Africa Energy Cooperation - Lessons and the Way Forward: V4 energy policy recommendations for Southern African region

Visegrad Fund

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UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Graduate School of Technology Management

CORVINUS UNIVERSITY of BUDAPEST

Research Centre for Strategic and International Management

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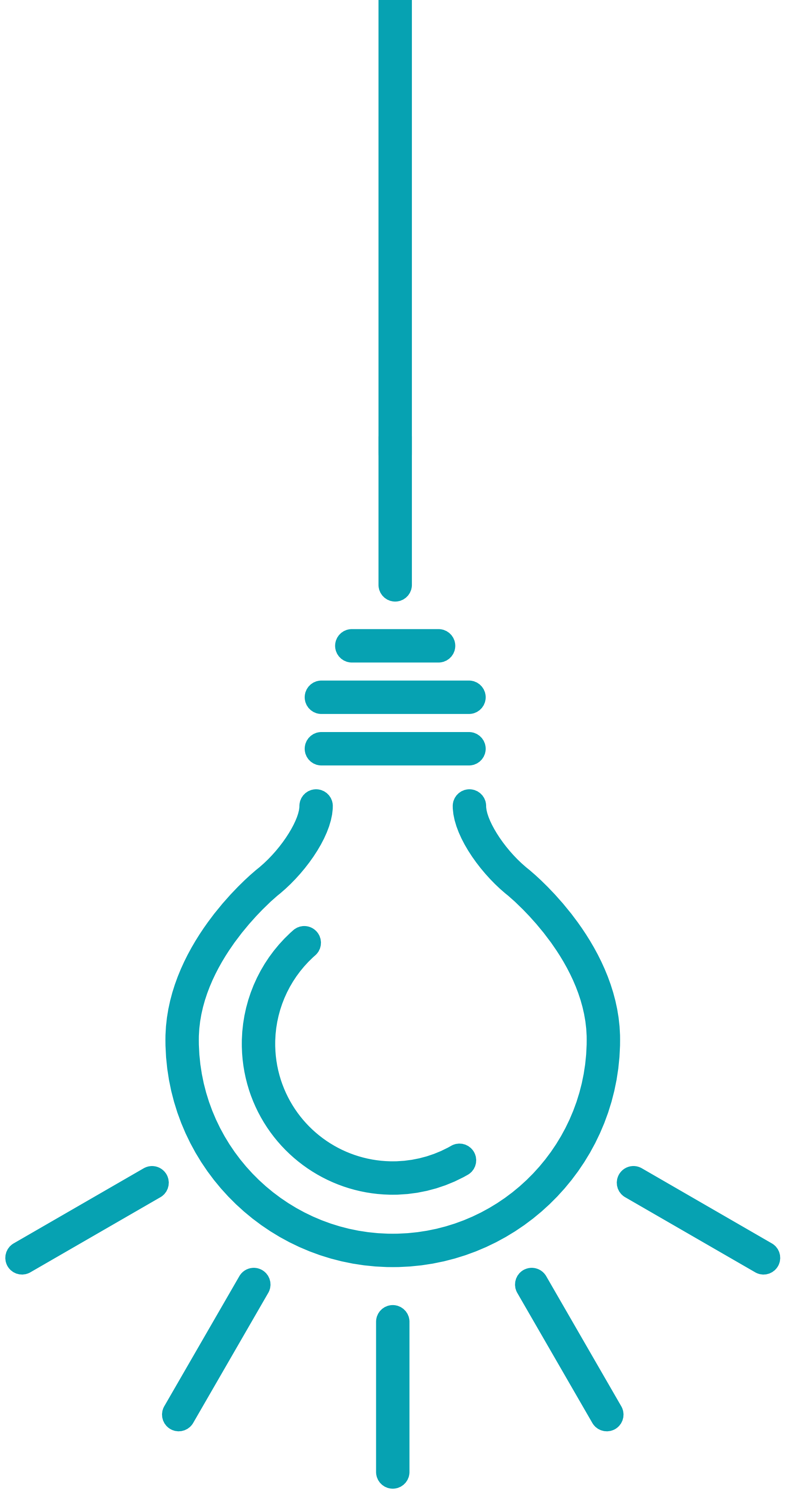


Africa Energy Cooperation - Lessons and the Way Forward: V4 energy policy recommendations for Southern African region

Policy paper following conclusions from the Innovative energy workshop, Pretoria, 1 - 2 September 2015[1]

This paper aims to summarize the innovative ideas, market model and policy recommendations presented by Visegrad Four energy policy experts in the Innovative Energy Workshop, hosted by the Graduate School of Technology at University of Pretoria in early September 2015. We believe that the cooperation between V4 countries and the countries of the South African region offers a great opportunity for both parties. There are numerous similarities between the current transition period of South Africa and past systematic changes encountered by the V4 countries, which went through a radical energy transition process in the last two decades. Learning from the experiences of the Central Eastern European (CEE) countries can help South Africa to solve its current energy challenges.

[1] Participant author: Balázs Felsmann, Corvinus University of Budapest
Editor: Dr. Michal Chudý, European Agency for Energy Security

Introduction

The international workshop organized by the University of Pretoria on 1st and 2nd of September 2015 invited open-minded discussion between academic community, state representatives and practicing managers about the best policy and technological solutions for the South African energy economy to advance from the coal-dominated energy system to a more sustainable one. One of the workshop panels highlighted the potential fields of cooperation between Central Eastern European (CEE) countries and South Africa in the areas of energy security, sustainable energy production, energy efficiency and market design. The four countries of the Visegrad Group - including Czech Republic, Hungary, Slovakia and Poland - offer a timely case study for South Africa, demonstrating the complexity of social, institutional, technological, economic and legal issues and their influence on the development of the energy sector in European transition economies.

The South African energy system is under tremendous pressure because of the core imbalance in supply and demand. Although South Africa is the leading electricity producer of the African continent, the scarce capacities cause power shortages regularly all over the country. More than 90% of the country's electricity demand is served by coal-based power plants.[2] South Africa is in the group of the world's top-20 emitters of greenhouse gases[3] and its economy is one of the most energy intensive because of the high proportion of mining, mineral-processing and heavy industries. Despite high potential, the share of renewable energy sources (RES) in total primary energy sources (TPES) remained at 11% during the last decade - 98% of which comes from biomass and waste. Renewable electricity accounts for only 1% of total electricity generation.

The South African electricity grid is vulnerable. Although in 2014 the state utility company (Eskom) largely avoided load shedding, in 2015 country suffered the worst load shedding in history with massive negative impact on the country's economy. High risk of load shedding will remain until new power producing capacities and grid investments are completed over the next years.

[2] IEA World Energy Outlook 2014

[3] OECD Environmental Performance Reviews: South Africa 2013

The energy system of the V4 countries in brief

The V4 countries formed their strategic partnership in 1991 shortly after the collapse of the centralized socialist system in all four countries[4]. The general idea of the cooperation of the four state s is to work together in several fields of common interest within the European integration framework. The institutional structure of V4 Group is based on periodical meetings of state representatives of various levels, from expert working groups to regular meetings of the prime ministers.

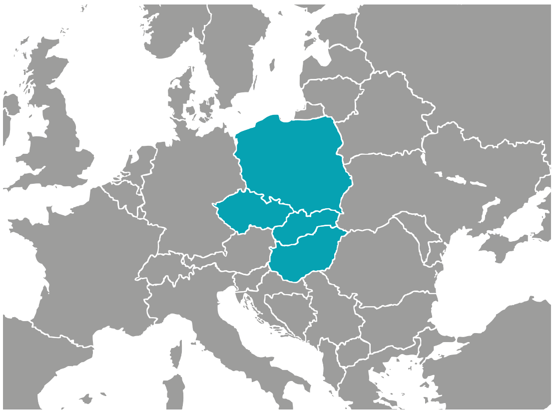
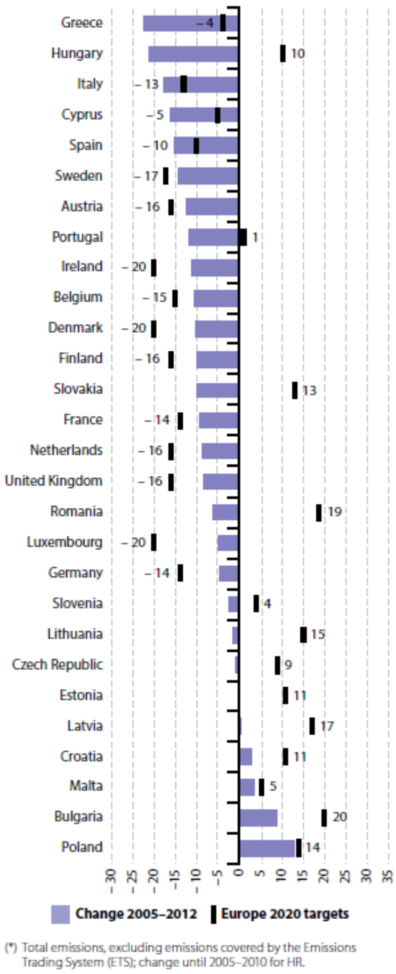


Figure 1 - Greenhouse gas



The four countries represented 65 million of population and 274 TWh electricity consumption in 2013. The V4 countries significantly **reduced their carbon emission** in the last two decades mainly by transforming traditional energy guzzling heavy industry.

Three of the four V4 countries (CZ, HU, SK) significantly reduced their final energy consumption from 1990 to 2013 which helped to decrease the greenhouse gas emission compared to the 1990 level. However there are still challenges ahead. Although the V4 countries achieved great results in utilization of renewable energy sources, the share of RES is still relatively low in comparison with the EU28 average (V4 average share of RES is 6% of total electricity consumption in 2013 excluding large hydro).

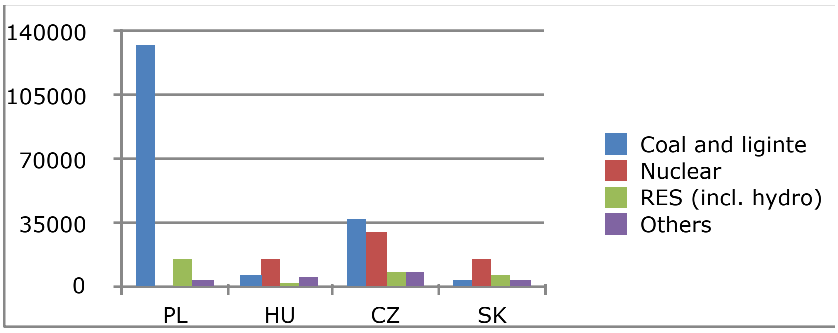
Polish electricity production is still dominated by coal and lignite fuelled power plants, with a share of over 90% (133 TWh in 2013). Czech Republic and Poland are electricity exporting countries, Slovakia has a balanced system and Hungary increasingly relies on a degree of electricity import. Three of the V4 countries (CZ, HU, SK) use nuclear energy in large scale, which accounted for 58 TWh electricity in 2014. The **share of nuclear energy** from the total local electricity production achieved 36% in CZ, 53% in HU and 54% in SK.

[4] The Visegrád cooperation was an alliance of three states (Czechoslovakia, Hungary and Poland) initially in 1991. Czech Republic and Slovakia became members as a result of the dissolution of Czechoslovakia in 1993.

Addressing aging conventional generation units are a common challenge for all V4 countries, further compounded by four important macro trends that have led to falling wholesale electricity prices; **declining demand**, the **rapid penetration of RES-E production** (mainly in Germany) and the **collapse of the European greenhouse gas emission market (EU-ETS) prices**. The fourth trend is the relatively overpriced gas in the region compared to other European regions because of the near monopoly position of Russia as a supplier. The high gas prices virtually eliminate the economic viability of gas-fired power plants, particularly in Hungary where the share of gas-based electricity production was the highest in the region. As a result of these developments, new gas-fired power plants represent uncertain future rates of return and are not being built. The situation is becoming untenable, especially in Poland, which already experienced a power crisis in August 2015 and faces serious risk of capacity shortages up to 2017. Inadequate generation capacity has become a serious energy security risk due to the convergence of these factors[5].

The **partial liberalization** of the early 2000's opened new opportunities for private companies to enter the V4 electricity market. As another step towards liberalization - and after accession to the European Union – V4 countries harmonized their laws and regulations with European standards for electricity in 2007 and natural gas in 2008. Since then, consumers who are not entitled to *universal services*[6] have to purchase electricity and natural gas only from free-market traders.

Figure 2 - Electricity production of V4 countries by sources in 2013 (GWh, Source. ENTSO-E



Although, theoretically, the new legislative framework supported a further strengthening of competition in the trading sector, in practice, some market segments remain under strong state pressure. However there are some positive developments in the market structure and design of the V4 countries. The newfound trade within the European electricity market had increased to 420 TWh by 2012 - close to three times more than the 150 TWh that had characterized the first half of 1990s. The increasing trade fostered the development of the European electricity and gas exchanges, which allowed for greater price discovery for the players.

The Central and Eastern European region is especially focused on the development of cross-border electricity trade. Cross-border capacity building and market coupling also helped the region to achieve the most dynamic growth in electricity trading in

[5] http://www.cepolicy.org/publications/v4-energy-security-and-energy-markets-challenges-ahead

[6] The framework for universal services is defined by the Third Energy Packet of the EU. While the regulation put an end to the supply obligations of energy companies concerning industrial consumers, regulated retail services are still available to households and small enterprises. The universal service providers are electricity and gas retailers, who have a supply obligation with regard to authorized consumer groups (households and small enterprises).

2013, with a 15% yearly increase in day-ahead market performance. Three of the four Visegrad countries (with the exception of PL) have established a coupled day-ahead electricity market from September 2012. The success of market coupling makes it imperative for V4 to further improve cooperation and to avoid policy interventions that could undermine regional electricity market integration. Although Poland declared its intention to join the CZ-SK-HU Market Coupling[7], the final decision is still pending.

Recommendations to the South African region

We strongly believe that the history of the CEE transitional economies offer various lessons for South Africa to gain from. While there are many similarities between the electricity market scenarios of the two regions, there are also important differences. The CEE electricity market has a duality in ownership structure. There is strong competition in the production and retail sectors between global multinational players such as E.ON, EDF, RWE, ENEL and regional electricity companies such as CEZ, PGE or MVM. This differs from the quasi monopolistic status of Eskom in the South African market. However there remains strong state influence on various segments of the V4 electricity markets. While the European unbundling regulation[8] requires the independence of the network companies (transmission system operators (TSO) under high voltage networks and distributed system operators (DSO) in medium and low voltage networks) from the commercial and producing activities, all of the V4 countries maintained state control over the national TSOs through direct or indirect ownership. Similarly to the South Africa case, three V4 members (HU, SK, PL) still use regulatory prices for households and there remain strong state controlled companies in production (CEZ, MVM and PGE in V4 and Eskom in South Africa) while power plant investments are suboptimal in both cases.

The following summarizes the ideas that V4 participants exchanged during the workshop in Pretoria, grouped into three main categories; (1) structural questions of the current market design, (2) issues of electricity generation and (3) price regulation.

1 Issues of market design

It can be observed that two competing electricity system paradigms are competing across the world. In the traditional top-down system, large scale power plants produce electricity that is delivered to customers via transmission and distribution lines for passive consumption. This includes a large proportion of base load producers (coal and/or nuclear) with other sources of electricity (RES and gas) mostly serving the "remaining" peak electricity demand.

The new electricity system paradigm has a generally bottom-up approach. As a result of distributed generation, consumers become active players and stakeholders in the production market. As prosumers, they consume, produce and sometime store elec-

[7] http://www.mavir.hu/documents/10262/183810537/20130128_+Press+Release_final_EN.pdf/bdc279ad-ef5a-4c41-b31f-0b019d34db16

[8] Directive 2009/72/EC

tricity on small scale. This electricity system is supported by robust information and communication technologies (demand side management, smart grid and metering technologies). Because of the increased share of intermittent renewable production (wind and solar) the share of traditional base load is continuously declining.

The current V4 and South Africa systems were built from the traditional electricity system paradigm and in the upcoming years both regions face the challenge of transition. The key elements of this transition are the following: (1) proper integration of RES capacities; (2) incentives for production and network investments and (3) transparent mechanisms of cross-border trading.

South Africa has embarked on this difficult process of shifting its energy system. For now 14 RES production projects delivering power through Eskom's main power grid help to alleviate the chronic energy shortage currently faced by the country. These projects consist of wind and solar programmes, providing more than 700 MW.[9] The electric utilities of nine neighbouring countries of the region (namely Botswana, Mozambique, South Africa, Lesotho, Namibia, Democratic Republic of Congo, Swaziland, Zambia and Zimbabwe) are interconnected. While there is an interchange energy trading mechanism for settlement of the cross-border energy flows, the integration of the regional market should be developed to reduce the vulnerability of the national electricity systems. Taking into consideration the main goals of the South African electricity system transition, we suggest the following to South Africa in relation to its electricity market design:

1 We recommend developing regional transmission and distribution network capabilities within an international cooperative framework of South Africa and the Sub-Saharan region. The capacity and quality of the transmission and distribution network is crucial for reduction of transmission losses, better integration of renewables and increasing the flexibility of the system. The examples of V4 countries demonstrate strong inverse correlation between the development of cross-border inter-connectors and grid development projects and the vulnerability of the national energy systems.

2 The established institutions with strong authority have a crucial role in proper market governance. The National Energy Regulator (NERSA) has to be fully independent from any political and industrial influences. We suggest the revision of the current legislative documents[10] of NERSA in order to increase the independency, power and jurisdiction of the regulatory body.

3 For incentivizing network investments, we suggest South Africa considers the implementation of unbundling legislation (such as in Europe) to separate the network, production and trading activities into legally or potentially ownership unbundled units. The separation of the transmission and distribution companies with a transparent network cost pricing method will better support the new investments needed for infrastructure.

[9] South Africa Energy Market Report - December 2015, NUS Consulting Group

[10] National Energy Regulator Act (Act No.40 of 2004), Electricity Regulation Act (Act No. 4 of 2006)

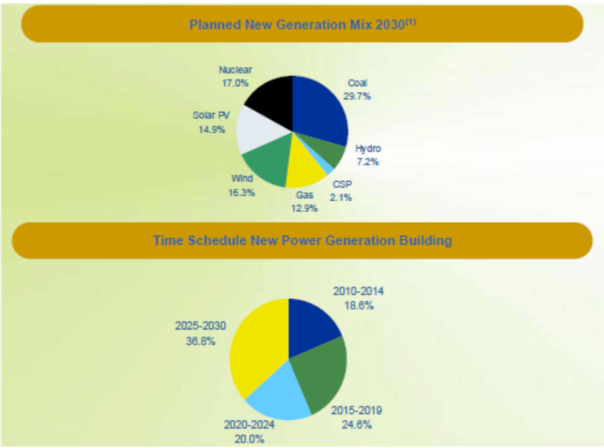
4 Establishing institutions to facilitate cross-border trading such as the electricity exchange and market coupling mechanisms would help to reduce the price disparities throughout the region. As a result of market coupling in September 2012, the price convergence between Slovakia, Czech Republic and Hungary increased from 11% to 82%. We suggest South Africa consider the establishment of a regional energy exchange as a first step for day-ahead market and later for intra-day trading.

5 The elaboration of a clear, stable and transparent regulatory framework of network tariffs has a significant role in promoting new investments. The two choices for price regulation of naturally monopolistic sectors such as transmission and distribution are the Rate of Return & Costs Pass-through (RoR) and the incentive-based (RPI-X) regulation. The majority of the European regulators, including all V4 countries, use the first method. However some European countries alter the RoR regulation by using incentives for operational efficiency. The main difference between the two frameworks is the allocation of the market risks of new investments between the company and the (end) users of electricity. The RoR model decreases the risks of the company by passing through costs to the customer as they arise. By contrast, the RPI-X explicitly shifts higher shares of the risks to the network operator, although the cost and revenue opportunities are different. RPI-X leaves both an element of risk (of poor forecasting of future costs) and a substantial opportunity for reward to the network operator if it can realise savings against its forecast costs. We suggest South Africa to carefully consider all aspects of these two choices for its long term regulatory framework.

2 Electricity generation

Experts agree that South Africa needs to significantly increase the share of renewable sources in its electricity generation in the coming decades. We share the opinion of the International Energy Agency that a maximum of 30-40% of variable renewable energy (mainly wind and solar) can be integrated without significantly increasing power system costs in the long run.[11] However, as the IEA underlines, the cost-effective integration calls for a system-wide transformation. South Africa needs to evaluate the proper balance of these technologies in the energy mix amidst rapid changes in electricity production technologies worldwide. IEA estimates that the share of fossil fuels will drop from the current 68% to 55% in 2040. The share of renewables will increase by more than 50%, reaching one third of global generation in 2040.[12] There will be 1700 hours in 2025, 2700 hours in 2035 and 3700 hours in 2045 of „free electricity" on the German market under the current estimations. This trend will hurt the business model of the base load producers[13]. Through the increasing cross-border trade of electricity this trend will relate directly the energy markets of V4 countries.

Figure 3 – Summary of the Policy-adjusted IRP Plans for South Africa's generation mix (Source: DoE, South Africa)



The future development of electricity production in a region will strongly depend on the degree of economic maturity, the political preferences and the local resource endowments.

As a first step we suggest to prepare a clear long term vision about the policy-level cornerstones required for the desired future energy mix of South Africa. V4 experts have experience with complex strategic analysis and modelling the expected impacts of an energy transition process including the social, environmental, legal, technological and economic factors. We believe that this knowledge can support the South African policymakers and researchers to select the most appropriate long term strategy to achieve its strategic goals.

Our recommendations to South Africa are to consider the following for the future energy production:

1 South Africa has a coal-dominant energy system. Although it is evident that the country has to reduce the share of the coal-based electricity production, we suggest a gradual, soft transition. Coal mining is an important sector of the South African economy and coal represents a cheap domestic input of electricity generation. V4 countries can offer research

[11] IEA EU Energy Policy Review 2014, p. 118.

[12] IEA World Energy Outlook 2014, p. 216.

[13] Öko-Institut e.V., Germany 2014

and development cooperation with new technologies that can reduce coal-fired power plant emissions (carbon-capture storages, retrofit projects). Poland is planning to refurbish and build new coal-based power capacities in the coming decades. This fact opens numerous potential fields of cooperation in technological planning, investment model structuring, engineering, and operational works.

2 Three of the V4 countries have deep knowledge and skills in operation of nuclear power plants. There is a nuclear project in Slovakia under construction and Hungary also decided to build a new 2x1200 MW of capacity. The experiences of the V4 nuclear experts is based on Russian technology, as the current units in CZ, HU and SK were built in the Soviet era. The nuclear technology seems an appropriate base-load technology to reduce the carbon emission of the South African coal-fired power plants. However we suggest a detailed analysis on the potential advantages and disadvantages of moving to nuclear for South Africa. Nuclear is the most capital-intensive power generating technology and as a primarily base-load contributor it is limited in its ability to coexist with intermittent renewables. The question of nuclear waste management is also an issue to be considered. Finally, South Africa has to consider the complex macroeconomic effects of the relying on imported uranium rather than domestic coal.

3 We think that South Africa is one of the best places to quickly move to renewables in electricity production. The solar radiation is one of the highest all over the world and the coastal areas offer opportunities for windfarms. Rural regions can increase the share of biomass production. Although the RES production is becoming more competitive, it should be subsidized in the short and medium term. A well-designed RES support scheme is highly recommended for South Africa to achieve the highest share of RES with the lowest additional costs. The Renewable Energy Independent Power Procurement Programme of South Africa (REIPPPP) has been built on the subsidy mechanism of long term power purchase agreements. Five years after the commencement of this program we suggest a review of the current incentives. V4 countries could share their experiences with South African experts about the best practices in subsidies (e.g. green certificates, feed in tariffs, premiums, quotas) through the existing V4 international coordination mechanism implemented to exchange relevant data and knowledge base on RES technologies.

3 Electricity prices and consumer price regulation

There is a continuous debate about the level of electricity prices in South Africa which are regulated by NERSA. Based on a recent report, between 2014 and 2015, South Africa's power prices increased 8.2% to 8.46 US cents per kilo-Watt hour (kWh).[14] Although this is still below European household prices, the gap is closing. Several municipalities are licenced to sell electricity to households, however the monopolistic position of Eskom reduces their role in determining the cost of electricity.

Various international organizations publish studies to compare existing European Union Member State practices concerning consumer price regulation. The European Regulators Group for Electricity and Gas (ERGEG) first prepared a report on the end-user price regulation of electricity and gas in 2010.[15] A report covering thirty countries (including Norway and Iceland along with EU Member States) showed that only 11 countries had overhauled regulations governing household consumer prices while 17 countries remained the same. Regulated prices are applied with small enterprises in 16 countries, large enterprises in 9, and energy-intense industries in 6. The European Commission repeated the survey in 2014.[16] Both the studies of CEER and the Commission indicate that most Member States which still have a price regulation actually plan to stop it. Regarding the CEER questionnaire, 11 countries from 14 answered that they plan to review their current price regulation system, and even consider its full termination.

Figure 4 - Price regulation methodology regarding customer prices in EU Member States in 2012

Methodology of regulation	Countries
No price regulation	Austria, **Czech Republic**, Denmark, Finland, the Netherlands, Luxemburg, Ireland, Great-Britain (except North-Ireland), Germany, Sweden, Slovenia
Rate of return/cost-plus	Cyprus, North-Ireland, France, Greece, **Poland**, Lithuania, **Hungary**, Malta, Italy, Romania, Spain
Price cap	Belgium, Denmark, Estonia, Lithuania, Portugal, **Slovakia**
Revenue cap	Bulgaria

There is a connection observed between the competitiveness of economies and the level of electricity prices in Europe. Statistical data of recent years shows that electricity market liberalization leads to declining industrial wholesale electricity prices without a significant increase of household electricity tariffs. The case of leading European economies such as Germany and Denmark show that the cost of energy transition can be allocate mainly to households without decreasing the overall competitiveness of the country.

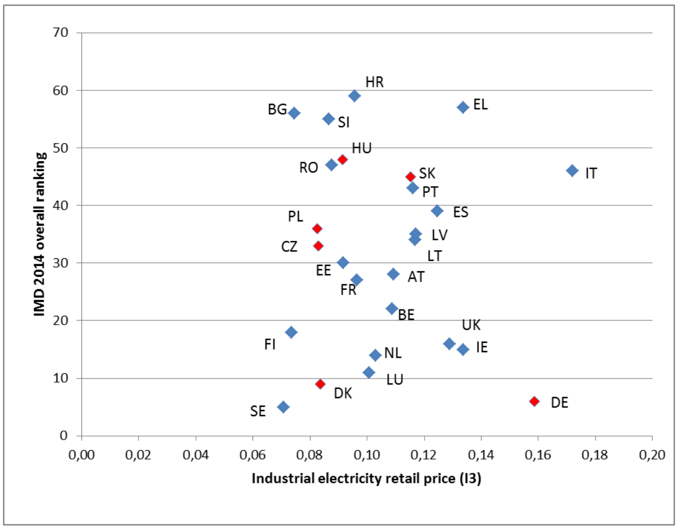
[14] Energy Market Survey by NUS Consulting, September 2015 (based on fixed, 12-month contract prices starting 1 June 2015 for the supply of 1,000 kW with 450 hours use)

[15] ERGEG (2010): Status Review of End-User Price Regulation as of 1 January 2010. European Regulators Group for Electricity & Gas. Ref: E10-CEM-34-03. Bruxelles, 8 September 2010.

[16] European Commission (2014). Energy prices and costs report. Comission Staff Working Document, SWD(2014) 20 final/2. European Commission, Brussels, 17 March.

Countries with the most expensive household electricity prices and the strongest commitment to RES revolution achieved the highest level of improvement in their competitiveness ranking in 2014 compared to 2013. Germany improved its general competitiveness rating from 9th to 6th and Denmark from 12th to 9th position. This highlights the complex formulation of energy retail prices. The higher prices can be compensated by the higher value added services of the economies. We do not suggest South Africans follow the German example and increase the prices of electricity, however the current monolithic role of Eskom in electricity trading should be revised. We suggest the consideration of the following changes in price regulation framework:

Figure 5 – Correlation between countries' competitiveness and retail industrial electricity prices (based on EUROSTAT and IMD data, 2014)



1. South Africa should implement a **liberalized electricity trading market** for industrial consumers, free to choose and modify their energy supplier on the open market. The European examples demonstrate that the liberalization of electricity trading increases the competitiveness of the participating companies in the electricity market, which develops the energy-awareness of the consumers and makes energy markets more transparent.

2. In the short run, the government could maintain the system of **regulated prices for households** and small and medium enterprises to guarantee affordable energy prices for citizens with smaller bargaining power against utility companies. The current development of the local market requires the active role of regulatory bodies to avoid the excessive price increase in the household segment. In the longer term, consideration should be given to the abolishment of retail price regulation.

3. We suggest a revision of the current role of municipalities in energy selling to the public. We would consider the definition of universal services on the basis of territorial monopolies or in a competitive system with clear regulatory framework ensuring supply obligations of the universal service companies.

4. We would suggest considering the implementation of a guaranteed minimum service level to vulnerable consumers which can reduce the energy poverty of the poorest people. Technical solutions, such as prepaid metering systems in a combination with financial aid services can help low income citizens have better access to the electricity systems.

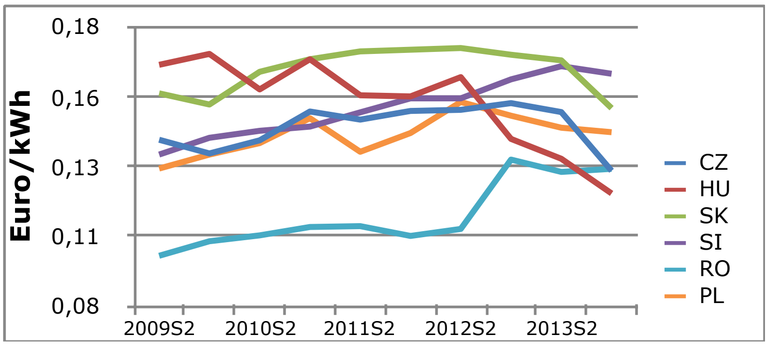
Final remarks

South Africa faces several challenges in its electricity transition process. The vision of a more sustainable electricity system with a high proportion of renewable sources, distributed generation, and competitive and affordable prices can be achieved only with long term cooperation between all stakeholder groups including policymakers, the academic community and industry. Workshops similar to the September 2015 program in Pretoria could provide the most appropriate platforms for focused discussions of various energy sector issues. The inclusion of experts from other regions, such as V4 countries, would help to incorporate relevant international experiences into the current debates. Sharing ideas with diverse backgrounds would be mutually beneficial for both sides, in this case South Africans and Europeans. As a main conclusion of the workshop, we suggest the South African organizers continue to hold a place for open-minded discussions about the visions, strategy and proper actions of the South African energy transition process.

Annex – Key V4 electricity market statistics

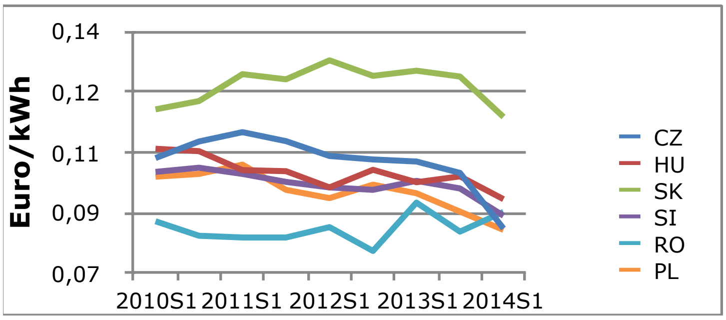
Household electricity prices in selected Central Eastern European countries(Source: EUROSTAT. Band DC : 2 500 kWh < Consumption < 5 000 kWh, all taxes and levies included)

	2009S2	2010S1	2010S2	2011S1	2011S2	2012S1	2012S2	2013S1	2013S2	2014S1
CZ	0.1394	0.1345	0.1392	0.1495	0.1466	0.1497	0.1501	0.1525	0.1493	0.1283
HU	0.1662	0.1701	0.1574	0.1682	0.1553	0.1549	0.1618	0.1397	0.1326	0.1202
SK	0.1560	0.1520	0.1637	0.1682	0.1710	0.1716	0.1722	0.1698	0.1678	0.1507
SI	0.1341	0.1401	0.1426	0.1441	0.1492	0.1542	0.1542	0.1610	0.1657	0.1630
RO	0.0979	0.1031	0.1052	0.1082	0.1085	0.1050	0.1075	0.1323	0.1279	0.1290
PL	0.1291	0.1341	0.1382	0.1471	0.1351	0.1418	0.1529	0.1480	0.1437	0.1421



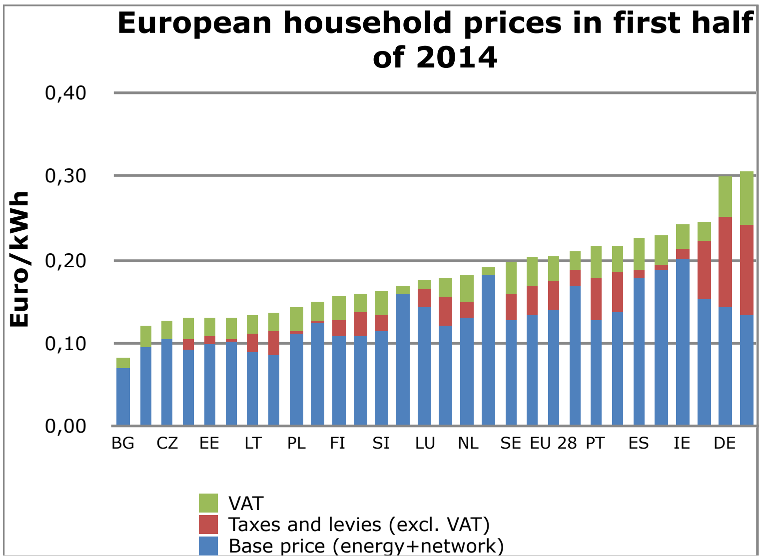
Industry electricity prices in selected Central Eastern European countries(Source: EUROSTAT. Band IC : 500 MWh < Consumption < 2 000 MWh, Excluding VAT and other recoverable taxes and levies)

	2009S2	2010S1	2010S2	2011S1	2011S2	2012S1	2012S2	2013S1	2013S2	2014S1
CZ	0.1122	0.1033	0.1081	0.1108	0.1082	0.1039	0.1029	0.1023	0.0990	0.0829
HU	0.1297	0.1060	0.1053	0.0998	0.0995	0.0948	0.0999	0.0963	0.0980	0.0914
SK	0.1403	0.1174	0.1198	0.1276	0.1261	0.1316	0.1271	0.1286	0.1269	0.1152
SI	0.0962	0.0993	0.1005	0.0987	0.0964	0.0948	0.0941	0.0967	0.0945	0.0866
RO	0.0828	0.0850	0.0808	0.0803	0.0803	0.0833	0.0764	0.0904	0.0820	0.0877
PL	0.0933	0.0979	0.0987	0.1014	0.0941	0.0917	0.0956	0.0931	0.0878	0.0825

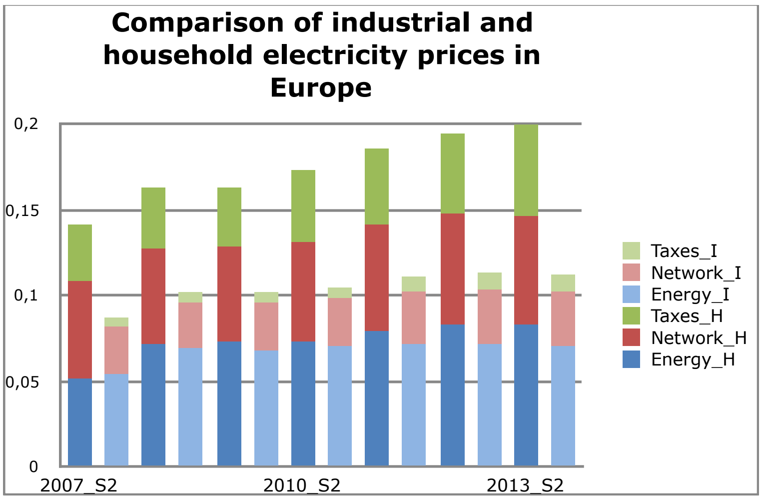


Household electricity prices in selected Central Eastern European countries(Source: EUROSTAT. Band DC : 2 500 kWh < Consumption < 5 000 kWh, all taxes and levies included)

Country	Installed capacity (GW) 2013	Power generated (TWh) 2013	Export/Import balance (TWh) 2013	RES as % of generation	Nuclear as % of generation	Market share of largest producer
CZ	21.1	87.1	+16.9	10.21	36	58.2 (CEZ)
HU	9.1	30.3	-11.88	6.6	43	51.9 (MVM)
PL	38.4	162.5	+4.5	12.0	-	39.3 (PGE)
SK	8.5	28.5	-1.1	20.8	55	83.3 (SE)



Source: EUROSTAT Band DC : 2 500 kWh < Consumption < 5 000 kWh



Based on Eurostat data, segments H2 and I3.
(H2: between 1000 and 2500 kWh yearly condumption. I3: between 500 and 2000 MWh yearly consumption.)

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