



SMART ELECTRICITY

Fast-tracking our transition to a healthy, modern, affordable electricity supply for all.



SMART ELECTRICITY PLANNING considers the *immediate* needs of people and planet. It makes modern, employment-creating choices that focus on renewable energy and energy efficiency, rather than utilising old technologies that are expensive and unhealthy.

A 20-year electricity supply and implementation plan - the Integrated Resource Plan 2010 to 2030 (IRP2010) - has been devised by the South African government. It does include a limited role for renewable energy. However, old and expensive technologies are prioritised. Rather, a SMARTer electricity plan, with renewable energy as a central component, would enhance environmental quality, provide more jobs, address energy poverty and reduce capital expenditure – a roadmap to a better future for all South Africans.

1 SMARTer expenditure

The SMART Electricity Plan, when compared to the IRP2010, would **reduce capital expenditure** more considerably as well as enable more flexible investments and avoid the high risk of expensive, stranded assets.

2 SMARTer jobs

Renewable energy and energy efficiency **create more jobs** across the country than a supply-centred plan focused on coal and nuclear energy, particularly when local manufacturing is prioritised.

3 SMARTer pro-poor access

The SMART Electricity Plan enables more people to **access energy services**, thereby improving their well-being. This importantly includes the promotion of gender equality.

4 SMARTer local economic development, particularly in manufacturing

Energy efficiency and renewable energy provide many opportunities for **small business development** – the exciting growth of a new industrial sector – well matched to the South African skills base.

5 SMARTer community-owned power generation technologies

Smaller, easier to raise financing allows **independence from a central power supply**, and creates jobs everywhere in the country. Renewable energy is fast to build – unlike nuclear – and can be installed close to the point of use.

6 SMARTer electricity conservation and efficiency

It is **five times cheaper** to invest in energy conservation and efficiency than to build a new power plant. We can reduce the country's electricity use immediately, using existing technologies, and roll out advancing ones quickly, while ensuring just economic development.

7 SMARTer health for people and planet

Renewable energies, unlike fossil fuels and nuclear, **reduce pollution and preserve scarce water resources**. Improved air and water quality in turn lead to better health, and reduce the risk of carbon trade penalties.

The Electricity Governance Initiative of South Africa (EGI-SA)

has undertaken detailed research, using a robust modelling tool developed by UCT's Energy Research Centre. The objective is to build on and strengthen the IRP2010 in order to fast-track our nation's transition to a smarter and more equitable electricity future. The result is a SMARTer roadmap. South Africa doesn't need further investment in the old-style electricity generation technologies of nuclear energy & coal. Instead, the country's energy needs can be met by focussing on energy efficiency and conservation measures, and the installation of renewable energy.

A different energy future

SMARTer demand forecasting and management

For the past two years, **demand growth has been at least 10% lower** than indicated in the IRP2010 and may remain, in line with global economic volatility, considerably lower for many years to come. Modelling done for the **Smart Electricity Plan** found that by using effective energy conservation strategies, and implementing the best available efficiency technologies and practices across different sectors:

- the residential sector could reduce its electricity demand by up to 40%
- the commercial sector could cut use by up to 25%
- mining and industry could slash its energy use by between 15% and 20%

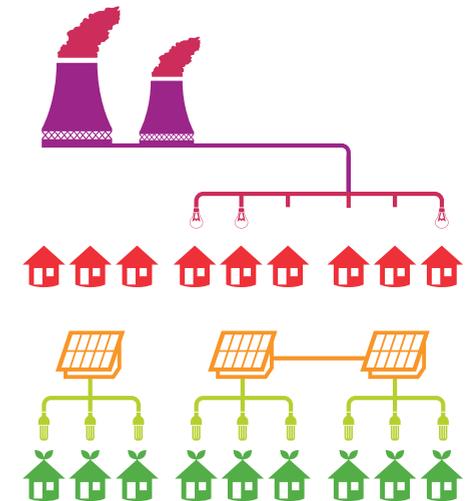
If South Africa reaches its National Energy Efficiency Strategy target of 12%, and continues with a very moderate energy efficiency programme until 2030, it **could cut the entire country's electricity demand by 16% by 2030 without compromising economic development.**

*The SMART Electricity Planning Report proposes three alternative scenarios, catering for different levels of energy-saving ambitions: **Smart Track, Smart Intrepid and Smart Max.** Smart track is the conservative option, continuing South Africa's current moderate efficiency targets, Smart Intrepid is more ambitious, and Smart Max is working to reach 'Best Practice' levels faster.*

SMARTer supply

- **The risk of expensive, stranded assets is real.** The IRP2010 calls for massive capital investments in a few large, high-risk power stations. These take long to build and lock us into dirty and outdated infrastructure.
- **The current high-risk climate calls for a low-risk approach.** Lower demand, global economic uncertainty, capital constraints and escalating environmental pressures call for caution.
- **The SMART approach makes a strong argument for modular planning,** where smaller, easier-to-raise capital tranches are invested in smaller, quick-to-build infrastructure – as and when needed.

An economy with lower energy intensity and timeous investments in renewable energy (RE) is more resilient against foreseeable cost escalations of fossil fuels. The flexibility of RE technologies, and decrease in costs, makes them well placed to respond to increases and decreases in demand.



SMART Supply scenarios adopt the Smart Track and Smart Intrepid as their foundational forecast assumptions, including energy efficiency potential. This is in keeping with an integrated energy planning approach and therefore 'SMARTer' than the supply-focused approach as used in the IRP2010.

1 SMARTer expenditure

Renewable energy is becoming more affordable as technology improves, economies of scale kick in, financing mechanisms mature, practical constraints are overcome, and public policy takes account of the negative impacts and true costs of fossil fuel and nuclear power.

Better investment (using 2010 prices for solar pv):
 IRP2010 = R910 BN vs. SMART Track = R748 BN
 (a conservative estimate!)



Costs: Coal and nuclear go up, while renewables go down

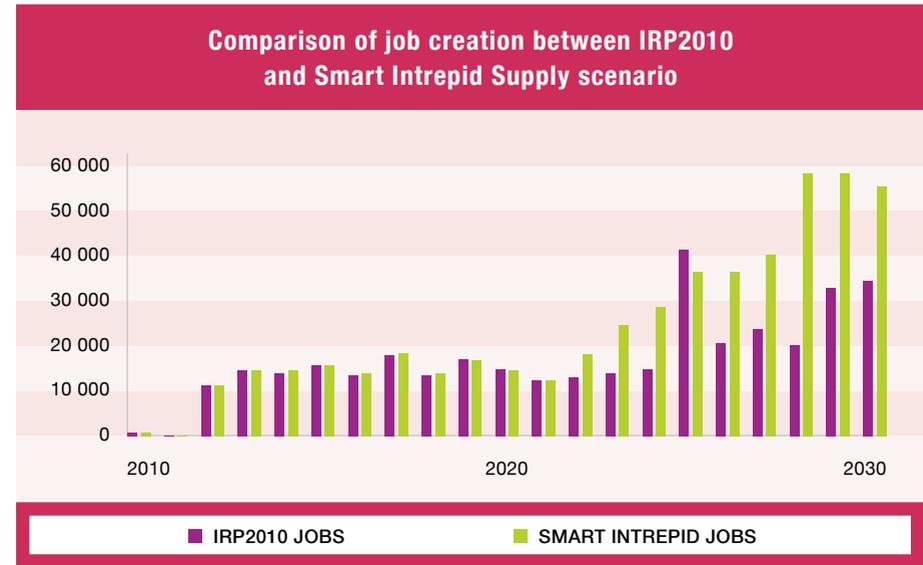
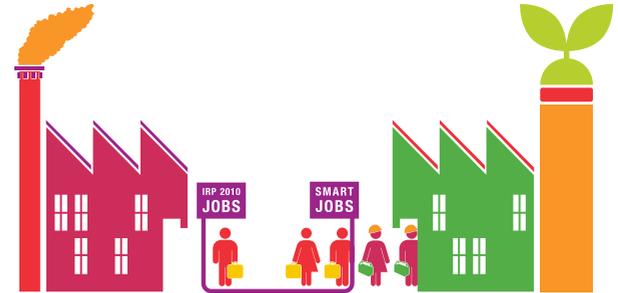
A recent Bloomberg report, Global Trends in Renewable Energy Investment 2012, states that over the past two years global electricity generation cost for solar generated photovoltaics and onshore wind fell by 44% and 7% respectively, while coal fired generation costs rose by 7%. And the 2011 World Nuclear Industry Status Report states that nuclear power plants have a history of massive cost overruns and missed deadlines, and nuclear costs have risen six-fold over the last decade.

The SMART PLAN, when compared to the IRP2010, would reduce capital expenditure by about 18%. This is when considering the 2010 supply options and following the more conservative Smart Track scenario. Considering price increases in the coal and nuclear industry and price decreases of renewable energy since 2012, the SMART option would be considerably cheaper.

2

SMARTer jobs

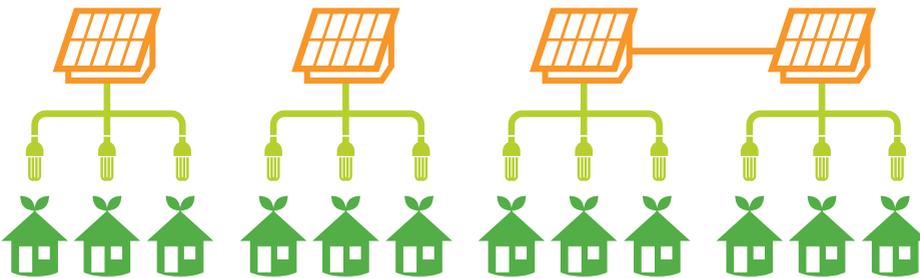
Renewable energy infrastructure creates more jobs than coal and nuclear, particularly when manufacturing is local. Whereas coal-fired and nuclear power plants are large and centrally located, renewable energy power plants can be distributed all over the country, thereby providing a more widespread allocation of jobs. The renewable energy industry is therefore likely to have broader impacts on migration and job-seeker patterns, with the creation of jobs in marginalised and diverse geographic regions, and contribution to rural economies and livelihoods. Development of South Africa's wind and solar potential would create abundant and sustainable new jobs, replacing outmoded fossil fuel-based jobs. Mining jobs would transition into the Renewable Energy sector. Further jobs would be created through Energy Efficiency.



3 SMARTer pro-poor access

Keeping electricity affordable

Even though the 2011 census shows that 84.7% of formal households in South Africa are connected to the grid, the rising cost of electricity still marginalises the poorest in the country. As the price of electricity rises, marginalised communities are forced to use polluting fuels. Eskom's electricity tariffs have increased on average by about 3.78 times between 2001 and 2011. But the average household income of black South Africans only increased by 2.7 times over the same period. We need more progressive electricity tariff structures, incentives and appropriate metering in municipal electricity distribution. If electricity planning doesn't include ways to keep power affordable, the country will undermine its development goals.



Additionally, investing in utility-scale, expensive, centralised electricity supply plants will lock the country into an increasingly outmoded, inefficient electricity system. Use of renewable energy is cheaper, so we need less electricity price increases if we take the SMART approach.

4 SMARTer local economic development, particularly in manufacturing

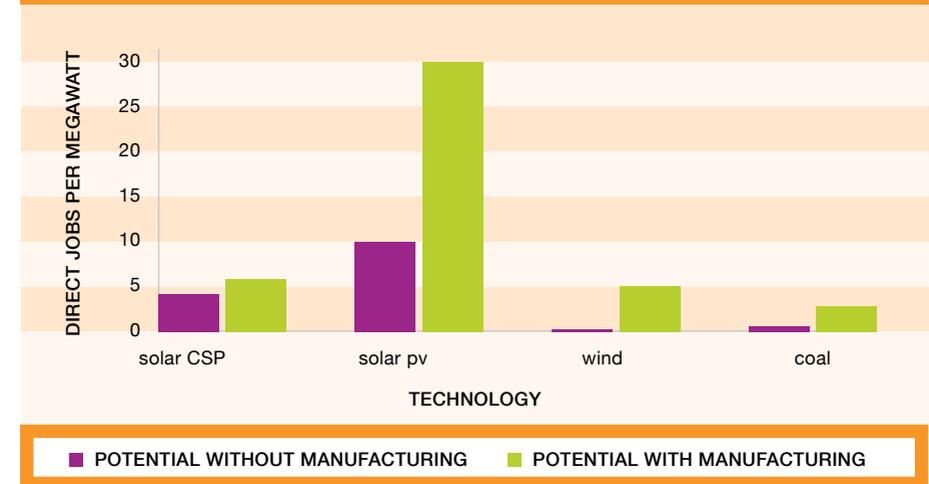
Energy efficiency and renewable energy provide an opportunity for **small business development** – the exciting growth of a new industrial sector – well matched to the South African skills base.

With the increasing use of Solar PV in the renewable sector, we are likely to see an increasing need for Solar PV manufacturing in South Africa. The number of job-



years created in the IRP2010 is potentially 360 000 until 2030. In comparison, the Smart Track Electricity Plan, which includes efficiency jobs and the installation of solar water heaters, is calculated to create about 530 000 job-years. This is a conservative estimate.

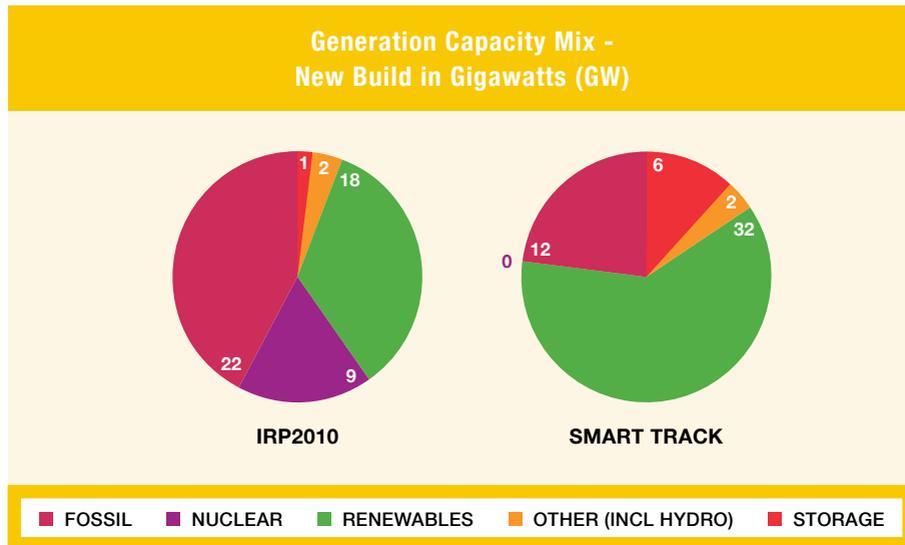
Job creation to demonstrate the impact of manufacturing (excluding construction)



SMARTer community-owned power generation technologies

Smaller, easier to raise structures allow independence from a central power supply, and create jobs everywhere in the country. Renewable energy is fast to build – unlike nuclear – and can be installed close to the point of use.

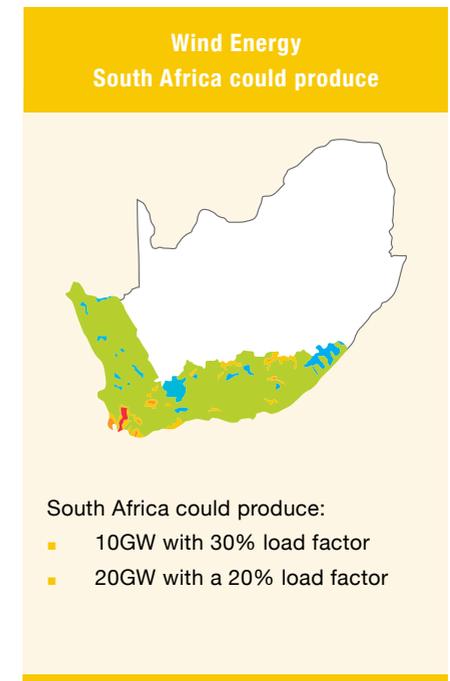
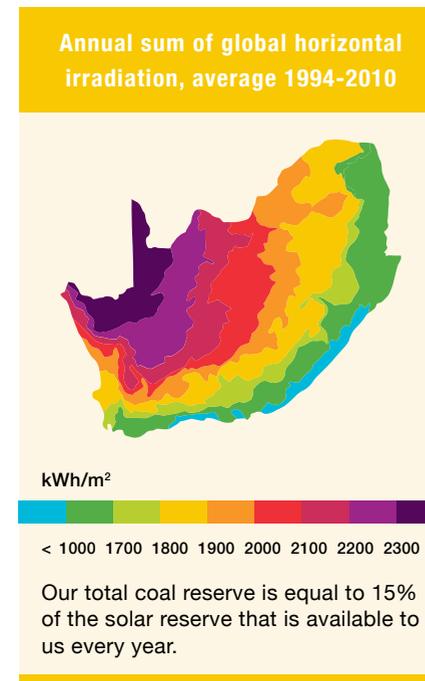
South Africa slips again in the most recent World Energy Council's annual 'Energy Sustainability Index', in part because of "a particularly weak performance in diversification of electricity production."



The changing energy mix – there are other ways to meet the country's energy needs:

- *Solar photovoltaic* (PV) technology is becoming more and more affordable for industry, commerce and residential sectors to install themselves, and is an affordable way for municipalities to meet the needs of low income homes.
- Utility-scale *concentrated solar power* (CSP) plants are a possible source of 'base load' electricity because of the storage capacity they offer, although they are expensive relative to other renewable energy sources.
- *Solar thermal* technology can be used effectively for commercial and industrial cooling and process heat requirements. Some commercial buildings are already using sun, geo-thermal and combined heat and power to meet their energy needs. This approach needs to be adopted more widely.

- *Wind* power can be small-scale, offering a few kilowatts of electricity, or scaled up to large megawatt-producing farms, without disrupting other intended land uses or polluting the environment.
- *Biogas* from waste water and bio-degradable waste could be a sound complementary energy source for the commercial, industrial and residential sectors. For instance, SABMiller's Newlands brewery in Cape Town gets 10% of its steam generation power by harnessing biogas from its waste water stream.
- *Landfill gas* and other waste-to-energy technologies need development.
- *New battery technologies* and energy storage solutions mean that renewable energy technologies are becoming more affordable and reliable as off-grid solutions.
- *Natural gas*, while still a fossil fuel, is cleaner than coal. It can generate heat and electricity at the point of use – at a large, small and micro-scale across all sectors. However, the process of hydraulic fracturing to obtain shale gas can be harmful to the environment.



6 SMARTer electricity conservation and efficiency

Proactive electricity conservation and efficiency measures will not constrain economic development. Through policy implementation, the government can create an enabling environment to make it easier for the rest of society to do what it needs to, in order to shift to smarter energy use.

These are a few things government could do to create an enabling environment:

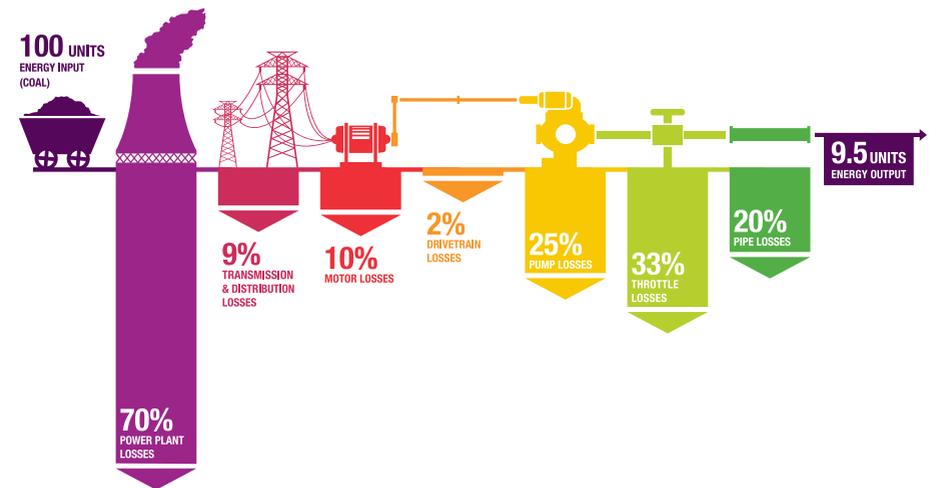
- *New building regulations* require more stringent energy efficiency and conservation measures, building on SANS 10400-XA: Energy Usage in Buildings. In the European Union, the *Nearly-Zero-Energy Building Standard* by 2020 is mandatory. Policy makers could require the same standards for South Africa.
- *Provide incentives* for energy improvements to existing buildings, for instance through including solar water heating and/or heat pumps, and insulation.
- *Provide the infrastructure* to bring natural gas to homes for cooking and heating.
- *Cut red-tape and enable* citizens, communities and enterprises to become *suppliers* in the electricity market. This needs proper incentives and policies that pay competitive rates for feeding energy into the grid.
- Set and implement *ambitious recycling targets*, since this reduces energy consumption significantly in aluminium, steel, glass, plastics and paper production.

The SMART Planning report shows that the mining industry of South Africa could contribute much more to national energy saving efforts than its existing target of 15%. Similarly, heavy industries could definitely achieve their current 15% energy saving target by 2015. Improved energy intensity beyond that to a level of 20% savings is achievable by using best available technologies. To achieve targets up to 40-50% would require higher capital investment in process and system changes, but these options are possible and feasible.

The wasteful electricity supply grid

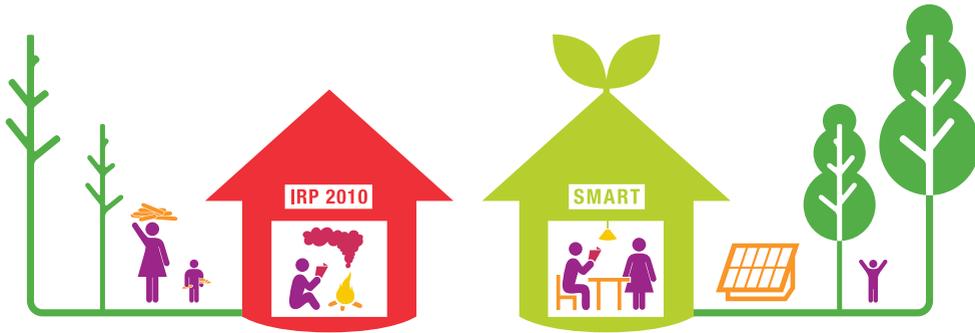
The current centralised grid system, which ships electricity mostly from large power stations in Mpumalanga and Gauteng, to the rest of the country, is enormously wasteful. Over 90% of energy that is extracted from the ground is wasted at some point along the path before final point of use. An electricity grid of the future would be decentralised, with independent power suppliers feeding electricity into a state-maintained grid infrastructure.

Energy losses: More than 90% of energy extracted from the ground is commonly wasted before it reaches the final point of use



7 SMARTer health for people and planet

Access to electricity is critical to meeting human development needs of every South African. Electricity can help improve health, quality of life and educational opportunities for South Africa's most vulnerable, while also helping to create jobs. However, the current electricity infrastructure is expensive and unhealthy for people and the life-supporting natural systems on which we all depend.



Energy access enables:

Better health & welfare

- Reduced air and water pollution reduces illness.
- Access to refrigeration for storing perishable foods ensures safe, nutritious, diverse food options.
- Access to hot water reduces illness.

Better for women & children

- Women manage household budgets, collect wood, buy fuel, and are responsible for cooking, cleaning, heating and childcare. These activities all have energy implications.
- Cooking indoors with wood and paraffin exposes people, particularly women and children, to respiratory diseases. Renewable energy could result in saving lives of 1.8 million children and 1.7 million adult women in sub-Saharan Africa between 2000 and 2030.
- Access to electricity can free women up from the labour-intensive and unhealthy nature of cooking and heating homes with these fuels, allowing them to use their time more productively elsewhere, and relieving them of the burden of chronic ill health, lost earning potential and stunted development.

Better access to information

- Electric lighting means more time for reading, studying and working every day.
- Access to electricity means people can use computers, television, radios and other technology in their homes, which allow them to access information and potentially become more productive participants in the economy.

Keeping nature healthy

- Access to fuel-efficient cooking technology, such as solar cookers or solar water heaters, provides alternatives to using wood or charcoal as an energy source in homes.
- Fuel-efficient technologies prevent deforestation, linked with wood harvesting and charcoal making, as well as the associated loss of plant and animal life.
- More efficient technologies also preserve the critical environmental 'services' provided by forests, such as buffering against flooding, erosion, and loss of fertile soil.

We have a choice! Let's be SMART.

Smart electricity planning is choosing to reject expensive, restrictive, dirty, outdated and centralised power solutions, in favour of energy conservation and efficiency, effective demand management initiatives, and job creating renewable technologies options.

These options are readily available to us and make financial, social and environmental sense. The key building blocks for an energy secure future are solutions that do not lock us into long-term debt, that improve the wellbeing of people and that prevent the current rapid pace of environmental degradation.

In order to realise a justice-oriented and environmentally-attuned electricity future, we need astute political leadership that makes forward-thinking planning choices, which are supported by industry and the citizens of South Africa.

The important choices we make today will determine the future that emerges for our country.

The Electricity Governance Initiative (EGI) is a global network of civil society organisations dedicated to promoting transparent, inclusive and accountable decision making in the electricity sector, and is supported by the World Resources Institute (WRI).

EGI South Africa is constituted of a committed group of justice-oriented organisations and individuals focused on electricity policy, planning and governance who meet regularly for working sessions, and in addition have frequent substantive discussions with key energy planners and stakeholders. EGI-SA partners are: 350.org, Gender and Climate Change – Women for Climate justice, Green Connection, Project 90 by 2030, Southern African Faith Communities' Environment Institute (SAFCEI), Sustainable Energy Africa (SEA), and WWF-SA. The Smart Electricity Planning Report is supported by Norwegian Church Aid.

Please find the full SMART report at <http://irp2.wordpress.com/smart-electricity/>