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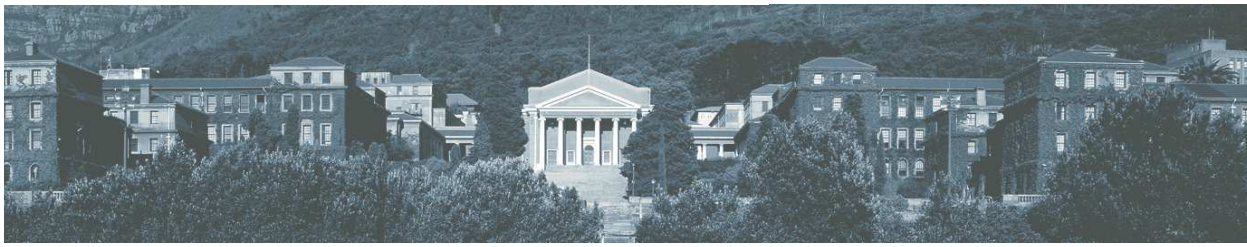

Draft policy framework for efficient water use in energy production

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March 2014

Key points

- South Africa faces imperatives to secure a supply of clean water and to protect water resources, and also to provide a secure supply of energy.
- It is important to use water resources efficiently in the energy production chain.
- Legal and policy instruments direct the management of water, energy and other sectors.
- Harmonisation of policies is required for effective management of the water-energy nexus.
- A policy framework is proposed to enhance harmonisation of policies linked to water and energy.
- This policy framework can assist in the development of new legal/policy instruments or review of existing instruments.

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1. Introduction

1.1 Context

1.1.1 General

South Africa faces imperatives to secure a supply of clean water and to protect water resources, as well as to provide a secure supply of energy. Over and above the mandates of ensuring clean water provision and of improving the coverage and security of a reliable energy supply, the government faces challenges of reducing poverty and unemployment, and of ensuring sustainable development. In order to meet these challenges, the national government has developed a set of progressive policies. Harmonisation of these policies is itself a considerable challenge.

In the mutually dependent relationship between energy and water (often referred to as the water-energy nexus), it is important that energy and water policy does not only cover individual energy sources or technologies, but also takes cognisance of the interactions in water governance and energy management at the systemic level. This policy framework focuses on water requirements for energy production and considers water usage associated with various forms of energy. It looks at both renewable and non-renewable energy sources, but with a focus on the former. This includes the management and planning of energy demand, the water efficiencies associated with the selection of technologies to supply energy, and the factors – including incentives – that influence decision-makers with respect to future national energy needs.

The importance of water in energy supply is recognised in national plans to address energy needs. South Africa's Integrated Resource Plan (IRP 2010) quantifies anticipated water demand and lists water as one of the deciding criteria for energy plans, alongside cost and greenhouse gas emissions. However, the impacts on water over the lifecycle of energy production are not easily quantified. As a result, trade-offs, for example between economic sectors or between dry cooling and generation cost of electricity production, may not be adequately translated into the process of decision-making on the utilisation of water resources in energy supply.

Water is used for energy production in the abstraction, growth and preparation of some fuels as well as in some generating technologies. It is also consumed in the acquisition and processing of raw materials for plant infrastructure, in the making of the components, and the building of power-generating infrastructure. These materials can be imported from any location. However, the volume of water used will vary widely, not only with the technology, but also with the materials used and even the infrastructure design. This water consumption is not limited to any water catchment, water management area or local authority. It should be noted, however, that the energy production chain comprises stages which are fixed to locations. These stages are fuel acquisition, production and processing, and energy generation. A certain amount of water is withdrawn (W), consumed (C), recycled (R), and discharged (D) at any given stage of the energy production process (Figure 1-1). So energy production has impacts on water resources. For example, the quantity of water remaining in the reservoir (Q) decreases with increasing the amount of water withdrawn (W) and consumed (C). In addition, discharged water (D) may be polluted, thereby negatively affecting the environment. These processes reduce water availability for other uses.

The importance of efficient use of water resources to meet energy demands is emphasised in the National Water Resources Strategy. However, the impact of energy provision on water resources is not sufficiently articulated at a policy level. At the same time, while national energy plans recognise that the limited nature of water resources necessitates water use efficiency, it is not apparent that decisions to invest in potentially long-term interventions for energy supply adequately consider potential changes to water supply in the long term (for instance in the context of climate change).

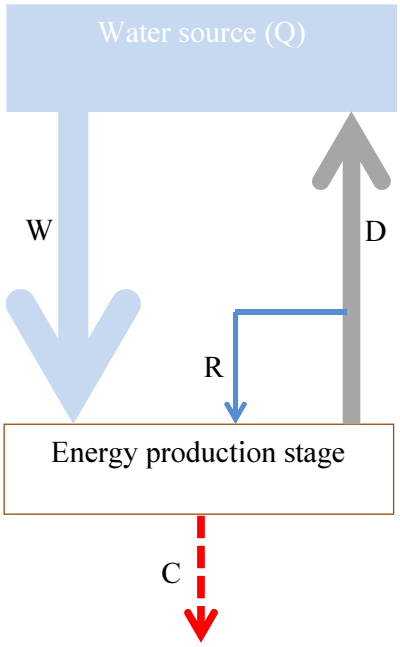

Figure 1-1: The water use in a given stage of the energy production process

1.1.2 Challenges and opportunities

a) Sustainability requirements

Coal is currently the main source of energy in South Africa, with most economic activities being driven by fossil fuels. Nevertheless, an economic growth is perceived to be unsustainable if it demands a lot of energy, generates significant pollutants, and negatively affects public health (Abdallah et al. 2013). This is a challenge because the country cannot continue to rely on coal without serious negative impacts on the society, environment and economy. On the other hand, renewable energy is perceived to be more friendly to the environment (low carbon emission) and secures energy for the present and future generations.

From a water perspective, fossil fuels withdraw a significant quantity of water over the life-cycle of energy production, especially for thermoelectric power plants operated with a wet-cooling system (Fthenakis & Kim 2010). However, South Africa is an arid, water-stressed country with water resources that are increasingly being placed under pressure. Reducing the water demand in the energy sector would therefore be deemed appropriate. In view of this, the use of dry cooling has been explored but it reduces the efficiency of the plant. The quality of water is also adversely affected in some stages of energy production from these fuels. For instance, acid mine drainage (AMD) in South Africa has been highlighted as a problem that can affect local environmental health through the contamination of aquifers, with coal mining being one of the major contributors to AMD (Botes et al. 2010). AMD has low pH and elevated concentrations

of heavy metals and other toxic elements. In contrast, some renewable energy technologies (such as solar photovoltaic and wind energy) have low demand for water and could thus be considered the viable options in terms of water withdrawal and consumption. Moreover, the observed water usage in solar photovoltaic and wind energy technologies is predominantly upstream in the construction of the plant. Consequently, the development of the renewable energy sector can provide an opportunity for reduced and efficient use of water within the energy sector.

It should also be mentioned that renewable energy technologies have the potential to improve water services through solar water heating, small scale pumping and water purification and treatment in off-grid areas (Platonova and Leone 2012). There are also opportunities for tax exemptions through the UNFCCC's clean development mechanism (CDM), community benefits from access to energy via renewable energy projects, long term employment in renewable energy projects and other benefits (DTI, 2010). Renewable energy can contribute to climate change mitigation and adaptation (Ogola et al 2012). Nevertheless, challenges (eg. Financial, technical, policy and other barriers) exist that prevent renewable energy technological uptake (Pegels 2010).

b) Policy and planning

To ensure sustainable economic development, South Africa needs to include water scarcity in planning its energy strategy, across all energy generating types. However, the challenge lies also where energy generation facilities in South Africa are located. It is important to understand where energy generating facilities are located in relation to water-stressed catchments. For instance, the Northern Cape region has the best solar resource suitable for concentrated solar power generation (Pierce et al. 2013), and in the Karoo there is exploration for shale gas. Nevertheless, water is scarce in these regions.

Combining renewable energy and water systems can be appropriate in both urban and rural environments, for instance, with a series of strategies ensuring co-benefits such as reducing energy tariffs via solar water heating and, at the same time, enhancing water availability and reducing flooding risks via a diffused rainwater harvest system connected to the solar heaters in urban areas (King et al. 2011).

The future energy mix needs to engage more comprehensively with the current and future impacts of water scarcity around South Africa. To achieve this, it is necessary to scrutinize the use of water in energy production and the impact of different types of energy resources on water resources (Platonova & Leone 2012). A harmonised policy landscape can positively contribute to the efficient use of water in the energy sector. In this vein, the proposed draft framework aims to assist in tracing and addressing deficiencies of synergy among the relevant policies.

1.2 Vision

The vision of this policy framework is two-fold. The first is to enhance a harmonised energy and water policy implementation so that intensive energy-generating technologies are sited in areas that are not vulnerable to the associated impacts on water resources. The second is to focus the attention of energy planning decision-makers on the importance of equitable sharing of water resources. This framework promotes the vision of a secure energy supply at minimal cost, promoting sustainable growth of the economy and providing employment. Energy supply should entail minimal negative impacts on the society, economy and environment (including water, air and other resources).

1.3 Objective

The objective of this policy framework is to assist decision makers to engage with the implications of choices related to energy supply on water resilience in South Africa, in the context of climate change and the potential need for adaptation at a local scale.

2. Guiding principles

Laws, policies and strategies provide the guiding principles for this policy framework. The primary guiding principles for water policy in South Africa are equity, sustainability and the efficient use of resources. For the protection of water quality, two principles apply: that of taking a precautionary approach where there is uncertainty of the risk to the environment, and that of 'the polluter pays'. The management of water quality should be done in a holistic manner and should take society and the environment into account; decision-making processes that affect water resources must be transparent and with full disclosure (DWAF 2002).

The right of equitable access to sufficient water is enshrined in the Constitution of South Africa (Chapter 2, section 27(b)). This principle is echoed in the National Water Resources Strategy which states that access to water is a basic human need and that there should be equity in access to water services, water resources and benefits from water resource use through social, economic and environmental development and management.

This right applies to the human needs of current and future generations, and requires that water resource use be managed in an environmentally sustainable manner, from which social and economic benefits should be derived for all over the long term (National Water Resources Strategy 2012). This principle is reiterated in the National Planning Commission National Development Plan (NPCNDP), which provides for all people to have access to clean, potable water and for sufficient allocation of water for agriculture and industry, meanwhile recognising the trade-offs in the use of water. The efficient use of water resources is encouraged by the National Planning Commission which targets the reduction in water demand in urban areas to 15% below the business-as-usual scenario by 2030.

Principles guiding energy policy include the principles of supplying energy at least cost and that of 'use it and keep it'. With respect to the environment, guidance is provided by the polluter pays' principle and by the priciples under the National Environmental Management Act 107 of 1998 (Winkler 2006).

The main guiding principles for renewable energy development are of equity (inter and intra generational), and of consideration of all the social, economic and environmental costs. Renewable energy policy should be guided by responsibility for global and regional issues, allocate resposibility of function to be effective in pursuing its objectives, and encourage equitable participation by all stakeholders in energy governance (DME 2003).

3. Key elements and common issues

3.1 Policy alignment

A policy framework promotes the vertical alignment and the horizontal harmonisation of key government and political commitments such as the Millenium Development Goals, the National Development Plan, the Climate Change Response Policy, and the shift to the Green Economy, all of which must be considered within planning for energy supply and water resource management. 'Integrated Energy Planning is therefore not only about ensuring that South Africa's energy needs are met, but rather takes a broader approach in ensuring alignment between cross-sectoral impacts and the National Objectives – where applicable, Regional developments are also considered' (DoE 2013).

South Africa has long protected the integrity of its water sources, and its National Water Act (Act 36 of 1998) is considered highly progressive (Seward 2010). The strategic objectives of the Draft National Water Resource Strategy 2 (2012) (NWRS 2) are to be aligned to both the National Water Act and the National Development Plan. With respect to water resources, the NWRS 2 recognises that the energy sector is highly dependent upon reliable supplies of water; that there are water challenges associated with new power stations as well as the return to service of older power stations which are wet-cooled; and that there is a need to reduce the water demand of the energy sector.

The Integrated Resource Plan 2010-2030 (IRP) and the Integrated Energy Plan (IEP) proposals for a future energy mix speak about and model water-use of different energy-mixes. The White Paper on Energy of 1998, the White Paper on Renewable Energy of 2003 and the Energy Act of 2008 provide impetus for planning for sustainable renewable energy, taking water considerations into account.

However, though it appears that water is explicitly given consideration within future energy planning in the IRP and IEP, and the water impacts of the energy environment are given consideration within the NWRS 2, both of these are deficient in detail and have gaps, including accounting for water uses and impacts throughout the energy production cycle, and planning for this. For example, the electricity sector relies on the mining industry for coal, but the impact of coal mining on water resources (in terms of use and impacts) is not given enough consideration within the water planning environment.

In the context of the water energy nexus the importance of harmonising water and energy governance is highlighted by the Draft NWRS 2 which stipulates that the Department of Water Affairs (DWA) should work with the Department of Energy (DoE), Department of Public Enterprises (DPE) and Eskom 'to ensure integration of medium and long term planning for the development of energy and water resources'.

The importance of various institutions working together on water is highlighted by the Draft NWRS 2 which mandates the DWA and the Water Research Commission (WRC) to collaborate with appropriate sectors to revise documents pertaining to the use of water by high water-consuming sectors. It highlights concerns related to the effect of energy supply and mining sectors on water resources.

An obstacle in harmonised governance of water resources and energy supply is that the relevant resources are managed at different levels of authority and appear to be working in silos. Under South Africa's water management strategy, as defined under the National Water Resources Strategy, the country is divided into nine water management

areas (WMAs). These WMAs encompass catchments or part thereof. At the more local level, each local authority regulates the abstraction and use of water within its boundaries. At the national scale, large-scale water abstraction and use (e.g. mining) is nationally regulated and licensed by the Department of Water Affairs.

Responsibility for energy planning and permitting rests with national government, which is pursuing its plan for electrification to supply 95% of the population with electricity by 2030, with non-grid options available for the rest (NPCNDP 2011). Alongside this commitment, in line with the provisions of the Constitution, each household has the right to 50kWh of free electricity, and 6000 litres of free water, per month. These commitments indicate the need for additional energy (electricity) capacity for new connections and the retiring fleet. The National Development Plan estimates that to meet these commitments about 20 000 MW (of 40 000 MW required new build) should come from renewable energy technologies, and that five million solar water heaters should be installed by 2030 (NPCNDP)

Further work to align energy development and water allocation is however needed, and the National Water Policy Review by the DWA states that 'a close look at the water energy nexus is critical for South Africa's sustainable development path', and that'' the 'current policy and legislative provisions on trading of authorised water use do not facilitate the achieving of one of the fundamental principles of the Act, namely equity in allocation' (DWA 2013). It is deemed important that the water and energy policies should take cognisance of one another, or at the very least, not be in conflict with one another.

3.2 Energy and water in the context of climate change

To meet the foreseen energy needs of South Africa in the context of a changing climate, the DoE developed an Integrated Resource Plan. The national strategy of the IRP (DoE 2010) is to meet the growing electricity demand, but at the same time also honouring South Africa's commitment to a greenhouse gas emission reduction of 34% below business as usual by 2030. The National Development Plan stipulates a peak, plateau and decline trajectory for greenhouse gas emissions, with the peak being reached around 2025 and that by 2030, an economy-wide carbon price should be entrenched and that the country enforces zero emissions building standards by 2030 (NPC NDP). In light of the proposed carbon tax, the carbon intensity of energy sources is an important consideration. It is likely that climate change is expected to put added strain on water provision. This, along with the drive to provide energy for all, will result in an increased demand for water if the current means of energy production are continued.

3.3 Prospects for change in the water-energy policy nexus

Water supply is mostly fixed by nature, whereas energy supply is by design. It is therefore important to assess the demands that might be placed on the country's water resources in the context of changing energy requirements and water availability. This can inform strategic investment in future energy supply. Electricity production is considered to be a high-value economic use of water, and electricity producers are considered to be 'priority users', hence this allocation of water takes precedence over most other activities. The DWA has recommended dry-cooling technology at new power plants but it has not recommended a transition to relatively 'water free' renewable energies.

The IRP was developed to meet foreseen energy needs. A part of this strategy is the need to diversify the energy from reliance on coal-fired electricity to an energy mix in which a third is generated from renewable sources. To meet this goal, incentives are being offered for investment in renewable energy technologies under the Renewable Energy Independent Power Procurement Programme (REIPPP).

4. Structure of the proposed policy framework

4.1 Legislation

4.1.1 Constitution of the Republic of South Africa (1996)

The Constitution is the overarching document which guides all the other legislative and policy instruments adopted by the government. Section 27(b) of Chapter 2 states that everybody has the right of access to sufficient water (RSA, 1996). The state is obliged to take reasonable legislative and other measures, within its capacity, to attain the realisation of this right. It is therefore necessary that all sector laws and policies should be properly aligned with the constitution for synergy.

4.1.2 National Water Act 36 of 1998

The National Water Act provides the legal framework for the effective and sustainable management of South Africa's water resources (RSA, 1998a). The Act aims to protect, use, develop, conserve, manage and control water resources as a whole. It further promotes the integrated management of water resources with the participation of all stakeholders. The priority is to provide water resources of sufficient quantity and quality to meet the requirements of the reserve (meeting a range of priorities) before water can be allocated in water management areas. These priorities include:

a) Water to meet international rights and obligations.

b) Water use of strategic importance – water use that is considered to be of critical national importance. The energy sector is the only strategic user at present and is given priority water allocation over any other economic water users in a water catchment.

c) Inter-catchment water transfers.

d) A contingency to meet projected future water needs.

Chapter 4 of this Act provides for use of water by various stakeholders (includes the energy sector). It covers general principles of water use, and issues of authorisation, licensing, lawful water uses, stream flow reduction activities, controlled activities and contravention of authorisations.

4.1.3 National Energy Act 34 of 2008

The National Energy Act 34 of 2008 empowers the Minister to undertake certain measures to ensure energy security including integrated energy planning, energy research and collection of information regarding energy generation, supply and demand. This regulatory instrument obliges the Minister of Energy to develop and publish an Integrated Energy Plan. The IRP for electricity needs to be linked to the outlook for energy because electricity forms a sub-sector of the energy sector. The Minister derives the power to determine and publish the IRP from the Electricity Regulations on New

Generation Capacity of 2009, which in turn are promulgated in terms of the Electricity Regulation Act of 2006.

4.1.4 National Energy Regulation Act 40 of 2004

The National Energy Regulator Act 40 of 2004 (RSA 2004) establishes the National Energy Regulator, now commonly referred to as the National Energy Regulator of South Africa. Its duty it is to regulate the piped-gas, petroleum and electricity industries of South Africa.

4.1.5 National Environmental Management Act 107 of 1998

The National Environmental Management Act 107 of 1998 provides a legal framework for 'integrating good environmental management into all development activities' (RSA, 1998b). Part 1 of Chapter 7 of this Act provides for the prevention of environmental pollution or degradation. This encompasses the pollution of water resources by various stakeholders, including the energy sector.

4.2 Strategies

4.2.1 Draft National Water Resource Strategy 2 (2012)

This Strategy takes on board a range of options for balancing the supply and demand of water (including conservation and demand management, and desalination of sea water). These options have implications for energy demand. It notes the impact of future technology on water resources. Challenges related to how to achieve equity and redistribution, ensuring water security for the future and water availability for economic growth and development are dealt with in this Strategy.

The Strategy notes that:

a) Current plans should include building dry-cooled coal-fired power stations (Medupi and Kusile) that will be more water efficient. 'These power stations are located in water-scarce areas, and would strain available water resources', and 'the return to service of older power stations, which are wet-cooled, has further burdened available water resources'.

b) As the availability of fresh water sources becomes fully utilised, the energy sector shifted to the implementation of dry cooling technologies but the need for improved air emission control has increased water requirements.

c) The energy sector is continuously improving the efficient use of water, specifically in the handling and management of ash and waste.

d) There are some challenges in implementing water allocations and water use authorisations that entrench water conservation and water demand management in the mining, energy and manufacturing sectors. The sectors are not homogenous and universal. So, water use efficiency targets cannot be set generically across the board.

e) 'Hydropower is one of the renewable sources for generating electricity referred to in the Integrated Resource Plan 2010 (IRP 2010) for developing South Africa's electricity generation to meet expected energy demands up to 2030. Development of renewable energy sources, rather than burning fossil fuels such as coal, will contribute to the reduction of carbon emissions, while also ensuring sufficient energy to support growth in the economy.' Recognising the potential

for small-scale hydro-electric plants, the Strategy states that this is being considered by the DWA, the Department of Environment Affairs, National Treasury, Eskom, the Central Energy Fund and private sector partners. 'DWA will work with the Department of Energy, Department of Public Enterprise and Eskom to ensure integration of medium and long term planning for the development of the energy and water resources. Particular attention will be paid to the potential for desalination of seawater for supplying coastal towns and cities where there are sufficient sources of electricity to support this.' (NWRS 2 2013).

f) 'The energy sector, although only using 2% of water, contributes about 15% to the Gross Domestic Product (GDP) of South Africa and creates jobs for 250000 (GCIS 2011). It generates about 95% of the electricity in South Africa and also exports it to countries in Africa. The energy sector, including Eskom, the national power generator, is highly dependent on reliable supplies of water for the generation of electricity (steam generation and cooling processes), and an elaborate and sophisticated network of water transfer and storage schemes have been developed specifically to support this sector and ensure high levels of reliability. The water sector is on the other hand highly dependent on a constant and reliable supply of electricity to 'move water' (NWRS 2 2013).

4.2.2 Energy Efficiency Strategy

The Energy Efficiency Strategy is mandated by the White Paper on Energy Policy (DME 2005). This Strategy links the energy sector with other government initiatives, and recognises the potential for improvements in energy efficiency across all economic sectors. It should be noted that the water sector is also an energy user. Energy is used in water abstraction, treatment and conveyance. Thus, implementation of energy efficiency in this sector can contribute to environmental, social and economic sustainability.

4.3 Policies

4.3.1 White Paper on a National Water Policy for South Africa

The White Paper on a National Water Policy for South Africa (1997) is aimed at guiding the management of water in the country. Its objectives are equity in access to water services, water resources and benefits from water resource use (DWAF, 1997). The policy highlights the need to focus on efficiency, effectiveness and demand-side management in water utilisation in order to promote water conservation. The policy also covers elements of protecting water resources.

A recent review of water-related policies was conducted (DWA 2013). The review identified unintended oversight and gaps in the present water policies. It outlines critical elements of equitable use of water as follows:

a) Provision of adequate supply of safe water to all households to meet their domestic and productive requirements (minimum of 25 litres per person per day provided free of charge to all indigent households).

b) Making sure that the authorisation to use water for productive purposes is aligned with the demographic realities of South Africa and serves to support black economic empowerment.

c) Allocation and use of water supports the reduction of poverty and inequality across the country.

d) Indirect benefits of water from healthy river systems are protected and maintained.

In addition, the review document identifies the need to carry out a comprehensive review of the White Paper on Water Supply and Sanitation (1994), White Paper on a National Water Policy for South Africa (1997), White Paper on Basic Household Sanitation (2001) and the Strategic Framework for Water Services (2003) in order to address the observed policy gaps.

4.3.2 White Paper on the Energy Policy of South Africa (1998)

The White Paper prescribes energy policy and formulation that promotes sustainable development by highlighting equity and the sustainable use of natural resources. The policy encouraged the introduction of a Renewable Energy Feed-in Tariff. The objectives of this policy are: a) increasing access to affordable energy services; b) improving energy governance; c) stimulating economic development; d) managing energy-related environmental impacts; and e) securing supply through diversity.

4.3.3 White Paper on Renewable Energy (2003)

This policy promotes sustainable development as a key element in the national renewable energy policy. It is the most comprehensive policy document pertaining to the government's vision on renewable energy. It informs institutions of roles, encourages the use of renewable energy technologies and stimulates market investment in renewable energy technology through the REIPPP. There is a 10-year plan to facilitate the production of 10 000 GWh of energy from renewable energy sources by December 2013 (approximately 4% of projected demand or 1 667 W of projected energy demand for 2013 of 41 539 MW) (mainly from biomass, wind, solar and small-scale hydroelectricity).

4.3.4 National Climate Change Response Policy

The National Climate Change Response Policy (NCCRP) (2011) focuses on mitigation through the reduction of energy generation and use sector emissions. The NCCRP notes that reduced emissions should come from greater energy efficiency, demand management and moving to a less emission-intensive energy mix. It notes several flagship initiatives including the Renewable Energy Flagship Programme, the Energy Efficiency and Energy Demand Management (EEDSM) Flagship Programme and the Carbon Capture and Sequestration Flagship Programme, and the Water Conservation and Demand Management (WCWDM) Programme (to be implemented in the mining, industrial, electricity, agriculture and water service sectors). As part of the EEDSM Programme, government has begun to implement a solar water heating programme primarily aimed at households. For businesses, an energy efficiency savings tax incentive is being proposed; for verifiable energy efficiency savings businesses will be able to make a deduction against taxable income (DNT 2013).

4.4 Plans

4.4.1 Integrated Resource Plan (2010)

The IRP document shows government intent to diversify energy supply. The plan for energy supply includes 3349 MW of imported hydroelectric power. The draft IRP target

for 2013 is 6 000 GW for renewables. It encourages co-generation (capacity 343 MW in 2010, 518 MW in 2011, 284 MW in 2012, 300 MW in 2013). The objective of the IRP 2010-2030 is to develop a sustainable electricity investment strategy for generation capacity and supporting infrastructure for South Africa over the next 20 years. The plan also accounts for implications arising from demand-side management and pricing, as well as capacity provided by all generators (Eskom and independent power producers). Specifically, water is recognised as a key constraint and risk in the IRP, and all the scenarios considered deal with the issue of water use in the context of scarce water resources. Clearly, efficient use of water in the energy sector can contribute to sustainable socio-economic development.

4.4.2 Integrated Energy Plan

The development of a National IEP was envisaged in the White Paper on Energy Policy of 1998 and, in terms of the National Energy Act of 2008. The purpose of the IEP is to provide a roadmap of the future energy landscape for South Africa which guides future energy infrastructure investments and policy development, and should have a planning horizon of no less than 20 years. The development of the IEP is meant to be a continuous process as it needs to be reviewed periodically to take into account changes in the macro-economic environment, developments in new technologies, and changes in national priorities and imperatives, amongst other factors.

This document lays out a plan to meet current and future energy demands, taking into account the need for job creation and minimising the impact on the environment. It presents models for water use under different energy scenarios going forward. Future scenarios up to 2050, with emissions limits, are covered (DoE 2013). It shows emissions and water use from different scenarios from the energy mix in the future.

At an inter-governmental level, stakeholder engagement is ensured by the IEP Steering Committee, which is an inter-departmental government committee led by the DoE and consisting of the following departments: Science and Technology; Environmental Affairs; Water Affairs; National Treasury; Economic Development; Trade and Industry; Human Settlements; Transport; Rural Development and Land Reform; Mineral Resources and the National Planning Commission. One of the objectives of the Draft IEPR 2012 is to promote the conservation of water (DoE 2013).

4.4.3 National Development Plan

In 2009 South Africa established a National Planning Commission (NPC), tasked with developing the National Development Plan (NDP), a long-term development vision for the country. It is important to note that the NPC does not have direct authority over government departments, although the NDP is being taken as a guiding document for implementation by all the departments (NPC 2011). The NPD has been adopted by both Cabinet and Parliament. It extensively deals with water and energy issues. On the subject of energy, it refers to the need for improved energy efficiency, including in transport, and an increased use of renewable energy. At the level of Cabinet, several clusters operate, focusing on particular aspects of decision-making. For instance, there is a Ministerial cluster for a specific issue, with clusters on infrastructure, economic, a social, and other issues. These clusters are mirrored at the level of Director-General. The purpose of these clusters is to ensure coordinated decision-making on critical programmes and projects among Ministers and departments.

4.4.4 Water for Growth and Development Framework

This framework provides the foundation, and creates the necessary pointers, for the development of the National Water Resources Strategy. It recognises that there is a close working relationship with the large water users in the energy sector to make sure that current and future power plants are included in the water resource planning initiatives (DWAF 2009). It is reported that 2% of the available water is allocated to the power generation sector. The document also notes that Eskom is embarking on a number of initiatives to reduce water usage, including the development of dry-cooled power plants. However, it is pointed out that this variety of power plants is less efficient and more costly to operate.

4.4.5 Department of Energy Strategic Plan 2011/12 – 2015/16

This strategic plan outlines the department's strategies to harness all available energy resources in order to meet future demand while achieving government mandates of universal electrification and affordable services. Some of the strategic objectives of this plan are 'Environmental assets and natural resources protected and continually enhanced by cleaner technologies' and 'Mitigation against, and adaptation to, the impacts of climate change' (DoE 2010:20). It is seen that these objectives are consistent with the White Paper on Renewable Energy (2003) and the NCCRP (2011).

This brief discussion shows that the efficient use of water is reflected in the major legislative and policy instruments. Figure 4-1 is a diagrammatic representation of the legislation, strategies, policies and plans, which have been considered in this investigation.

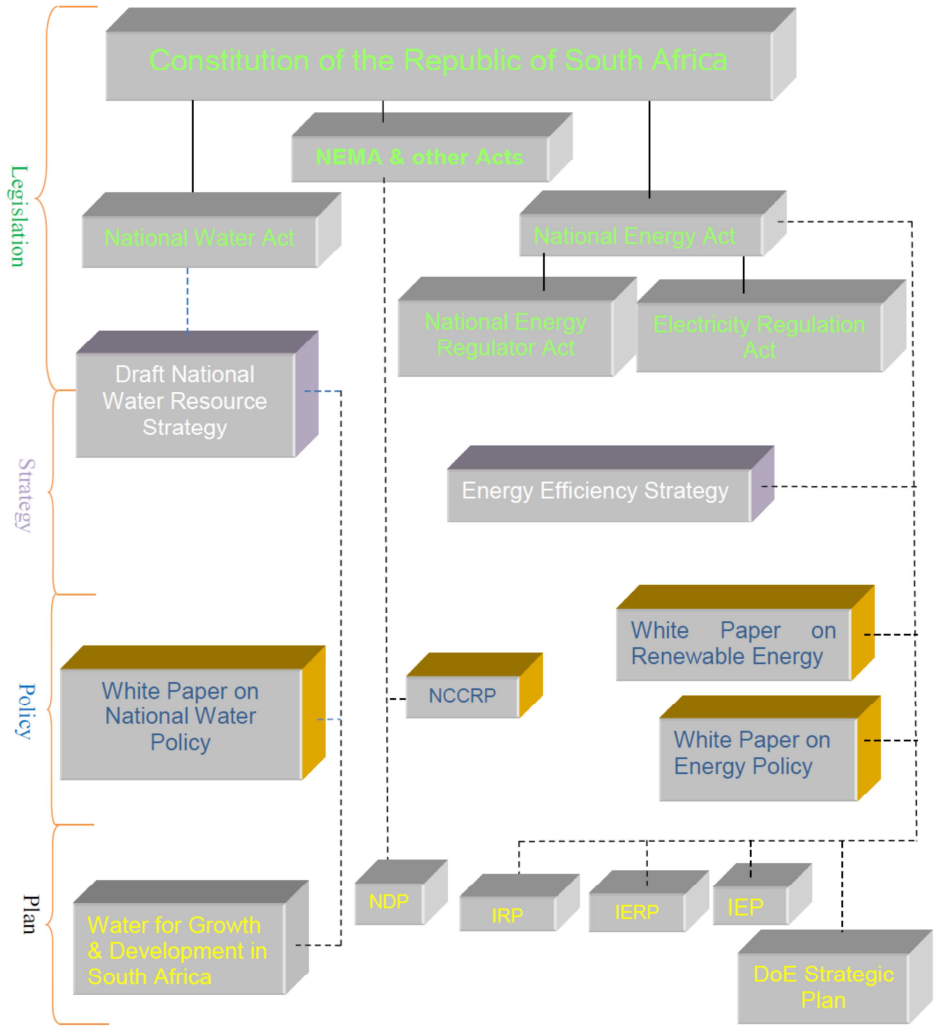

Figure 4-1: Diagrammatic representation of the legislation, strategies, policies and plans considered in this investigation

4.5 Recommended policy framework

This paper has shown that there exists a network of legislative and policy instruments in South Africa that directs the management of water and energy resources. Nevertheless, there is an insufficient degree of synergy amongst them with regard to the efficiency of water use in the energy sector. There is therefore need for a framework that can assist in tracing policy links in order to achieve sustainability towards effective and efficient resource management and planning

The constitution of the Republic of South Africa is the supreme piece of legislation (Figure 4-1). This overarching legislative instrument informs the development and implementation of the National Water Act, Energy Act, Environment and other acts. It should be mentioned that domestic legislation is influenced by international agreements, for example under the United Nations Framework Convention on Climate Change. For instance, South Africa has ratified the Kyoto Protocol. In view of this, the country is making policy and regulatory shifts in line with international law (RSA, 1996). At the level of legislation, it is necessary to ensure that horizontal linkages exist during the

design and implementation of the piece of legislation (see diagrammatic representation in Figure 4-2). It is also important that legislation regarding water, energy and other matters should be harmonised with regard to the efficient use of water. In turn, this legislation should influence the vertical development of relevant strateges/policies which are horizontally synergetic. Similarly, national water and energy plans or programmes should emanate from national strategies and policies. These plans should also be comprehensively aligned. There is need to capture elements of water use efficiency at all the levels of policy.

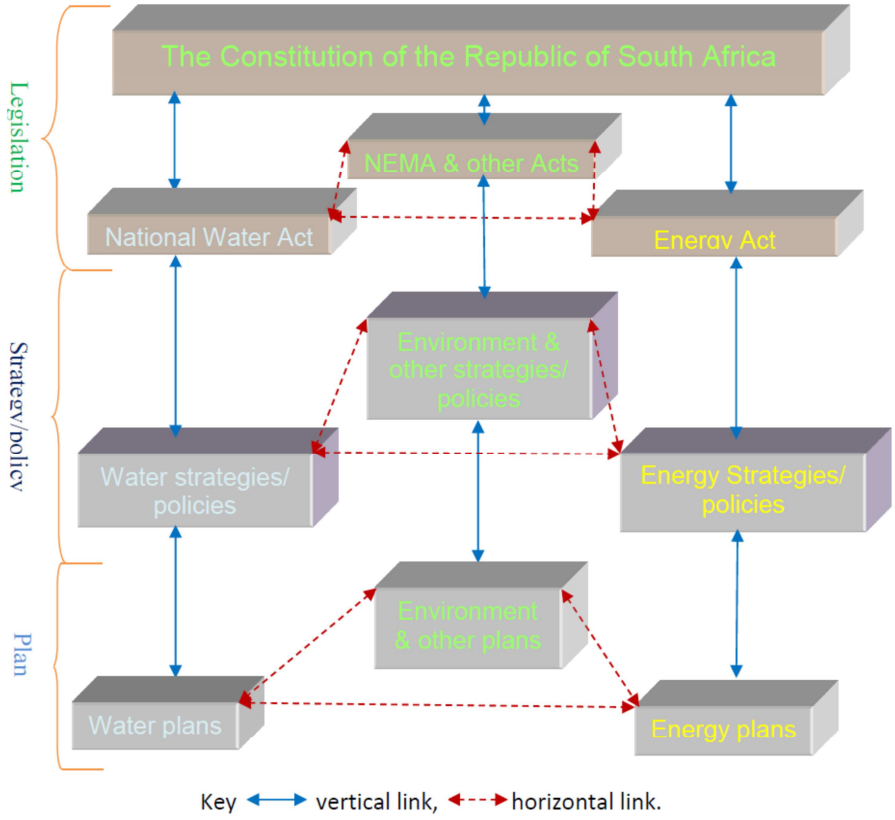

Figure 4-2: Diagrammatic view of the framework for harmonisation of legal and policy instruments for water use in the energy sector

4.6 Application of the framework

This framework can assist in developing of new policy (legal) instruments or reviewing existing instruments. It should be noted that a given instrument should be linked vertically and horizontally. A missing vertical or horizontal link, where two policies or legal instruments are in conflict or fail to support the primary guiding principles of the other, would indicate that there is need to review the instruments to reflect the efficient use of water.

It is important to establish existence of a policy on the efficient use of water in the energy sector. This may be a stand-alone policy or a section on efficient use of water within a wider energy-related policy. The policy needs to be linked to water, environment and other relevant policies. Synergy with other policies is also vital for a successful policy instrument. For example, is there some contradiction with other policies? Figure 4-3 shows a suggested flow chart for reviewing or formulating a policy instrument to include efficient use of water in the energy sector.

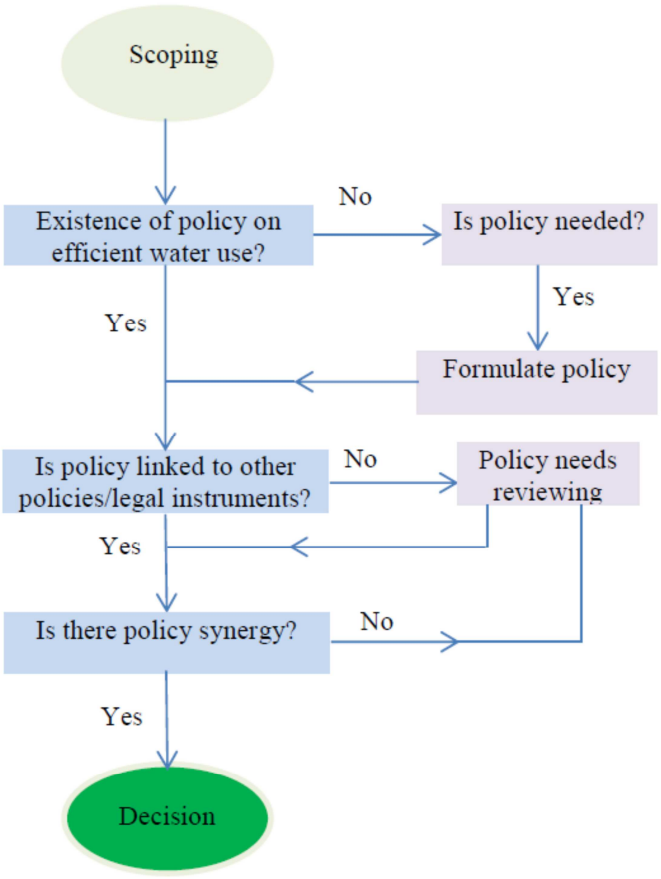

Figure 4-3: Flow diagram for policy review/formulation to incorporate efficient use of water in the energy sector

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