



Division of Technology, Industry and Economics

UNEP

Sustainability Assessment of Technologies (SAT)

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Structure of Presentation

- 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?

- 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)

- 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

- 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

- 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

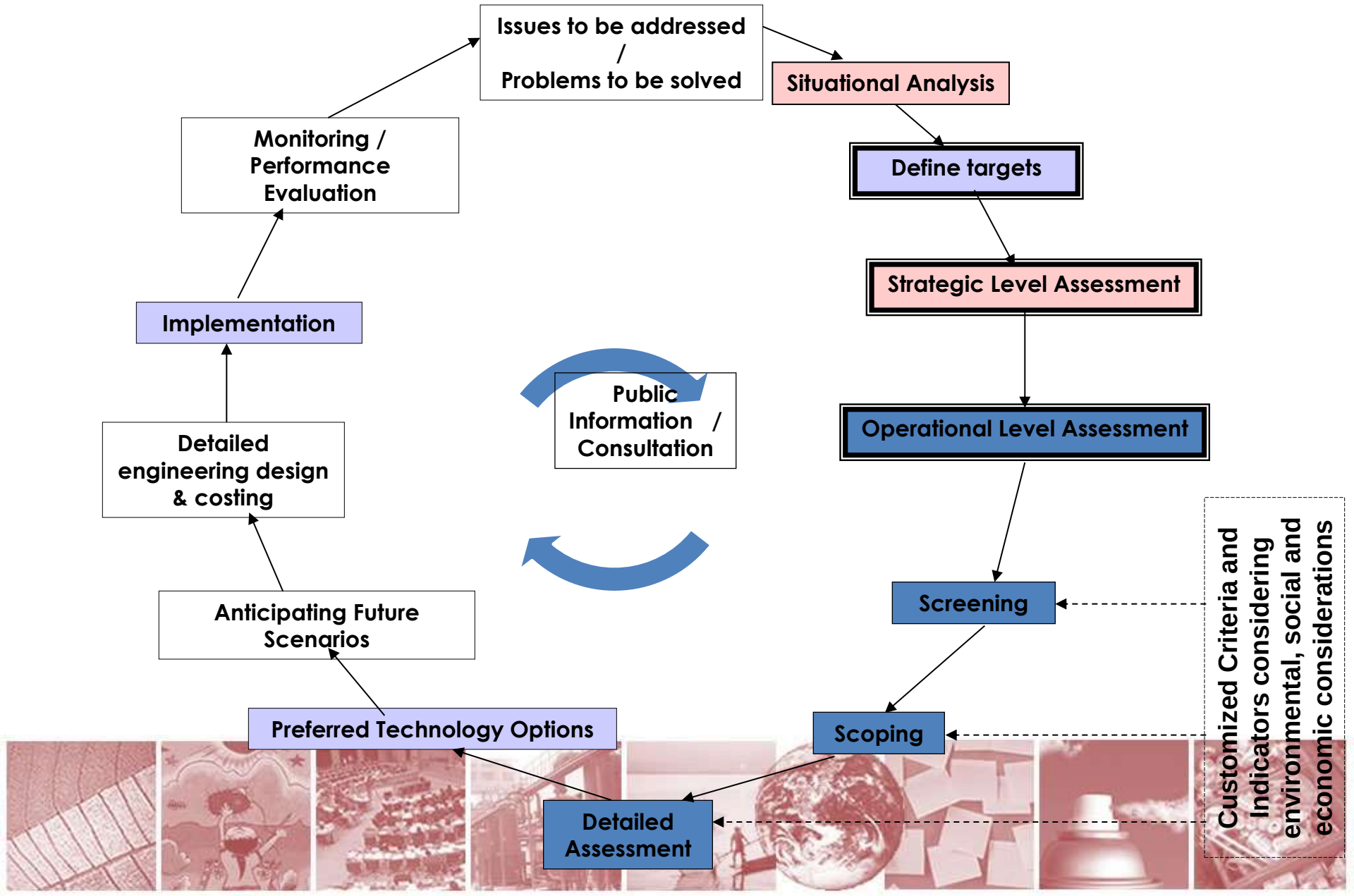
For comparing technology options

Application of SAT

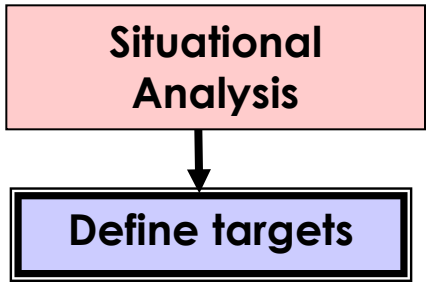
The application areas include:

- 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

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

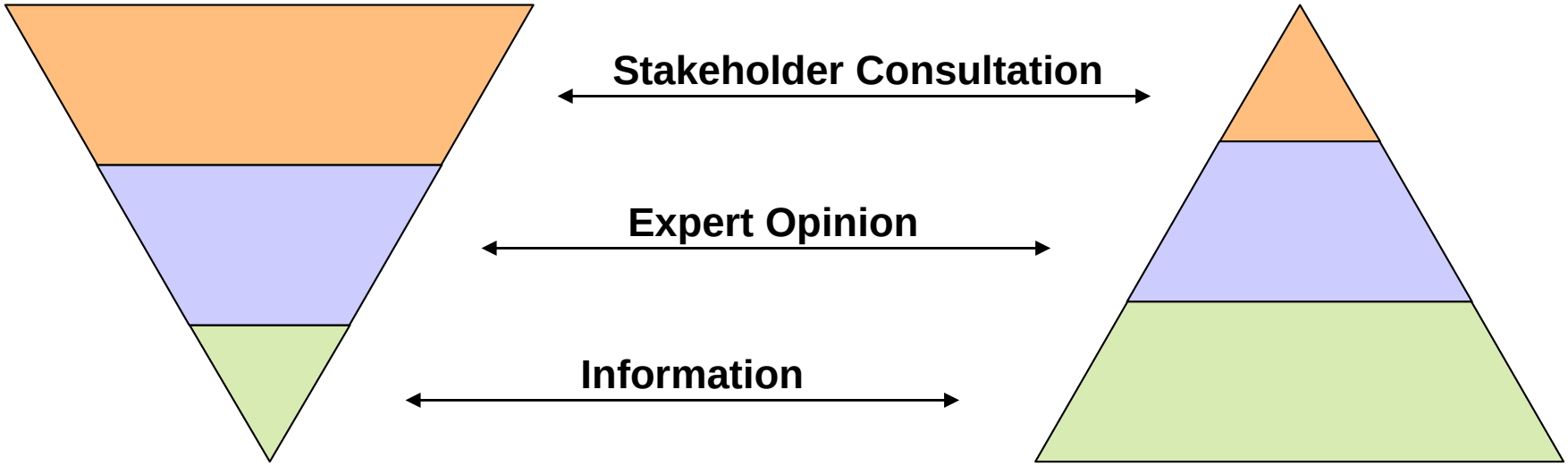
Operational level assessment

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.

Tools for SAT

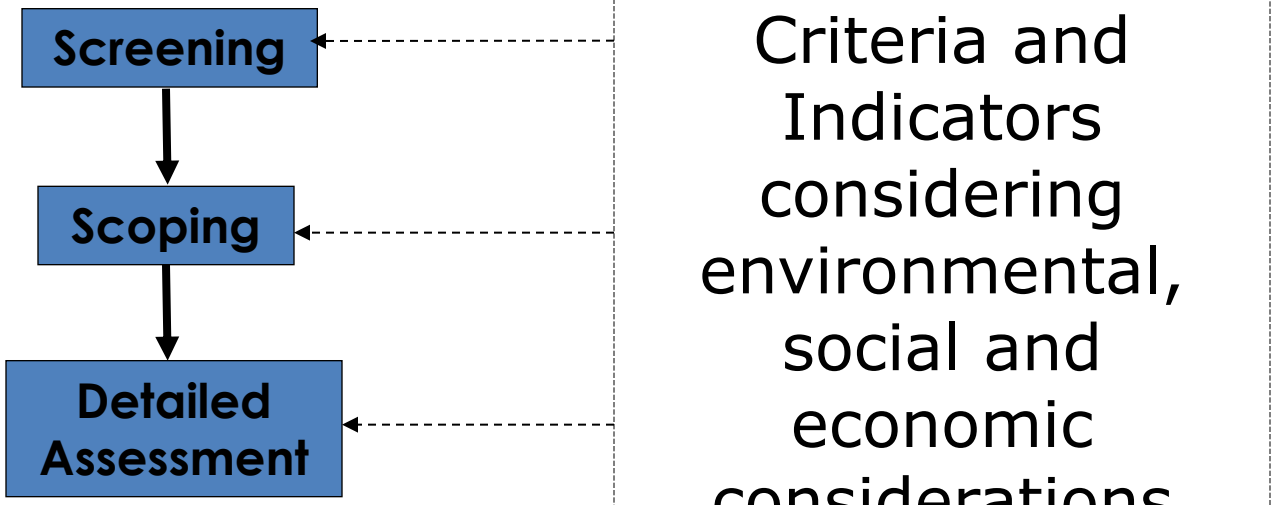


Strategic Level Assessment

Operational Level Assessment

SAT Methodology – Operation Level

Three-Tier Assessment



SAT Methodology – Operation Level

Screening

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

Screening at Operational Level

Example: Waste Treatment Technology

Criteria	Mass burn	Modular incineration	Fluidized bed incineration	RDF	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 – Operation Level

Scoping

- 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***

Sccoping at Operational Level

Example: Waste Treatment Technology

Criteria	Weight (Wt.)	Mass burn		Fluidized bed incineration		RDF		Sanitary land filling combined with aerobic composting		Sanitary land filling combined with bio-methanation		Manual land filling combined with vermicomposting	
		Score	Wt.*score	Score	Wt.*score	Score	Wt.*score	Score	Wt.*score	Score	Wt.*score	Score	Wt.*score
Suitability of waste characteristics to technology application	10												
Past experience (under similar condition)	10												
Land requirements	10												
Overall pollutant removal efficiency	10												
Acceptability (to the public)	10												
Income generation potential	7												
TOTAL (Weight * Assign score)													

Scoping at Operational Level

Example: Waste Treatment Technology

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

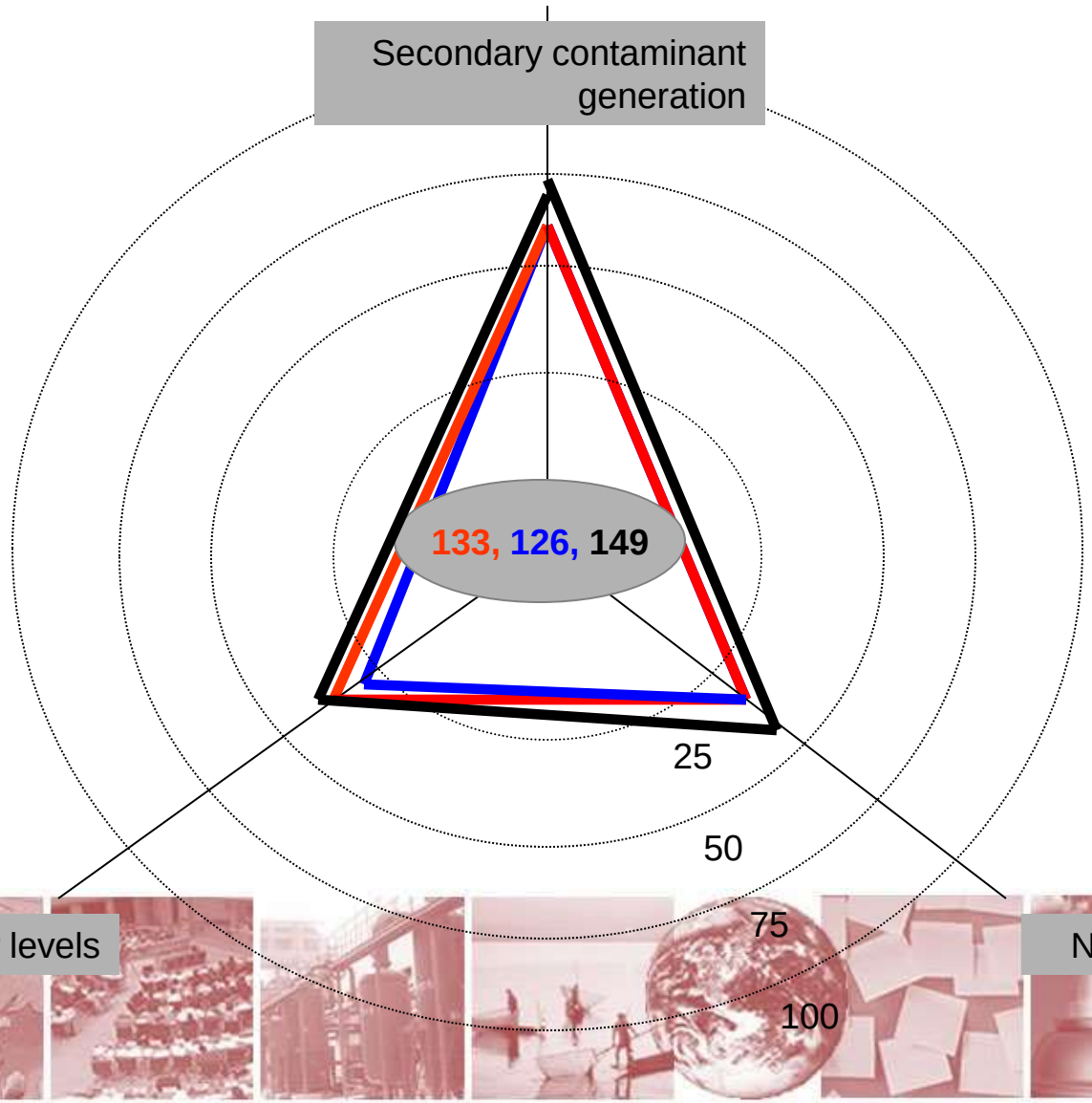
The first three ranks of technology systems are short listed for Detailed Assessment

SAT Methodology – Operation Level

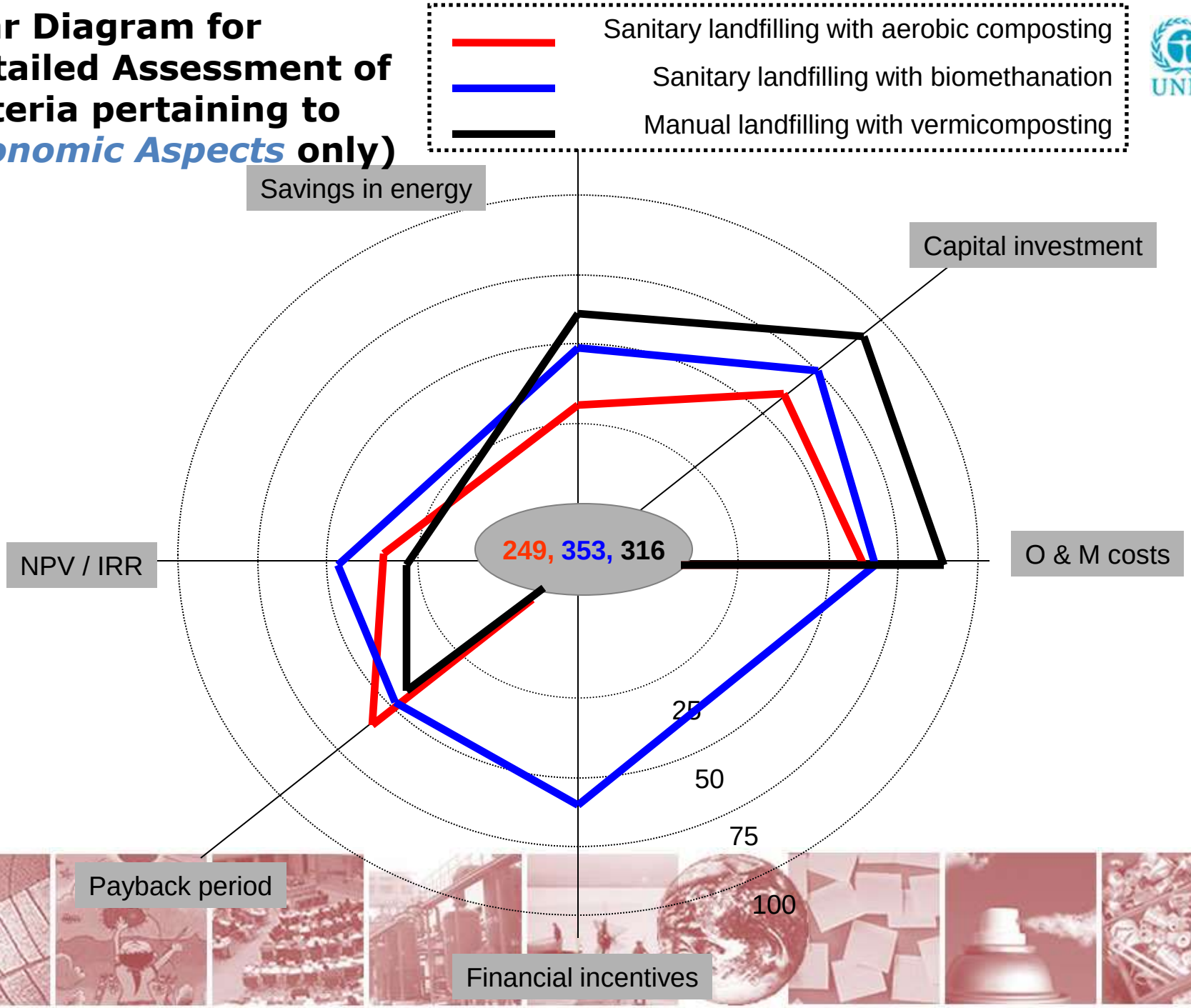
Detailed Assessment

- 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

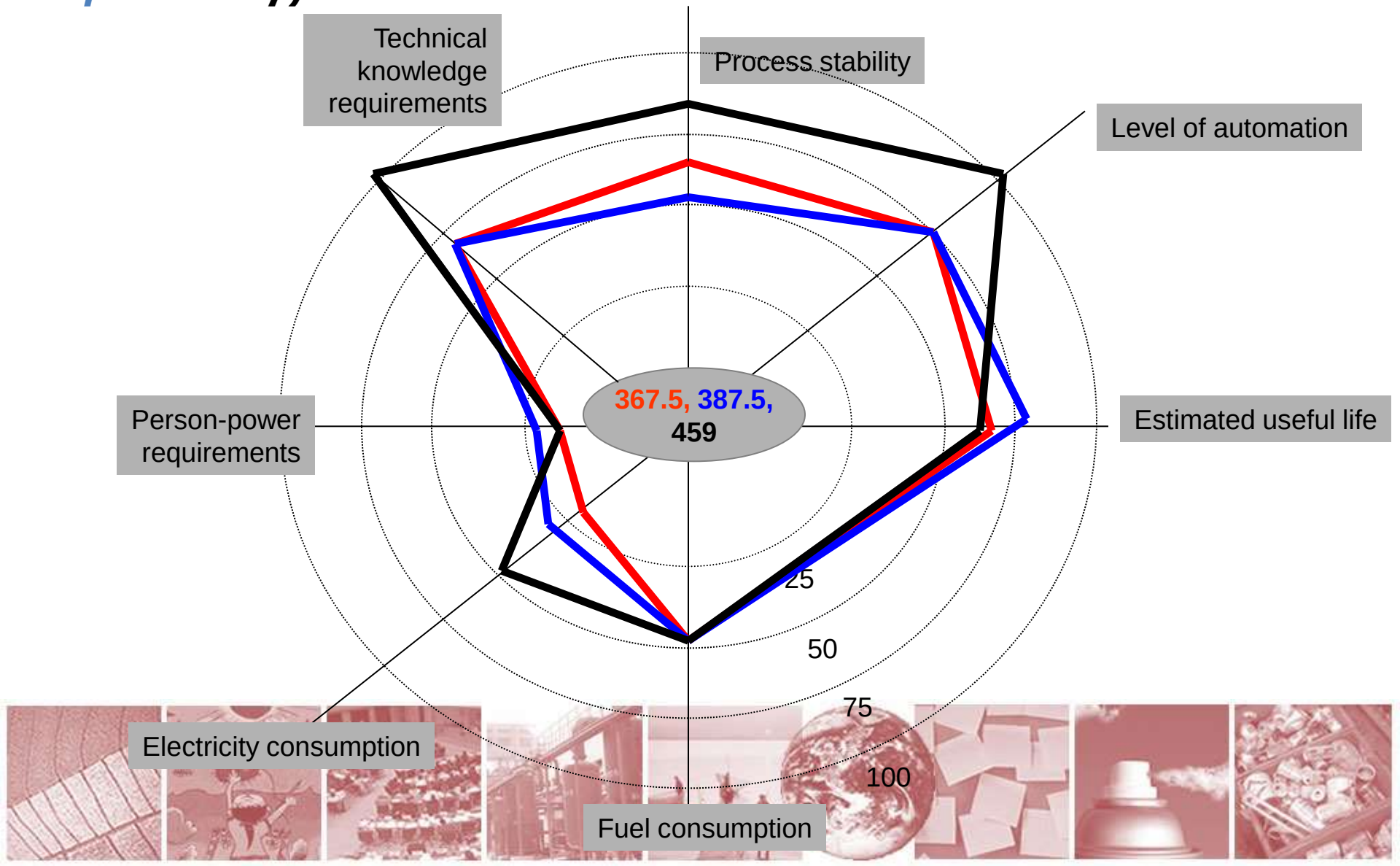
Star Diagram for Detailed Assessment of criteria pertaining to *Environmental Aspects* only



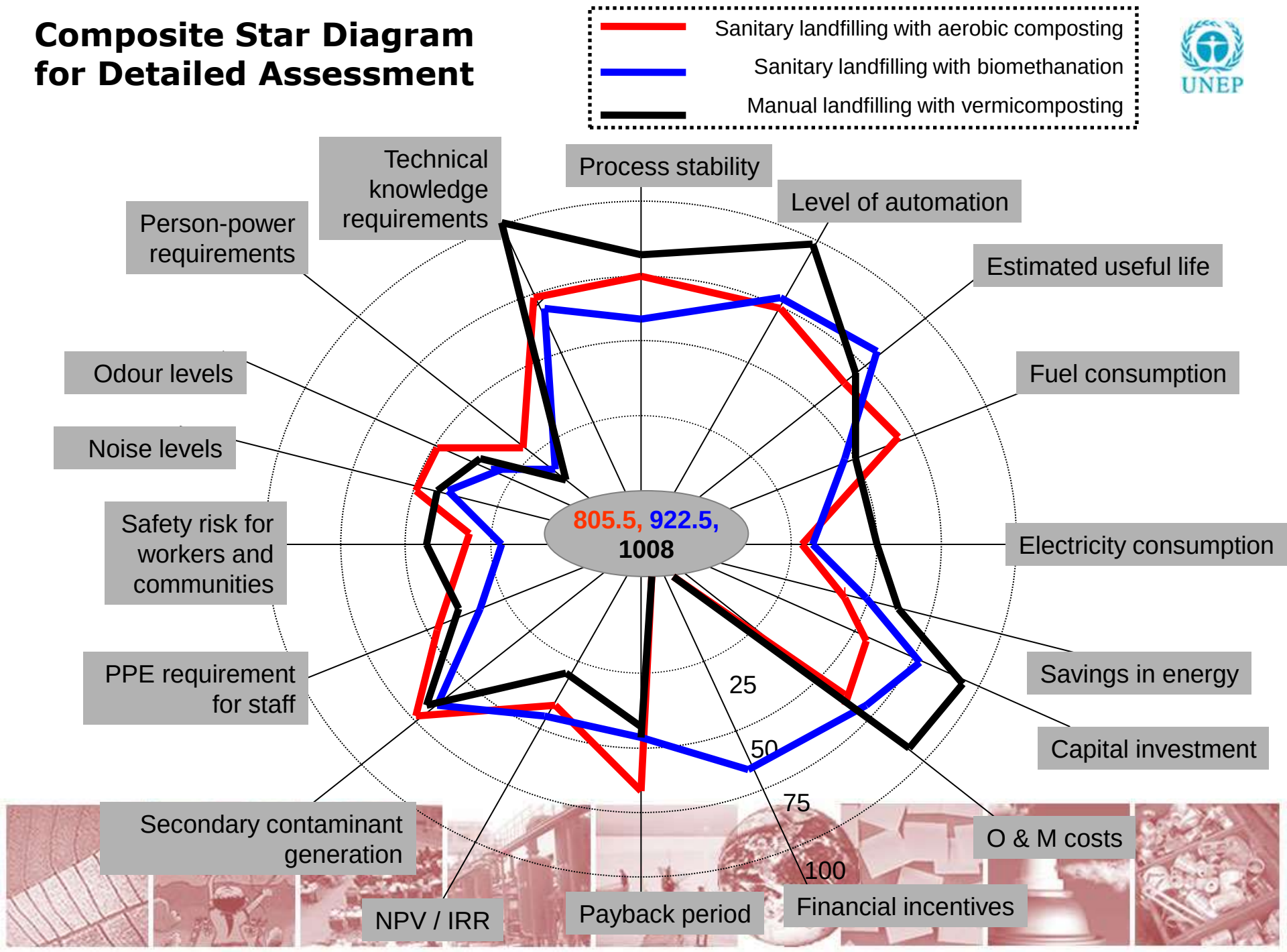
Star Diagram for Detailed Assessment of criteria pertaining to *Economic Aspects* only)



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



Composite Star Diagram for Detailed Assessment



Ranking of Technology Options

***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 – Operation Level

Anticipating Future Scenario

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

SAT Methodology

Preferred Technology Options

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 – Operation Level

Implementation and Monitoring

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

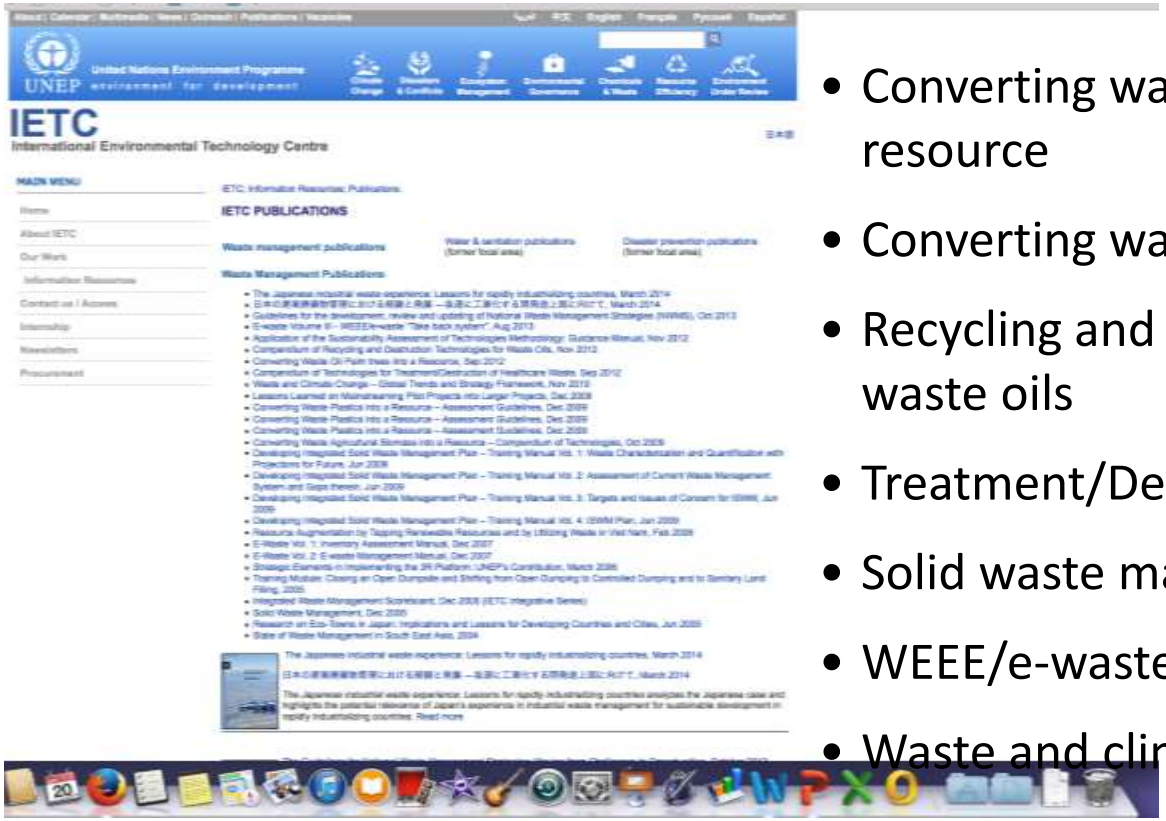
- Reporting the outcome of monitoring and evaluation to stakeholders, govt. agencies and decision makers acts as basis for situation analysis for future projects and helps in making informed decisions
- It helps refine and build the Methodology by

  - *Inclusion of additional criteria*
  - *Disqualification of technology in future for similar situations due to negative experiences*.

SAT Application Details

Tier 1 screening	***4 criteria total*** Compliance with local environmental laws or guidelines, compliance with national environmental laws, compliance with MEAs, meeting project objectives
Tier 2 Scoping	***5 components, 32 criteria total*** Technical suitability: 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 Environment – health & safety risks: risk levels for workers, communities, biodiversity… Environment – resources and emissions: resource usage, energy consumption, renewable energy, water consumption, resource augmentation capabilities… Economic/financial aspects: capital investments, O&M costs, benefits Sociocultural aspects: acceptability, extent of resettlement/rehabilitation, etc.
Tier 3 Detailed assessment	***3 components, 18 criteria total*** Environment – resources and emissions: land/space requirement, labor requirement, energy consumption,, emissions, etc. Economic-financial aspects: capital costs, O&M, benefits (nutrients and energy reclaimed, carbon credits, etc.), financial incentives Economic viability: NPV, payback period…

Compendium of technologies, guidelines, reports and publications



- Converting waste agricultural biomass to a resource
- Converting waste plastics into a resource
- Recycling and destruction technologies for waste oils
- Treatment/Destruction of healthcare waste
- Solid waste management
- WEEE/e-waste management
- Waste and climate change
- Wastewater reuse
- Water use efficiency – every drop counts

http://www.unep.org/ietc/InformationResources/Publications/tabid/56265/Default.aspx

Demonstration & Pilot Projects

Integrated Solid Waste Management

Wuxi New District, China – 2008

Pune City, India – 2008

Maseru City, Lesotho – 2009

Matale City, Sri Lanka – 2009

Novo Hamburgo, Brazil – 2009

Nairobi – 2010

Bahir Dar, Ethiopia – 2010

Pathum Thani, Thailand – 2011

Addis Ababa – 2011

Danang, Vietnam - 2012

Kampot, Cambodia - 2012

Bangkok – 2012 Honduras – 2013

Penang (Malaysia) and Ho Chi Minh (Vietnam) – 2014-15

Waste Agricultural Biomass, Waste Plastics & E-waste

Sri Lanka, Nepal, Pakistan & Malaysia – 2010-11

India, Cambodia and Costa Rica – 2012-13

Wastewater reuse, rainwater harvesting and organic waste recycling in sugar industry in Vietnam - 2007

Important Considerations for Technology Transfer

- Types of technologies

  Off the shelf technologies

  Prefabricated with minor installation

  Fabricate and install based on local requirements

  Franchise technologies

- Holistic approach - Installation, operation and maintenance (involving trade in spare parts, refurbishment, etc.)

- Local consideration – environmental vs. commercial technologies

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Thank You…