POLICIES & STRATEGY AND ECONOMICS FOR SPENT FUEL AND RADIOACTIVE WASTE MANAGEMENT

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PRESENTATION SCOPE

- The need for RWM P&S
- Policy development (prerequisites, typical elements, implementation)
- Strategy development (prerequisites, available options, development aspects, implementation)
- P&S updating
- Economics
- Examples of P&S contents (if time)

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THE NEED
FOR RWM POLICY & STRATEGY

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LESSONS FROM PAST EXPERIENCE

- Countries that first embarked on nuclear energy didn't have any radioactive waste policy or strategy.
- Normally, nuclear technologies were introduced and the waste issue was something to be solved later!

=> Consequences:

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LESSONS FROM PAST EXPERIENCE (2)

- Waste not properly characterized as it was generated
- No control over waste generation (waste tracking)
- Liquid waste accumulated
- Loss of control of sealed sources
- Waste stored on an ad hoc basis
- Waste processed without WAC
- Waste “stored” in unlined trenches
- Unlicensed disposal
- Unclear links among involved institutions
- Financial liabilities not defined

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REASONS FOR ESTABLISHING NATIONAL POLICY/STRATEGY

- Missing RWM system or need for improving the existing one
- Need to allocate responsibility for RWM
- Missing capabilities (facilities, staff)
- Planning
- Inadequate legislative system (nuclear, non-nuclear)
- Nuclear technology expansion

REASONS FOR ESTABLISHING NATIONAL POLICY/STRATEGY (2)

- Security and safety matters
- Need for assuring long-term sustainability of nuclear technologies
- Need for creating system for financing RWM
- Need for international harmonisation and cooperation
- Public perception of nuclear activities
- Others…?

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SOLUTION

- Every country should have some form of **POLICY** and **STRATEGY** for managing its radioactive waste and spent fuel
- Required/recommended in some IAEA publications, but the contents of a national policy and strategy are not well elaborated in these documents
- In some MSs national P&S well established, in others they exist but without explicit statement; in many developing MSs P&S do not exist
- Strategy flows directly from the policy. In particular, by defining the required end points, policy will control the possible strategy options

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DEFINITIONS – policy

Policy is a set of established goals or requirements; they normally define national rules and responsibilities and are established by the national government.

- Often codified in the national legislative system
- Provides principles, infrastructure and formal requirement for policy implementation through the development of appropriate strategies

DEFINITIONS – strategy

Strategy is the means (organizational, technical,) for achieving the goals and requirements set out in the national policy.

- Normally established by the relevant waste owner or operator
- A national policy may be elaborated in several different strategies
- The individual strategies may address different types of waste (e.g. reactor waste, decommissioning waste, institutional waste, etc.) or waste belonging to different owners.

The line separating policy from strategy is not sharp

=> **sometimes P/S mixtures exist**

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POLICY NEEDED

- As a basis for the preparation of related legislation;
- To define roles and responsibilities in RWM;
- As a starting point for the development of RWM strategies;
- As a starting point for further developments and modifications to the existing national practices;
- To provide for the safety and sustainability of RWM over generations;
- For the adequate allocation of financial and human resources over time; and
- To enhance public confidence in RWM

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STRATEGY NEEDED

- To specify how the national RWM policy will be implemented by the responsible organizations using the available technical measures and financial resources;
- To define how and when the identified goals and requirements will be achieved;
- To identify the competencies needed for achieving the goals and how they will be provided;
- To elaborate how to manage the various RW types; and
- To enhance public confidence in relation to the RWM.

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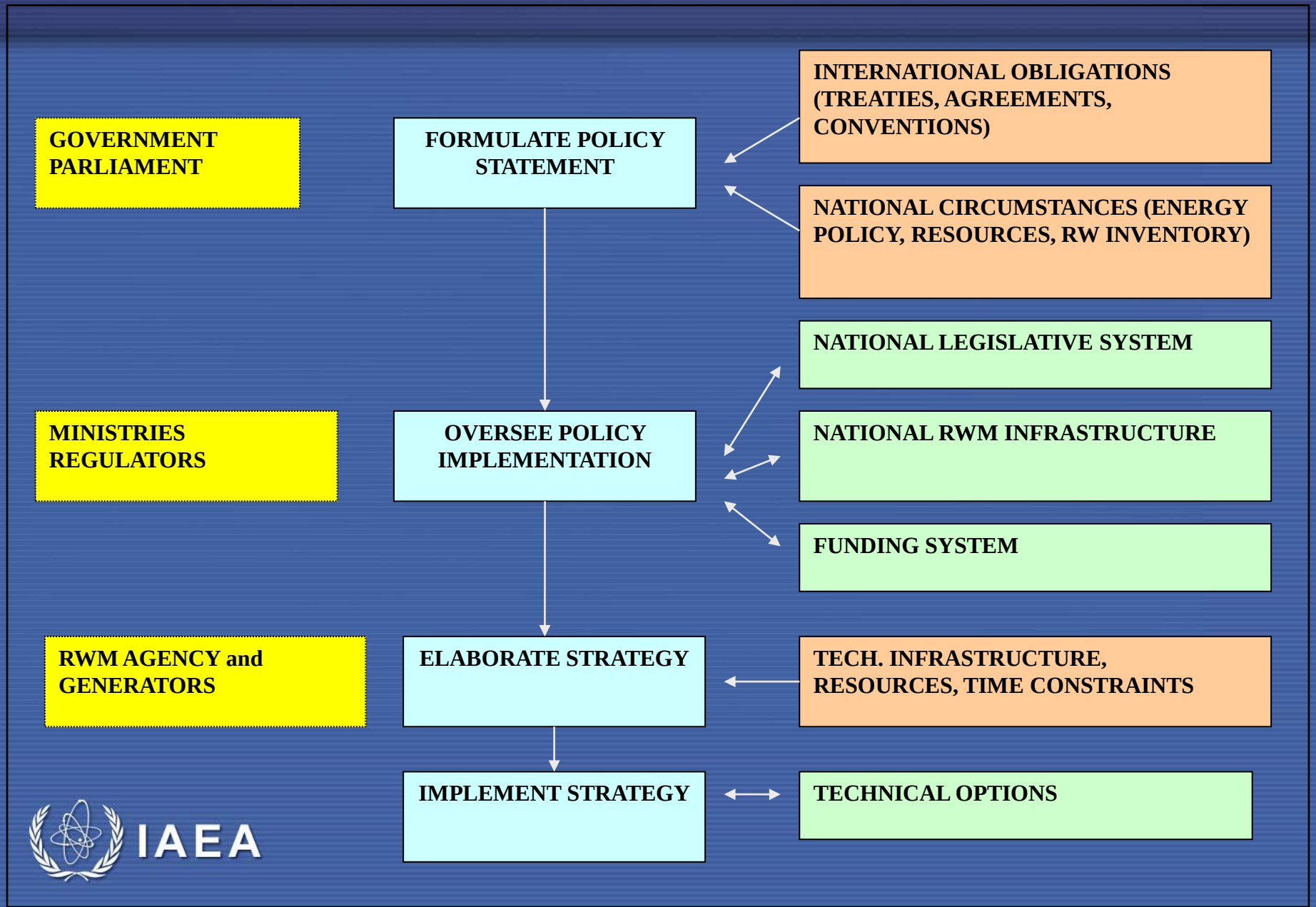
POLICY – STRATEGY LINKS



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POLICY DEVELOPMENT

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PREREQUISITES FOR POLICY

Knowledge of:

- *Present national legal framework*
- *Present institutional structure*
- *Applicable international conventions*
- *Present national policies and strategies*
- *Spent fuel and radioactive waste inventory*
- *Availability of resources*
- *Situation in other countries*
- *Stakeholder interests/involvement*

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TYPICAL POLICY ELEMENTS

- Allocation of responsibilities
- Provision of resources
- Safety and security objectives
- Waste minimization
- Export/import of radioactive waste
- Management of spent fuel
- Management of radioactive waste (incl. NORM and DSRS)
- Public information and participation

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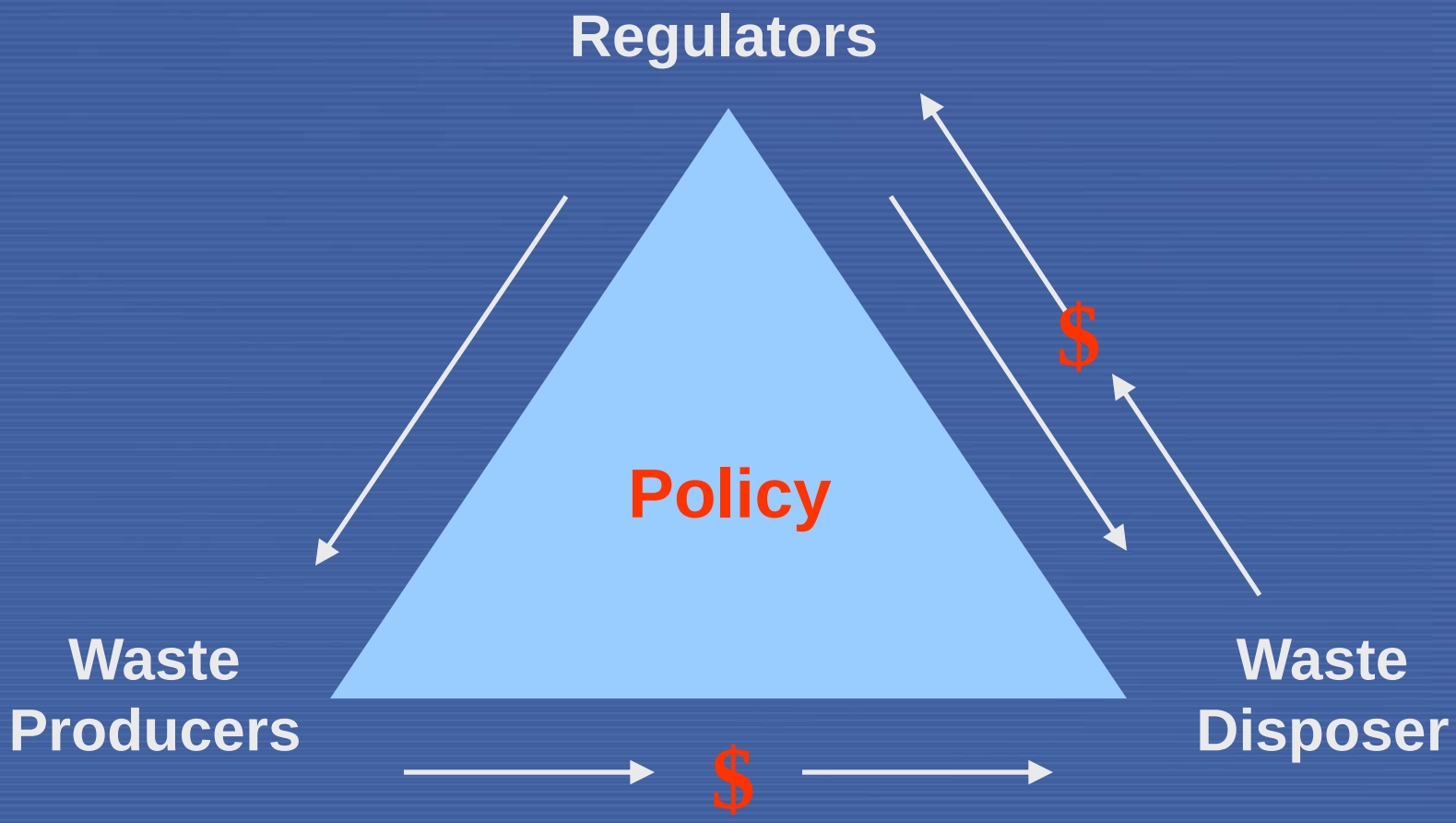
NATIONAL INFRASTRUCTURE – THE "CLASSICAL TRIANGLE"



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ESTABLISHMENT OF NATIONAL POLICY

- Long-term perspective
- Policy statement to represent the views of all organizations concerned in RWM
- Representative committee: regulator, RWM organization, generators, others involved…
- Draft policy statement to review/recommend by all relevant players
- Final approval by government to produce the official position of the government
- NOT SENSITIVE TO POLITICAL CHANGES

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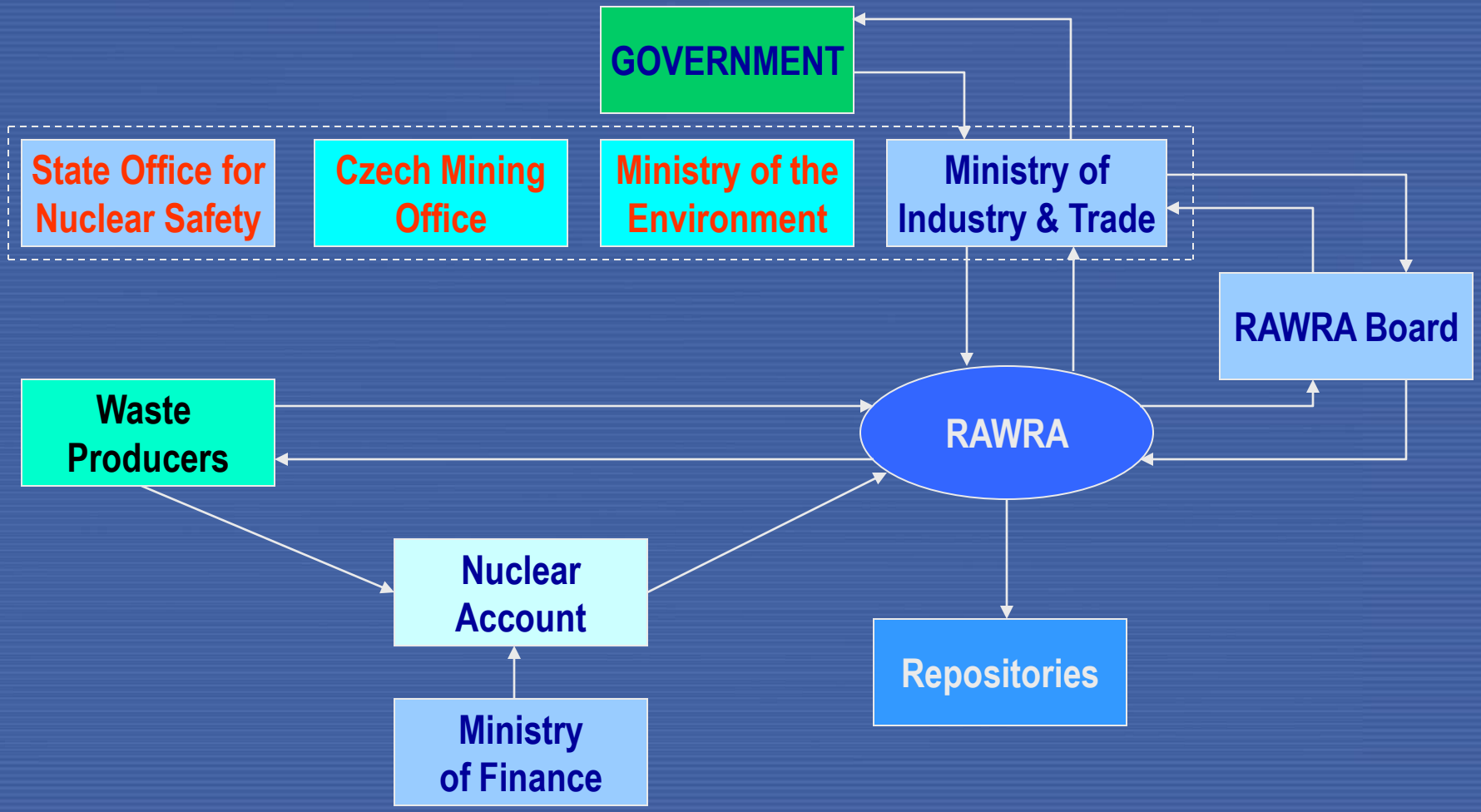
IMPLEMENTATION OF A NATIONAL POLICY

- Establish an adequate and appropriate RWM institutional framework
- Create a funding mechanism to provide adequate financial resources for the whole RWM lifecycle (to finance the necessary facilities, equipment and staff for RWM)
- Allocate the responsibility for strategy development
- Assure that the staff involved is competent (within the RWM infrastructure)

EXAMPLE OF RWM INFRASTRUCTURE - CR



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STRATEGY DEVELOPMENT

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PREREQUISITES FOR STRATEGY

- *Inventory of spent fuel and radioactive waste*
- *Waste classification system*
- *Waste stream characterization*
- *Existing waste management facilities*
- *Availability of resources*
- *Existing regulatory regime*
- *Waste management strategies in other countries*
- *Stakeholder expectations and interests*

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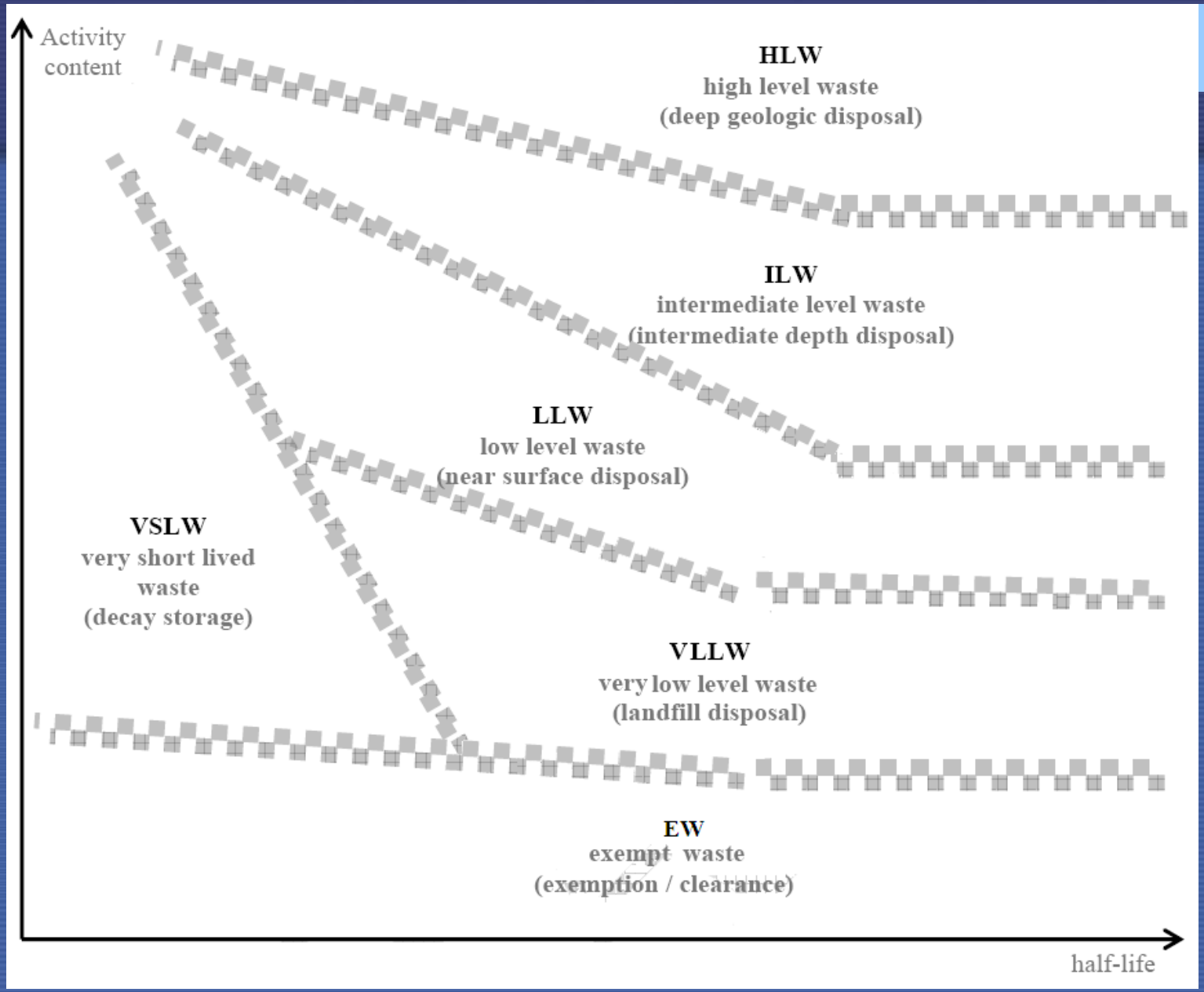
Activity content
HLW
high level waste
(deep geologic disposal)
ILW
intermediate level waste
(intermediate depth disposal)
LLW
low level waste
(near surface disposal)
VSLW
very short lived waste
(decay storage)
VLLW
very low level waste
(landfill disposal)
EW
exempt waste
(exemption / clearance)
half-life

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STRATEGY DEVELOPMENT

- Preferred approach:

  To concentrate the waste and to contain the radionuclides in waste matrix and container followed by disposal to provide isolation from the biosphere

- Strategy formulation based on End-point determination

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Allocation of waste types to disposal route

Waste type	Storage	Disposal
VLLW	Interim pending disposal	Authorized landfill
LLW	Interim pending disposal	Engineered near surface (ENS)
ILW-SL ILW-LL	Interim pending disposal	ENS or geological Geological
SNF / HLW	Cooling storage	Geological
DSRS-SL	Decay storage	Landfill
DSRS- LL	Interim pending disposal	Borehole
NORM	In situ disposal / long-term storage	

CONSIDERATIONS IN STRATEGY DEVELOPMENT

- Strategic approaches (recycling, immediate vs deferred disposal, multinational facilities)
- Compliance with policy
- Graded approach
- Resources (financial, human, technical)
- Generic technical options (shared, centralised, mobile facilities)
- Country specifics (population, climate, neighbours)
- Constraints on strategy selection (non- and nuclear)
- Public sensitivity
- Uncertainties

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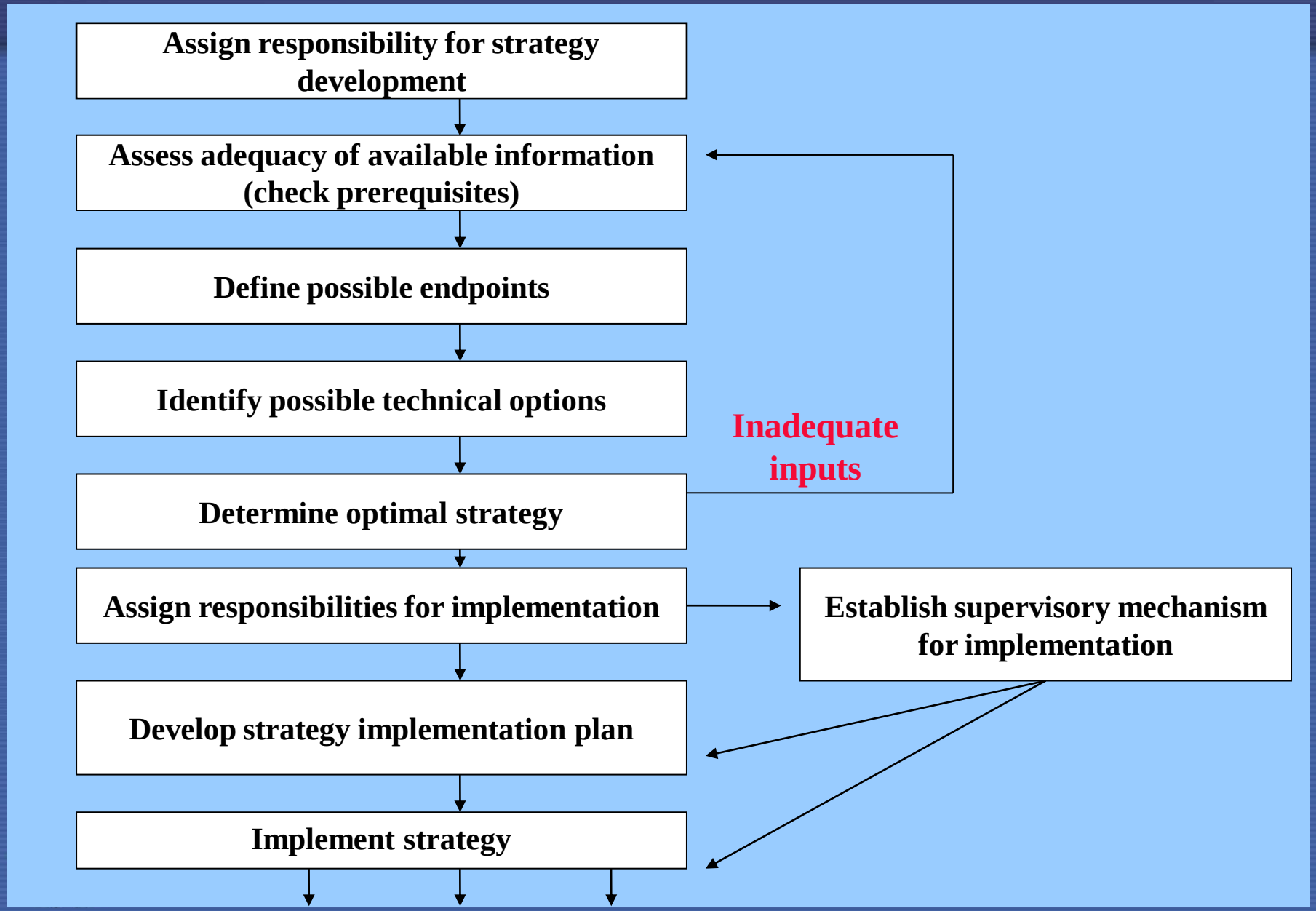
STRATEGY FORMULATION/IMPLEMENTATION



UPDATING POLICY AND STRATEGY

- Experience obtained
- New national circumstances
- New international agreements
- Policy updating (government)
- Strategy updating (operator)

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ECONOMICS

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“Polluter pays” principle (Wikipedia)

The Polluter pays principle is also known as **extended producer responsibility** (EPR). This is a concept that was probably first described by Thomas Lindhqvist for the Swedish government in 1990.

EPR seeks to shift the responsibility of dealing with waste from governments (and thus, taxpayers and society at large) to the entities producing it.

In effect, EPR internalises the cost of waste disposal into the cost of the product, theoretically meaning that the producers will improve the waste profile of their products, thus decreasing waste and increasing possibilities for reuse and recycling.

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Who is the polluter here?

- Disused sealed source previously used for tank level monitoring in an ore processing plant
- Disused sealed source previously used for diagnostic X-rays in a hospital
- Research reactor
- Nuclear power plant

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Follow the money!

Source of waste	How is the money generated?
Disused sealed source previously used for tank level monitoring in an ore processing plant	Embedded in the cost of the product
Disused [illegible] used for [illegible] hospital	[illegible]
Research reactor	State funds/ contractual arrangements
Nuclear power plant	Embedded in the cost of electricity – electricity surcharge passed to decommissioning & RWM fund

Caution! Large sums of money have a habit of disappearing

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P&S EXAMPLES

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Policy Document contents list

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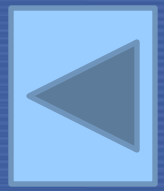
Policy Introduction

- Preamble
  - Whereas … and recognizing …[sets the context]
- Purpose:
  - to achieve and maintain a high level of safety and security …;
  - to set out the aims and goals for RWM…;
  - to establish roles and responsibilities …;
  - to ensure provision of resources …;
  - to provide a framework for …strategy
- Scope
  - Consistency with law & international agreements
  - civilian radioactive waste including NORM



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Policy - Safety and security objectives

- Responsibility for radioactive waste management
- National security infrastructure
- Long term management of radioactive waste
  - Repatriation where possible
  - Otherwise storage followed by disposal
- Management of register of sources and national inventory of radioactive waste

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Policy - resources

- Current status
- Establishment of funding scheme
  - RA and WMO funded by State budget
  - Fee payable to WMO to hand over DSRS
- Educational provision
  - Government to supply

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Strategy Document contents list

S1 Introduction – purpose and scope of national strategy in terms of realization of policy objectives

S2 Strategy Elements

S3 Radioactive waste management infrastructure

S4 Implementing the strategy

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Strategy – purpose and scope

- The national policy for radioactive waste management defines the objectives that will ensure that management of radioactive waste, disused sealed radioactive sources and spent nuclear fuel in the Republic of X is performed to internationally-recognized standards of safety and security. The national strategy for radioactive waste management aims to describe the activities and allocate the responsibilities that will allow these objectives to be realized.

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Strategy Elements

S2.1 Register of sources and the national radioactive waste inventory

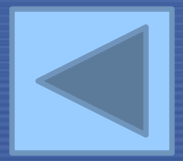
S2.2 Waste classification

S2.3 Waste characterization

S2.4 Disused sealed radioactive sources

S2.5 Other radioactive wastes

S2.6 Orphan sources



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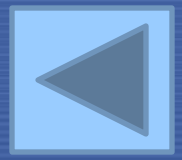
Infrastructure

S3.1 International standards

S3.2 Current status of institutional framework for radioactive waste management

S3.3 Requirements for short- to medium-term infrastructure development for strategy realization

S3.4 Long term requirements



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Implementing the strategy

S4.1 Allocation of responsibilities for strategy implementation

S4.2 Monitoring the implementation

S4.3 Strategy updating

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Action Plan

Activity	Responsibility for implem-entation	Responsibility for supervision	Time-scale	Success criteria
1) Review, revise and approve policy and strategy for RWM	Ministry	Minister	Jul 2017	P&S published
2) Technical education to meet the needs of RA and AEC and similar organizations				
a) Establish strategy for technical education	RA	Minister for regulation	Sep 2017	Publication of strategy
b) Implement strategy for technical education	University Faculty and TSO	DG AEC	Sep 2018	Qualifications agreed; courses in place
3) Nuclear Regulation				
a) Appoint Ministry responsible for nuclear regulation	Cabinet of Ministers	President	Jan 2017	Responsible ministry appointed Bill passed into law
b) Establish Regulatory Authority with the requisite resources, powers and responsibilities	Ministry for regulation	Cabinet of Ministers	Jan 2019	Independent RA established

TO SUMMARISE

- NATIONAL POLICY DEVELOPMENT IS A TWO STEP LOGICAL CONSENSUAL PROCEDURE – ITS IMPLEMENTATION NEEDS TIME AND MONEY
- STRATEGY(IES) DEVELOPMENT IS A TWO STEP TECHNICAL PROCEDURE – NEEDS TIME AND MONEY
- THOROUGH REVIEW OF THE CURRENT SITUATION NEEDED PRIOR TO P&T FORMULATION (weak points, future needs, available capacities, obligations)
- KEY ISSUES
  - ALLOCATION OF RESPONSIBILITIES
  - PROVISION OF RESOURCES
- NO SINGLE RECIPE – NATIONALLY SPECIFIC

- EVEN AN INADEQUATE POLICY IS BETTER THEN NOTHING

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Thank you for your attention