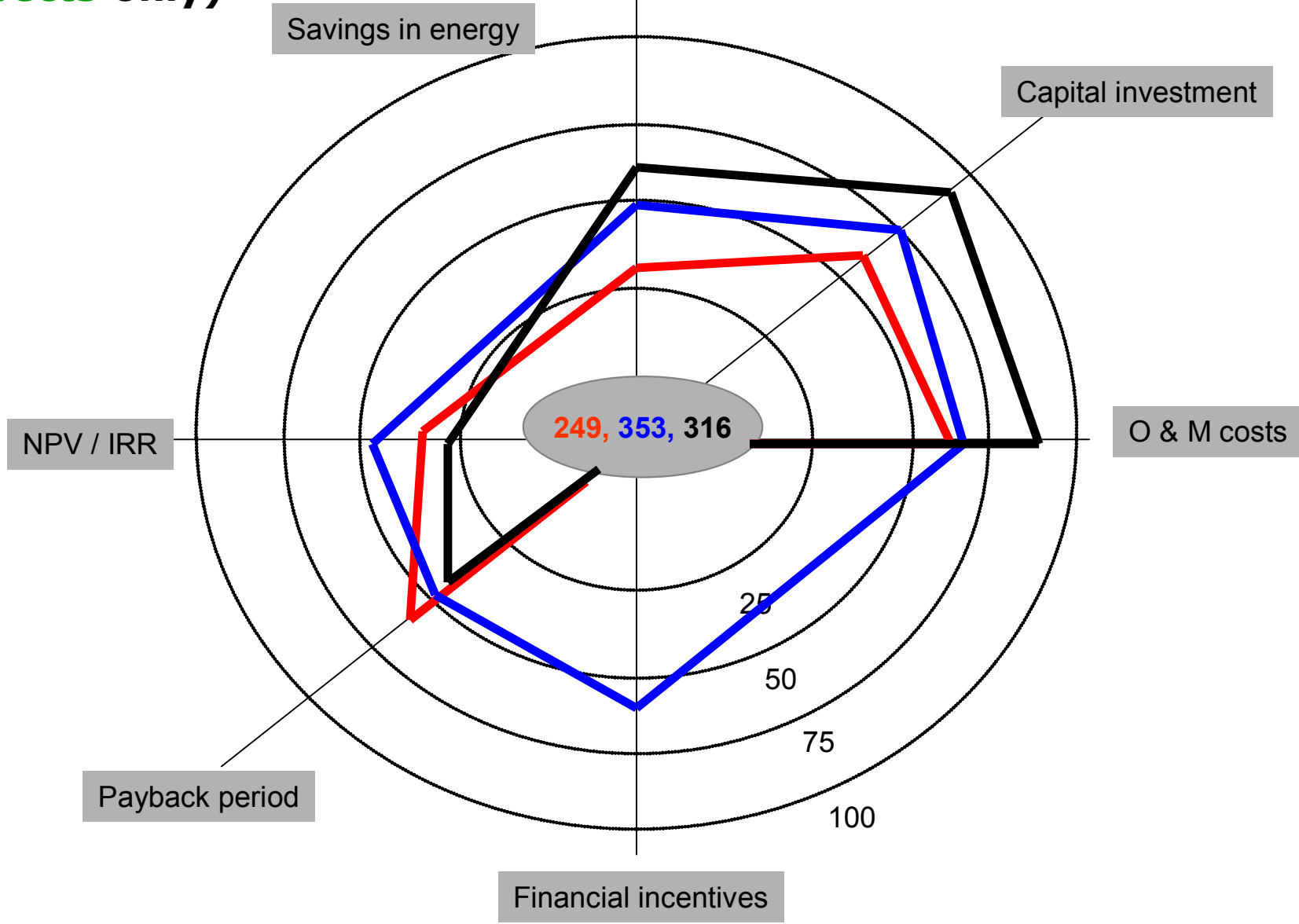
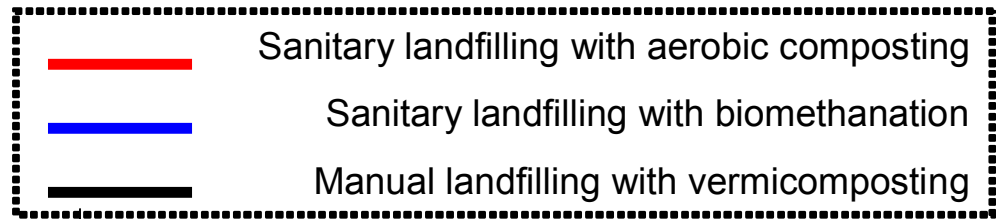
- The options with best overall ratings from *Scoping* are selected for Technical and Economic feasibility Assessment
- The Assessment level is situation specific and requires *detailed and quantitative information*.
- The outcome is a list of technology options *ranked* as per their scores



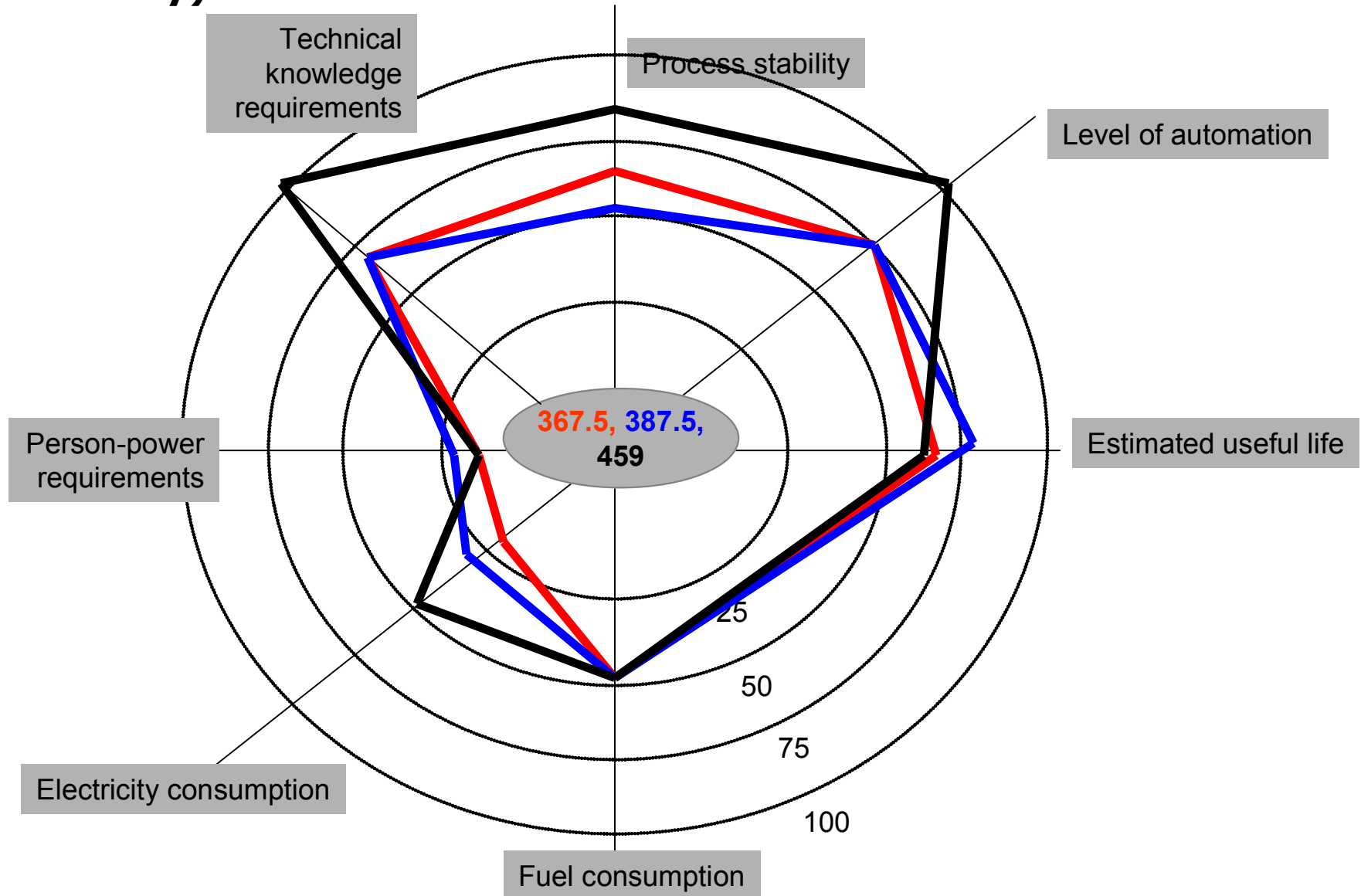
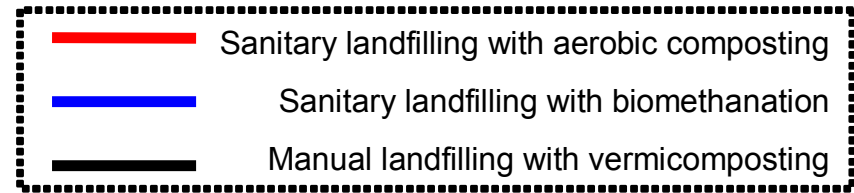
# Star Diagram for Detailed Assessment of criteria pertaining to *Environmental Aspects* only



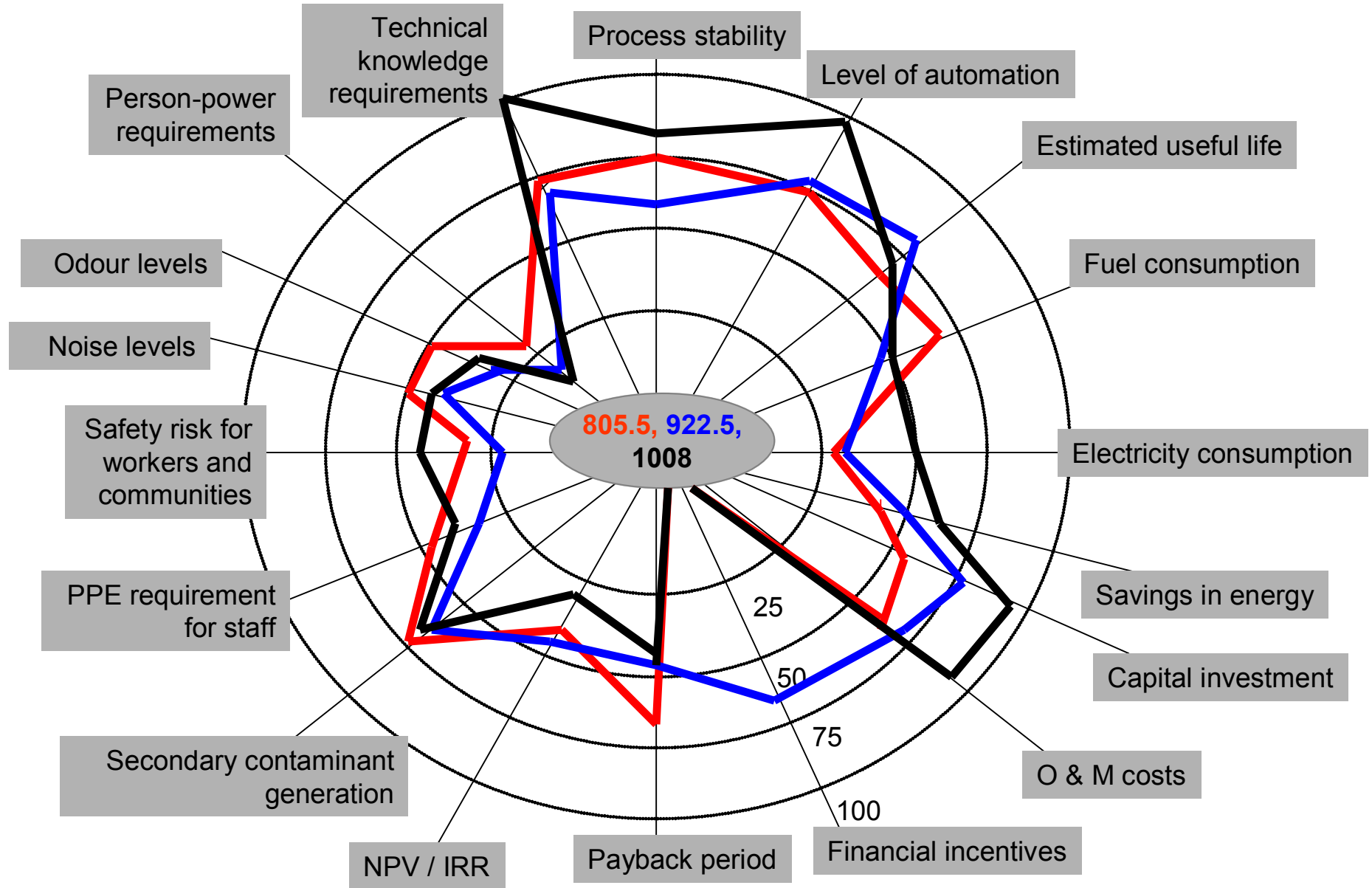
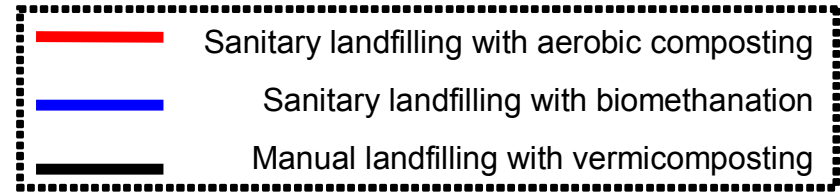
# Star Diagram for Detailed Assessment of criteria pertaining to *Economic Aspects* only)



# Star Diagram for Detailed Assessment of criteria pertaining to *Technical Aspects* only)



# Composite Star Diagram for Detailed Assessment



## Ranking of Technology Options

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***At this stage the ranking of technology system options is as follows:***

- Option 1: Manual land filling with vermicomposting
- Option 2: Sanitary land filling with bio methanation
- Option 3: Sanitary land filling with aerobic composting



## SAT Methodology - *Anticipating Future Scenario*

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In order to check the robustness of selected technology options, same methodology with simulated future scenario's to be applied so as to confirm that the technology stands the test of time.



## SAT Methodology - *Preferred Technology Options*

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Before discarding low scoring options and/or final decision on selection of technology one must keep in mind

- *Highest score technology option for current scenario needs to be carefully reviewed for different scenarios as it may not be equally eligible as feasible option in other scenarios*
- *On the other hand, the technology options with less score may qualify for different scenarios with suitable technology transfer/capacity building efforts.*



## SAT Methodology - *Implementation and Monitoring*

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Once the decision on Suitable Option is made, this step covers the following:

- *Engineering design*
- *Tendering*
- *Actual construction and commissioning*

Evaluation of technology during operational phase ensures meeting of desired objective against criteria considered in SAT process



## SAT Methodology – *Reporting, Monitoring and Feedback*

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- Reporting the outcome of monitoring and evaluation to stakeholders, govt. agencies and decision makers acts as basis for situation analysis for future projects and helps in making informed decisions
- It helps refine and build the Methodology by -
  - *Inclusion of additional criteria*
  - *Disqualification of technology in future for similar situations due to negative experiences.*



# UNEP SAT Application Detail

<p><b>Tier 1 screening</b></p>	<p><b><u>4 criteria total</u></b></p> <p>Compliance with local environmental laws or guidelines, compliance with national environmental laws, compliance with MEAs, meeting project objectives</p>
<p><b>Tier 2 Scoping</b></p>	<p><b><u>5 components, 32 criteria total</u></b></p> <p><u>Technical suitability</u>: compatibility with local conditions (geographical and climate, including settlement patterns and density), local material usage, availability of expertise, track record on performance, technical knowledge requirements, compatibility with existing situation, adaptability to future situations, process stability, estimated useful life, pollutant removal efficiency</p> <p><u>Environment – health &amp; safety risks</u>: risk levels for workers, communities, biodiversity...</p> <p><u>Environment – resources and emissions</u>: resource usage, energy consumption, renewable energy, water consumption, resource augmentation capabilities...</p> <p><u>Economic/financial aspects</u>: capital investments, O&amp;M costs, benefits</p> <p><u>Sociocultural aspects</u>: acceptability, extent of resettlement/rehabilitation, etc.</p>
<p><b>Tier 3 Detailed assessment</b></p>	<p><b><u>3 components, 18 criteria total</u></b></p> <p><u>Environment – resources and emissions</u>: land/space requirement, labor requirement, energy consumption,, emissions, etc.</p> <p><u>Economic-financial aspects</u>: capital costs, O&amp;M, benefits (nutrients and energy reclaimed, carbon credits, etc.), financial incentives</p> <p><u>Economic viability</u>: NPV, payback period...</p>



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# SAT Applications for Iraqi Marshlands Sanitation Pilot Project

SAT applied for in-depth analysis of applied technology to inform future decision-making on EST selection and replication in Iraq

[Snapshot of SAT applications](#) →

for each criteria, indicators and ratings are given, with descriptions

GROUP HEADING	CRITERIA	INDICATORS	RATING	NOTES
<b>Tier 1: Screening</b>				
Compliance	Compliance with local environmental laws	Yes / No		Not applicable (no specific local laws)
	Compliance with national environmental laws	Yes / No	yes	Comply with effluent standards of MOE
	Compliance with Multilateral Environmental Agreements (MEAs)	Yes / No		Not applicable
Other Requirements	Meeting the objective (3Rs)	Yes / No	yes	
<b>Tier 2: Scoping</b>				
Technical suitability	Compatibility with local natural conditions (geographical, climate)	Low / Medium / High	High	Suitable technological solution for small rural communities Native species of reeds: used for nutrient removal, growing in optimal conditions
	Extent of local materials usage	Low / Medium / High	Medium	Construction materials: coming from other locations inside Iraq Pumps and generators: procured from outside Iraq Native species of reeds: used for nutrient removal
	Availability of local expertise	Low / Medium / High	Low	Installation and start up performed by contractors Operational training provided to local personnel to increase availability of local expertise
	Track record on performance	Low / Medium / High / Not available	Low	First time application of technology inside Iraq for pilot/demonstration purposes Regular monitoring of water intake/outflow to accumulate performance records for Iraq
	Technical knowledge requirements (qualifications / special knowledge needed)	Low / Medium / High	Medium	Operation and maintenance: UG (undergraduate level)
	Compatibility with existing situation (technology,	Low / Medium / High	High	No existing wastewater management system prior to the installation of this system: no compatibility problems

## Overall performance of the selected EST system:

- It met local environmental needs and was suitable for socio-economic conditions
- It produced positive environmental and socio-economic benefits, particularly through the reduction of health risks, reduction of wastewater discharge and increased employment opportunities (for further detail, see: <http://marshlands.unep.or.jp>)

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**THANK YOU**

For further information:  
<http://www.unep.or.jp>

