sanedi
South African National Energy Development Institute (SOC) Ltd.

Exploring waste to energy opportunities

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About SANEDI

The National Energy Act, No. 34 of 2008 established the South African National Energy Development Institute (SANEDI) by merging the South African National Energy Research Institute (SANERI), also a wholly owned subsidiary of CEF, and the National Energy Efficiency Agency (NEEA).

The National Energy Act, 2008 (Act No. 34 of 2008), Section 7 (2) provides for SANEDI to direct, monitor and conduct energy research and development as well as undertake measures to promote energy efficiency throughout the economy.

The overarching purpose of SANEDI is to assist the Department of Energy in fulfilling its energy mandate and transition towards a sustainable, low carbon energy future.

South Africa's Power Generation – A Snapshot

State-owned utility Eskom dominates generation:

- It generates 2/3 of Africa's electricity
- It generates 95% of SA's electricity
- It also imports and exports regionally e.g. from Cahora Bassa hydro project in Mozambique
- Current generation capacity approximately 40,000 MW
- >70% access to electricity, compared to SADC average of 20%
- Almost 90% of generation is coal, remainder nuclear and hydro/pumped storage
- Currently almost no renewable generation (changing)

South Africa's Generation Needs

- Economy is energy intensive – mining, pulp and paper, smelting
- Widespread load shedding occurred in 2007, 2008
- Reserve margins extremely tight in coming years and load shedding expected to return (it has in 2014)
- 10,000 MW of current 40,000 MW expected to be retired in next 20 years
- Eskom estimates that 50,000 MW of new generation capacity needed in next 20 years
- Private power and renewable power expected to play a significant role in new generation
- Rapid deployment of renewables essential to keeping the lights on

A case for Renewables

SA among highest emitters of carbon dioxide in the world:

- SA ranked 12th in the world in terms of top emitters

Urgent need:

- Reduce fossil fuel dependency
- Reduce carbon footprint
- Diversify energy mix and supply

Solution (no panacea)

- Renewable Energy (RE) – resources abundant, sustainable, can be quickly implemented, offer work opportunities and have a much lower impact on the environment

Renewable Energy Sources




Natural resources
Naturally replenished

Renewable Energy Resources

SA has a reasonable wind energy resource, geographically dispersed allowing for security of supply

SA has a world-class wave energy resource, predominantly along the south and west coasts

SA has one of the best solar regimes in the world - most abundant renewable resource in the country

SA biomass and hydro energy resources are limited

Waste is more readily available and exploitable.

In South Africa…

- 108 Mt total waste generated
- 98 Mt waste landfilled
- 10% approximate percentage of total waste that is recycled

(Source: DEA, 2018)

Typical landfill site

Waste-to-energy (WTE) projects have been implemented with high success rates all over the world and could effectively be used to **improve energy security** in South Africa.

While the rest of the world rapidly deploys WTE plants, the emphases on this method of disposing waste has only been gaining momentum in South Africa in the last year.

The focus on WTE intensified with the new **National Waste Management Strategy** that was approved for implementation in November 2011. The new strategy specifically stipulates that municipalities should invest and look out for **opportunities** to launch WTE projects.

Rationale

- Waste to Energy technologies offer most opportunity for job creation and local economic development in the semi-skilled and unskilled segment of our economy
- South Africa disposes almost all of its waste into landfills mostly owned by Municipalities, e.g.
  - Johannesburg 1.6 millions tons of waste disposal/year at 4 landfills. If no intervention-10 years landfill airspace available

- The Economic and Financial Calculations and Modelling for the Renewable Energy Strategy Formulation document (DME, 2004) identified 57 feasible landfill to energy sites ranging from micro (646 kW Capacity) up to Large (4000 kW Capacity) in South Africa that are estimated to produce 43 million m^3 of methane gas per year with an estimate potential of 598 GWh of electricity per year.

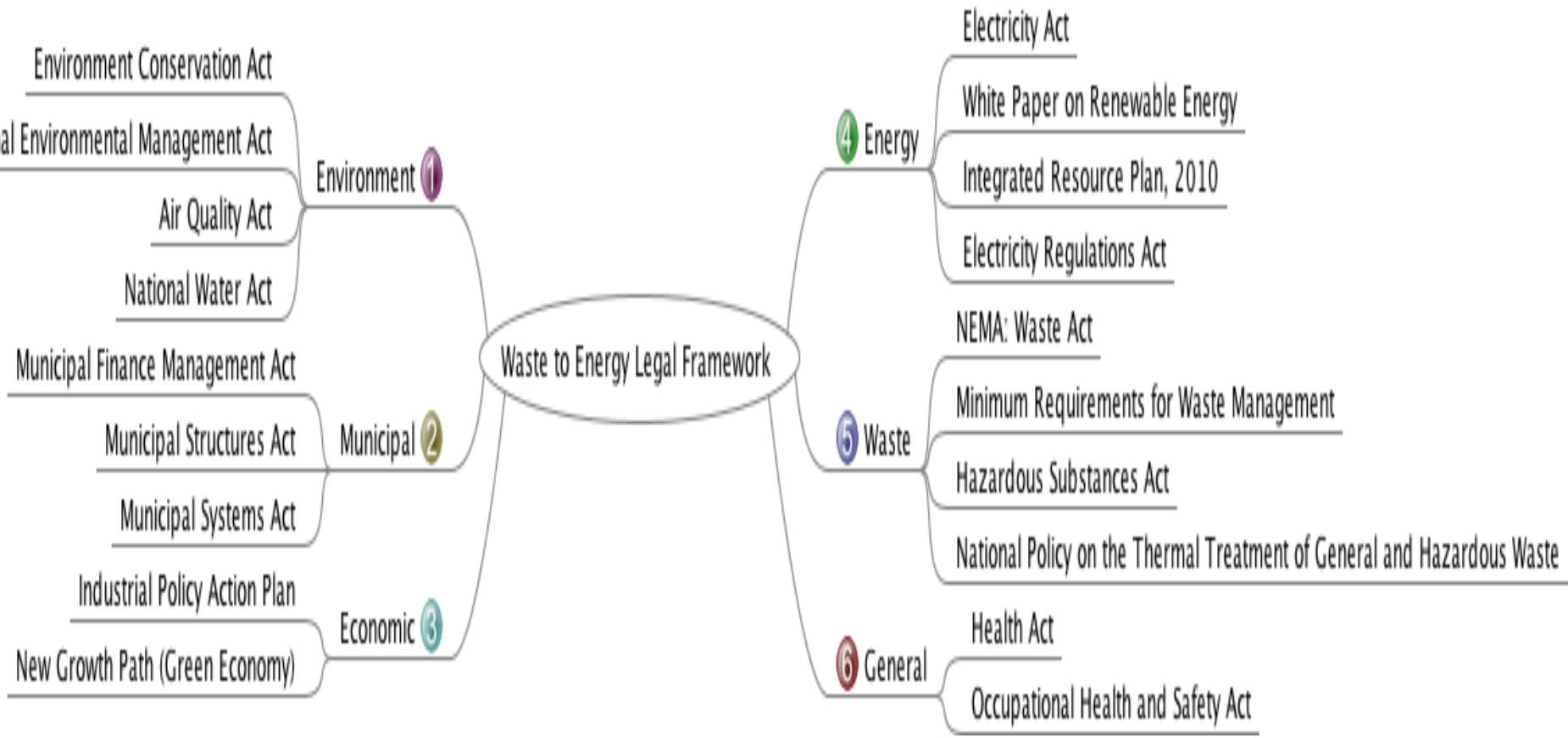
- *eThekwini Africa's 1st LFG, CDM project,* 7.5 MW Generation of Electricity, 216 000 MWh by July 2012, 20 000 Tons CO2 equivalent destroyed /month (www.dbnlandfillgas2elec.co.za)

But, because of limited WTE implementation experience in South Africa to date, **numerous questions remain** regarding an optimal, integrated, solution-driven mix of technologies with consideration of different waste streams, seasonal fluctuations, technology options, environmental impacts and the needs of a specific application or community, town or metro.

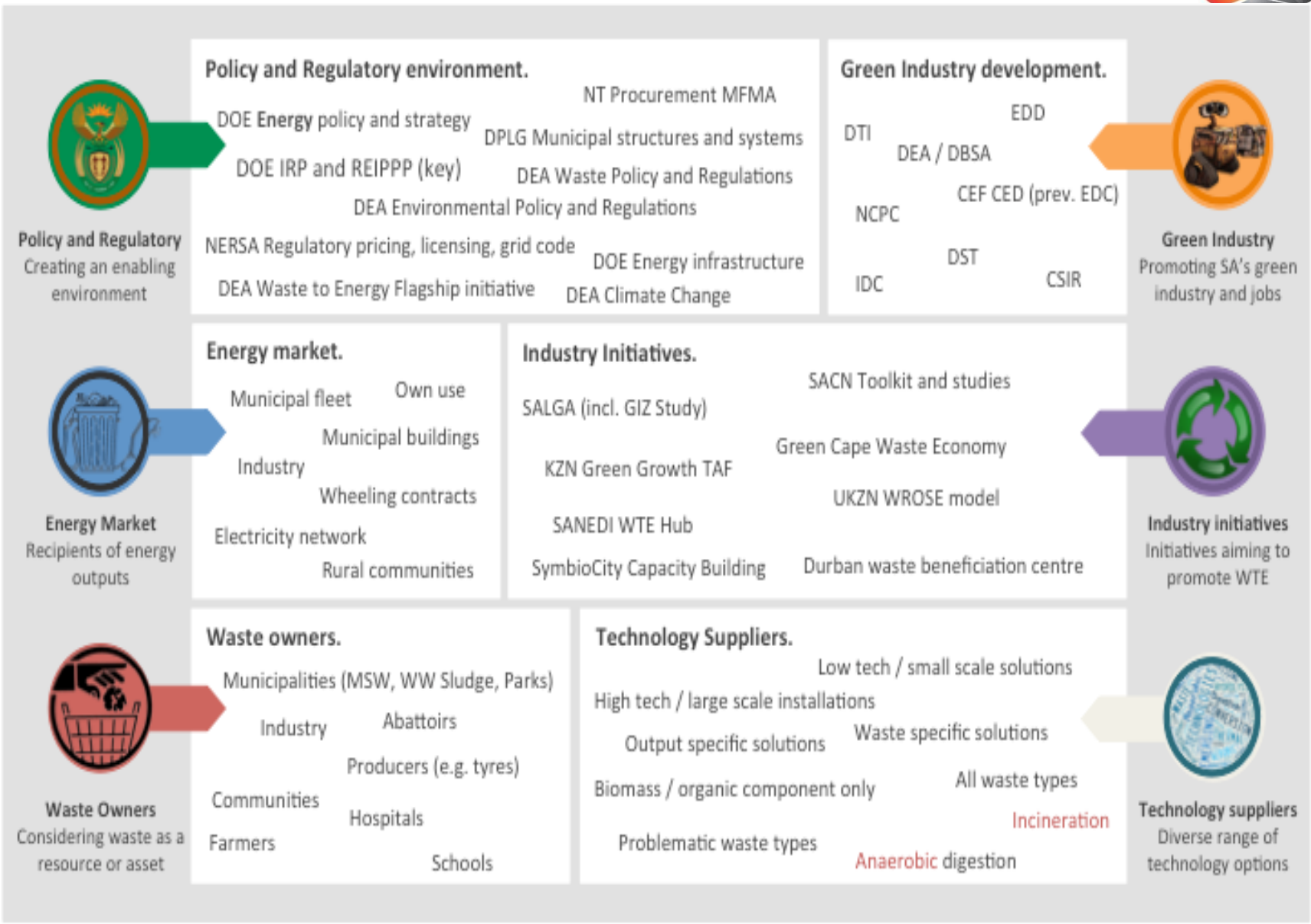
Our challenges

- Low tariff for landfill tipping.
- Difficult to find market for Heat produced or Tri-gen for additional revenue.
- Electricity prices in SA competing with cheap coal based power (changing!).
- Securing off take/market for electricity challenges due to PPA, access to grid/integration, etc.
- Challenges in dealing with Municipalities due to capacity, MFMA, MSA, etc.
- No clarity on green fuel taxes and other levies by NT.
- Lack of biogas standards, certifications, etc. (SABIA busy developing)
- No mandatory blending (about to change)
- Project Developers with limited resources, experience and own funding.

A high level overview of the legislative context for WTE in South Africa



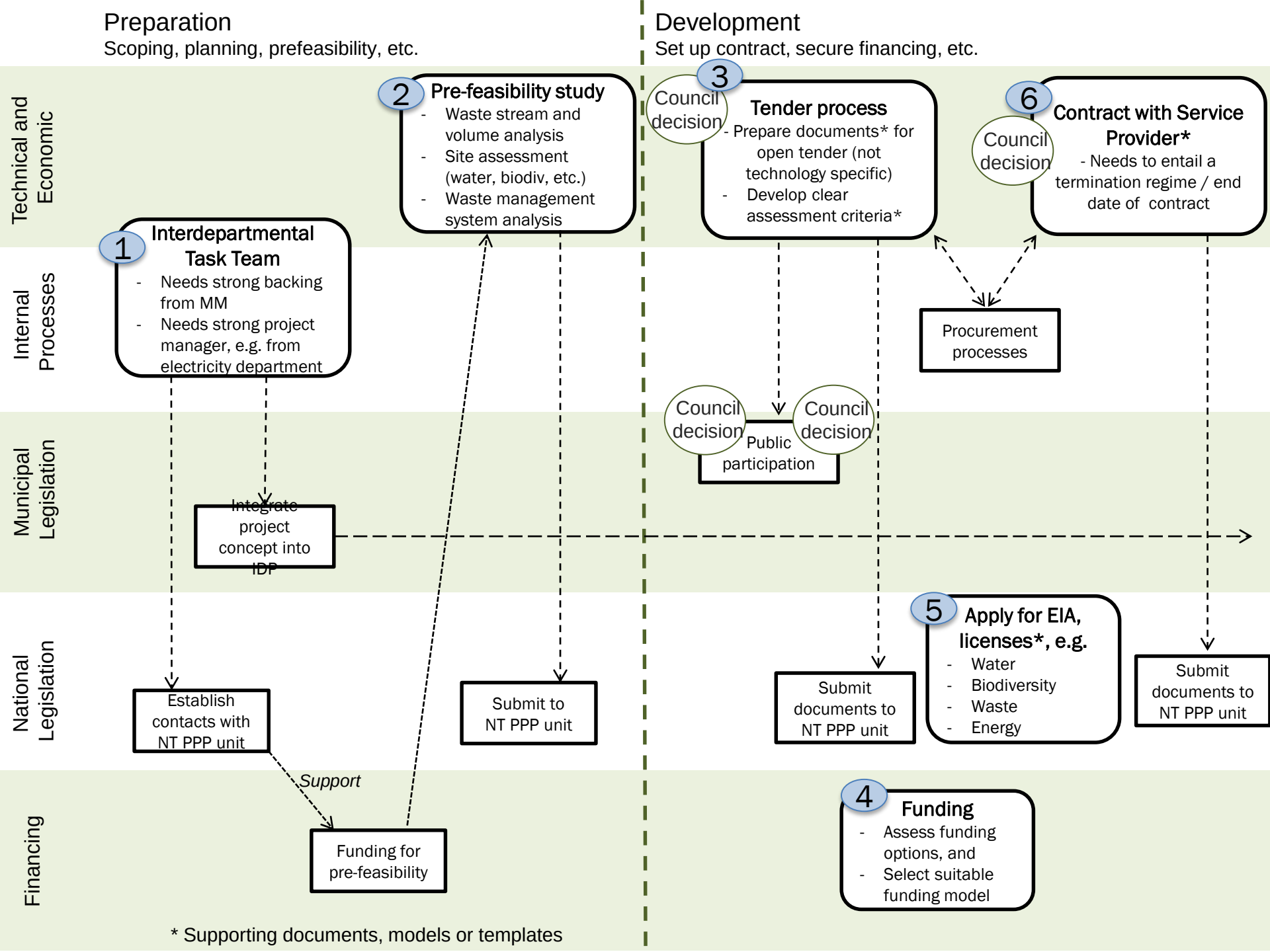
Stakeholders with interests in WTE



Scope of guideline

- Covering in detail the project preparation and development phases

- Providing checklists for
  - ❖ the stage before a decision has been made to initiate a waste to energy project (e.g. weigh bridge in place at landfill? MRF established?)
  - ❖ the stage of implementation, operation and maintenance (e.g. when and how to set up a monitoring plan)


Preparation
Scoping, planning, prefeasibility, etc.
Development
Set up contract, secure financing, etc.
Technical and Economic
Internal Processes
Municipal Legislation
National Legislation
Financing
1
Interdepartmental Task Team
- Needs strong backing from MM
- Needs strong project manager, e.g. from electricity department
2
Pre-feasibility study
- Waste stream and volume analysis
- Site assessment (water, biodiv, etc.)
- Waste management system analysis
3
Council decision
Tender process
- Prepare documents* for open tender (not technology specific)
- Develop clear assessment criteria*
6
Council decision
Contract with Service Provider*
- Needs to entail a termination regime / end date of contract
Procurement processes
Council decision
Council decision
Public participation
Integrate project concept into IDP
Establish contacts with NT PPP unit
Submit to NT PPP unit
Submit documents to NT PPP unit
5
Apply for EIA, licenses*, e.g.
- Water
- Biodiversity
- Waste
- Energy
Submit documents to NT PPP unit
Support
Funding for pre-feasibility
4
Funding
- Assess funding options, and
- Select suitable funding model
* Supporting documents, models or templates

BIOENERGY EXPLOITATION IN SA

A suite of bioenergy related initiatives

- Various household level bio-digesters erected in some rural & peri-urban parts of the country (applications – *cooking, heating, lighting*)
- Woody biomass modernisation (*charcoal, pellets*)
- Municipal solid waste-to-modern energy (*landfill gas-based power plants*)
- Fairly small-scale 1st generation biofuels
- 2nd generation biofuels research work
- Biomass co-firing with coal (*Biomass Co-firing Demonstration Facility at Arnot power plant*)
- Farm waste-energy (*biogas from pig waste*)
- Compressed biogas (application – *transport fuel*)
- Sugarcane bagasse (*process steam & electricity generation*)

REIPPP Megawatts to Date

	MW in window 1	MW in window 2	MW in window 3	MW remaining
Solar PV	632	417	435	1 041
Wind	634	563	787	1 336
Concentrated Solar Power	150	50	200	200
Small Hydro (less than 40MW)	0	14	0	121
Landfill Gas	0	0	18	7
Biomass	0	0	16	43
Biogas	0	0	0	60
TOTALS	1 416	1 044	1 456	2 808

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THANK YOU

ENERGY INNOVATION FOR LIFE