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# REVIEW OF THE COMPETITIVE BID FOR PV IN SOUTH AFRICA

**IS SA MAXIMISING JOB CREATION AND VALUE FOR MONEY FROM ITS  
PHOTOVOLTAIC INDUSTRY?**

## **POLICY AND INDUSTRIAL STRATEGY: COSTS AND OPPORTUNITIES**

*This paper will review the competitive bid strategy followed by South Africa in Renewable Energy. The paper will examine the international context and deconstruct the South African renewable energy independent power producer procurement programme for photovoltaic's. It will examine benefits of competitive bidding in contrast to a feed in tariff (FIT), through the lens of certainty and efficiency. Is the price of renewable energy a trade off with job creation? Or can South Africa have both cheap photovoltaic renewable energy and the jobs associated with local manufacture?*

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# Contents

Plagiarism declaration.....	ii
Contents.....	iii
List of figures:.....	v
Introduction: .....	1
Section 1:.....	2
1.1 Background .....	2
1.2 Literature review.....	4
1.2.1 Macro Overview South Africa .....	4
1.2.2 Micro Overview South Africa .....	6
1.2.3 Overview of International policy mechanisms to support renewable energy's.....	9
1.2.4 Infant industry protection:.....	12
1.2.5 Protectionist policies in PV .....	13
1.2.6 Local content requirements in the rest of the world.....	14
1.2.7 Support mechanisms: Case studies .....	14
a) Spain:.....	14
b) Germany: .....	16
c) United Kingdom .....	18
1.2.8 Competitive Bid vs Feed in Tariffs in South Africa: .....	19
1.2.9 Localisation strategies that have been suggested for South Africa.....	21
a) Towards a PV Policy for South Africa – Potential Development & Impacts of PV .....	21
b) The localisation potential of photovoltaics (PV) and a strategy to support large scale roll-out in South Africa.....	22
1.2.10 Current policy support for localisation in South Africa.....	22
1.2.11 Job Creation in PV: .....	26
1.2.12 Renewable energy jobs – no net benefit, a criticism.....	28
1.2.13 Conclusions from the literature review .....	29
Section 2: Research questions & objectives .....	32
2.1: To what degree has the REIPPPP resulted in local manufacture?.....	32
2.2: How do the costs of locally manufactured panels compare to imported panels?.....	32
2.3: Where in the PV value chain can jobs be created? .....	32
2.3.1 Subsection on employment creation.....	32
2.3.2 Subsection: Impact of the current generic definition of local content.....	32
2.4: How could future rounds of REIPPPP be improved to maximise employment while still delivering value for money? .....	32

Section 3: Methodology.....	33
3.1 Research Design .....	33
3.2 Assumptions.....	33
3.3 Epistemological and ontological concerns.....	34
3.4 Data collection .....	34
3.4.1 Sampling.....	36
3.5 Data analysis methods.....	36
Section 4: Results.....	37
4.1 To what degree did the REIPPPP result in local manufacture .....	37
4.2 How do the costs of locally manufactured panels compare to imported panels?.....	38
4.3 Where in the PV value chain can jobs be created .....	42
4.3.1 Subsection: Employment creation in South Africa .....	44
4.3.2 Subsection: Impact of the current definition of local content .....	46
4.4 How could future rounds of REIPPPP be improved to maximise employment while still delivering value for money? .....	48
Section 5: Conclusion.....	52
5.1 Areas for future research:.....	55
Bibliography .....	56
Appendix A: How to become an IPP in South Africa.....	60
Appendix B: Successful bidders details, round 1 and 2 .....	63

## List of figures:

- Fig 1: Graphic representation of the market share of the top PV manufacturers.
- Fig 2: A diagram representing a simplified PV value chain.
- Fig 3: This figure shows the allocations to the various technologies. This diagram shows the extent of the procurement that is targeted by South Africa over the next 18 years.
- Fig 4: The table outlines the key milestones of the REIPPPP process.
- Fig 5: The figure shows the allocation of PV projects in the first round of bidding. The break down is by province
- Fig 6: Full breakdown of the prices, allocations, job creation and local content of the bids in rounds 1 & 2.
- Fig 7: Global status report, showing the prevalence of various policy instruments used around the world to encourage renewable energy technologies.
- Fig 8: Fundamental focus on price or quantity
- Fig 9: Understanding the market clearing point for renewable energy under the policy instruments of setting prices or setting quantities.
- Fig 10: Diagram demonstrating the theory of infant industry protection
- Fig 11: Comparison of the manufacturing subsidies between China and the USA
- Fig 12: International policy support mechanisms for localisation – specific focus on renewable energy
- Fig 13: Predicted and observed employment figures in Spain, and the corresponding study
- Fig 14: Break down of the firm activity per value chain item in Germany
- Fig 15: Graphic representation of internal and external failures in the UK's renewable energy roll-out
- Fig 16: Number of projects bid vs number of projects successfully commissioned in the UK
- Fig 17: Prices originally advertised by NERSA as feed-in-tariffs, 2009
- Fig 18: World trade organisation tariff codes and categories for PV
- Fig 19: Local content requirements and targets for the REIPPPP
- Fig 20: Possible split of local content targets and thresholds
- Fig 21: Example of actual commitment to local content and how it is broken down. As reported at the NERSA public hearings for a generation license.
- Fig 22: Breakdown of job creation along the PV value chain, Bloomberg
- Fig 23: Breakdown of job creation along the PV value chain, University of California
- Fig 24: Summary table of job creation along the PV value chain
- Fig 25: Map indicating the location of all of the round 1 and round 2 renewable energy projects in South Africa
- Fig 26: Table indicating the project, prices, sizes and suppliers for the projects using locally supplied modules
- Fig 27: Comparison of the bid prices for the projects bid in round 2
- Fig 28: Graph indicating the cost break down for projects that are put together by the EPC Tenesol,
- Fig 29: Job creation on utility scale PV systems – from mining silicon sand to grid tied PV
- Fig 30: Job creation in the manufacturing/production of PV, Where are the jobs created?

Fig 31: Job creation figures from round 1 and round 2

Fig 32: Job creation figures and percentages form observed and undertaken from round 1 and round 2

Fig 33: Price digression from round 1 to round 2

Fig 34: Average bid price from round 1 to round 2

Fig 35: Comparison of prices, job creation, construction costs, local content, local spend between round 1 and round 2

Fig 36: Full list of preferred bidders across technologies for both rounds 1 and 2

## **Introduction:**

South Africa's utility scale renewable energy industry began in earnest in November 2012. November 2012 saw the 1<sup>st</sup> round of utility scale renewable energy projects reaching financial close. These, renewable energy independent power producer, projects will be integrated into the national electricity grid and become part of South Africa's electricity generation mix.

South Africa's renewable roll-out is set against a period of strong growth in the international renewable energy market particularly 2010 and 2011. The recent slowdowns in the market in Spain and Germany make South Africa highly attractive to foreign developers, financiers and suppliers.

The path to reaching financial close for the first round of renewable energy project in South Africa was an uncertain one. South Africa switched from the more popular feed-in tariff (FiT) to a competitive bidding system in late 2010, causing delays and decreased confidence in the South African market.

Within the new, competitive bidding programme there were complicated surety, economic development, financing and structuring requirements. These requirements reflect the myriad and sometimes unaligned goals of National Treasury, the Department of Energy (DoE), the Economic Development Department (EDD) and the Department of Trade and Industry (the dti).

By the end of 2012, bids for the first two rounds of projects had been concluded, preferred bidders announced and financial close of round 1 achieved. This progress has raised questions. Were the goals of value for money and economic development attained? Are there additional areas where South Africa could improve the process to yield a more politically, socially or financially desirable result? Where is the job creation in these projects and what portions of the projects are localised?

This research paper will consider the impact of the competitive bid on local manufacturing, specifically in the photovoltaic industry, and develop an understanding where jobs are created along the value chain. This research paper will assess the competitiveness of locally manufactured photovoltaics? It will identify the portions of the value chain that yield high relative concentrations of jobs, and whether policy makers could design incentives and regulations that focus on the portion of the value chain which increases 'value for money' in South Africa?

## **Section 1:**

### **1.1 Background**

Renewable energy accounted for about half of the new energy installations world-wide in 2011. This prolific growth has led to a multi-billion dollar industry with a footprint in over 118 countries. Photovoltaic's (PV) have been installed in over 100 of these countries. Photovoltaic's had an extraordinary year in 2010/11 with global production and markets more than doubling. This growth was led by the European Union, particularly Germany and Italy. Cell manufacture has begun shifting to Asia with 10 of the top 15 cell manufactures located there (United Nations Environment Programme, 2011).

The PV market has exhibited a steep learning curve, and corresponding decreasing costs. In a review of 156 studies conducted into these learning curves, 95% of the studies put the price decrease at 17-24% (Winkler, Hughes, & Haw, 2009). This puts the price of PV on a drastically decreasing path. With the continued push toward a 'cleaner' way to produce electricity and the rapid price digression of PV it is expected that grid parity, where PV can compete directly with traditional fossil energy, will be reached in Europe within the next 3 years. Grid parity in Spain and Italy is expected in 2012, while further North in Germany this will be achieved by 2015 (European Photovoltaic Industry Association, 2010). Fuelled by this high growth international market, a vibrant and competitive manufacturing industry has sprung up.

Sovereign countries, states and provinces have set their own regulations and incentives to encourage the installation of PV. There is a bouquet of incentives that are commonly used internationally, the most popular being a feed-in tariff (FiT), with over half of the 100 countries making use of a FiT as a subsidy for renewable energy (REN 21, UNEP, 2011). South Africa had originally indicated that it would follow a REFIT – Renewable energy feed in tariff (NERSA, 2012). However, as the nuances of the South African context were introduced to this market, the policy changed to a competitive bid process.

As sovereign nations set targets and policy frameworks to establish and grow domestic PV manufacturing industries, they do so within the international guidelines of the World Trade Organisation. The WTO places tariff bounds of 10% on PV, these bounds represent the maximum import protection that a sovereign nation can implement as a customs tariffs (International Trade Administration Commission of South Africa, 2012). Subsidies and incentives offered around the world have led to the growth of a new multi-trillion dollar industry. The size and competition in this industry has led to trade disputes. In 2011/2012 these trade disputes began to become prevalent. The

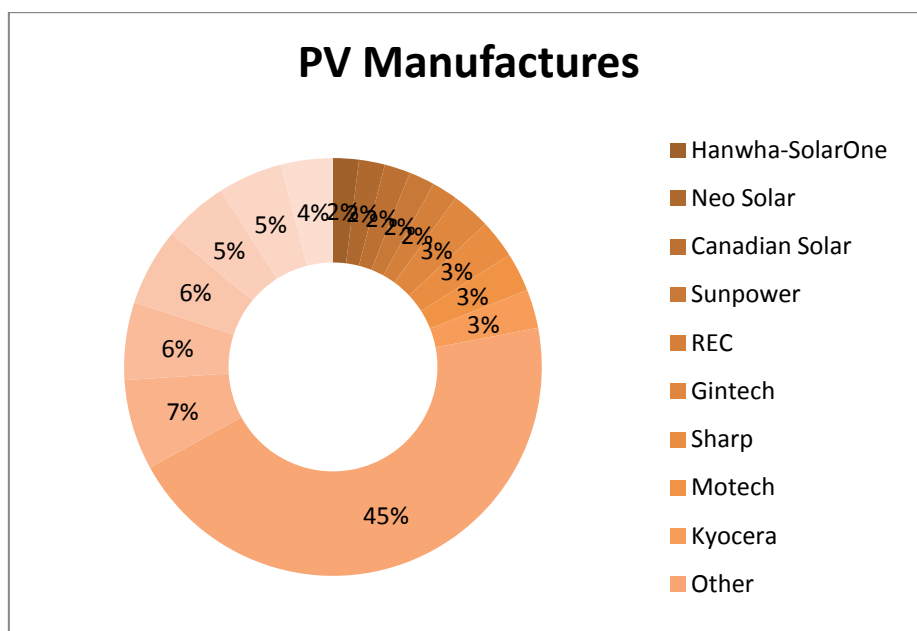
### **Department of Trade and Industry: What is PV?**

PV is a solar technology, which turns sunlight directly into electricity. It is growing in importance worldwide and is the subject of constant innovation, which is rapidly driving down costs. While PV does not consume water and can be installed rapidly, in the absence of a back-up electricity source it requires an electric storage source (a battery) to ensure supply at night or when the sun does not shine. DTi (2012).

coalition for American solar manufacturing (2011) has challenged these bounds at the World Trade Organisation as they believe there is dumping and anti-competitive behaviour on the international PV markets.

President Obama recently (2012) reviewed the hotly contested import duty on PV panels from China. The review found that the dumping margins into the US market ranged from 31% - 249.96% on imported Chinese panels. While the US commerce Department is only expected to make a final ruling in late 2012, the indications are they will implement anti-dumping measures (AD) as well as countervailing duties (USITC, 2012). It is speculated that these measures will impact the US market by approximately \$3.1bn, in duties. The investigation into Chinese dumping on the international markets is important for the review of the policy in South Africa. At a policy level, the South African government must decide if the country is best served by importing subsidised PV, or through encouraging local manufacture.

The international PV market does exhibit some economies of scale, but not enough to have pushed the market into an oligopoly (REN 21, UNEP, 2011). The market breakdown below shows a highly competitive non-monopolistic market. Competition is driving prices down, and this will undoubtedly affect the structure of the market. The comfort afforded PV through the standard use of a FiT has led to a diverse market in 2011. This diverse non-oligopolistic market is expected to change as price competition drives the market; several market expert-analysts (Bloomberg NEF, PwC, Spanish consortium in SA) suggest that the increase in anti-dumping measure and the moves towards price competition internationally will see a consolidation of the PV manufacturing market to one that more strongly resembles an oligopoly (REN 21, UNEP, 2011).



**Fig 1: The diagram above gives a graphic representation of the market share of the top PV manufacturers. The diagram shows that this market supports many players with none exhibiting a dominant market share, with the largest player only cornering 7% of the market (REN 21, UNEP, 2011)..**

In the breakdown of the value chain for PV it is common to see manufacturers focusing only on module manufacture, while sourcing their wafers and cells from the most competitive of 3 or 4 top wafer suppliers. This strategy allows manufacturers to make use of the rapid price digression in

manufacturing silicon wafers for PV, without bearing the sunk cost of vertically integrating wafer manufacture into their supply chain. The diagram below represents the PV value chain from silicon sand to a full solar system. (Grau, Hou, & Neuhoff, 2012)



**Fig 2:** The diagram above represents a simplified PV value chain, it begins with the mining of silicon sand and ends with a grid tied PV system. Each section of the value chain represents an opportunity for localisation in South Africa. Source: (SunSi) – The PV value chain.

## **1.2 Literature review**

### **1.2.1 Macro Overview South Africa**

The integrated resource plan 2010 (IRP2010) is the electricity strategy for South Africa for the next 20 years. The time frame spans 2010 to 2030, and the plan identifies the type and quantity of technologies that will supply South Africa's electricity mix. This is the main policy document of the Department of Energy and underpins the department's commitment to renewable energy. A total 42% of the 'new build' in this period is allocated to clean or renewable sources.

The first tranche of renewable energy deployment is the renewable energy independent power producer procurement programme (REIPPPP). This programme will see 3750MW of renewable energy installed by 2016. The graph below describes the full allocations made to each of the technologies in the IRP2010 and the REIPPPP. The initial programme will run until 2016, after which the targets laid out in the IRP2010 may be adjusted and then rolled out.

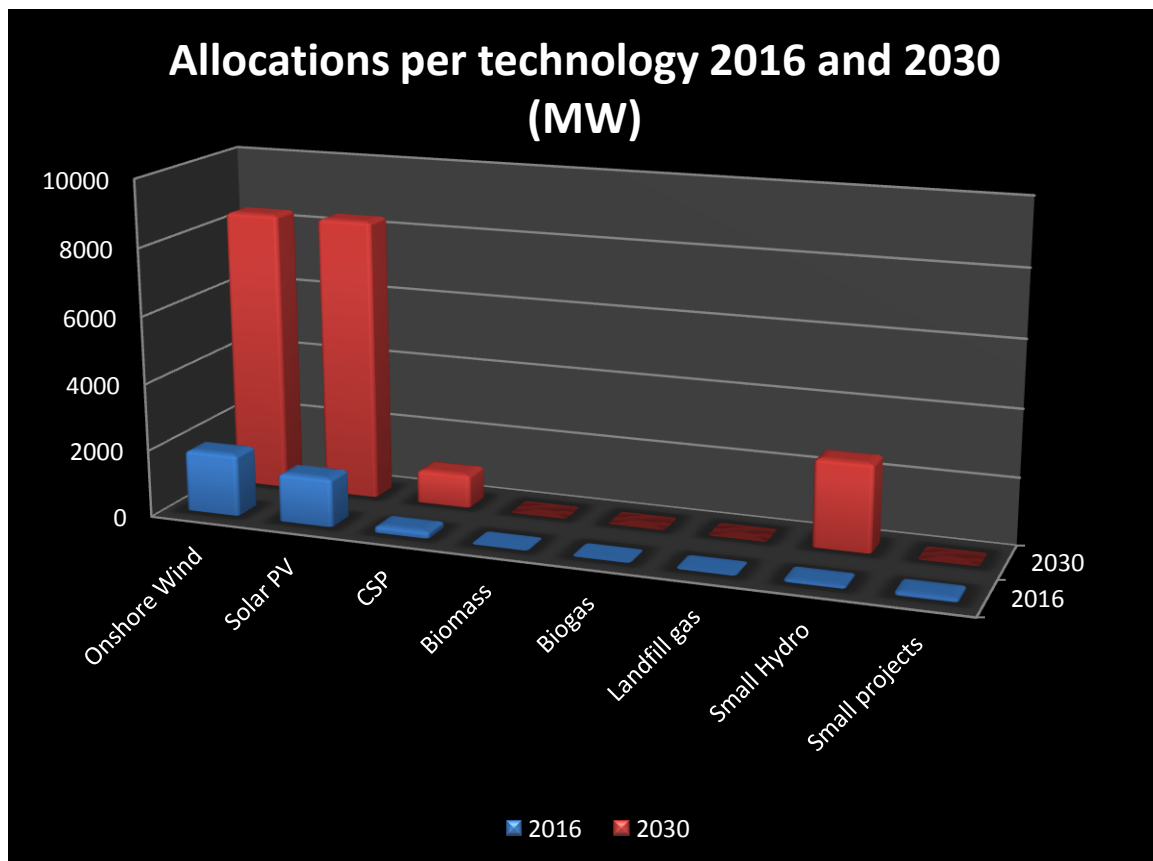


Fig 3: The above figure shows the allocations to the various technologies in the IRP2010. The figures in blue are part of the REIPPPP and are targets for 2016. The figures in red are the combined totals from the IRP2010. This diagram shows the extent of the procurement that is targeted by South Africa over the next 18 years. Source: Author Generated with figures from the IRP2010 and the IPP Procurement programme (Department of Energy, 2011) (Department of Energy, 2012)

The socio-economic background in South Africa is one of structural inequality and high unemployment. Some of the latest figures suggest the unemployment rate in SA is as high as 25% (Statistics South Africa, 2012). It is in light of this high unemployment that South Africa has committed itself to job creation. Targets of 1 million climate jobs have been set by civil society and labour; this is endorsed by the national government push to increase employment creation. In the President’s State of the Nation speech job creation was a clear priority (Zuma, 2012).

The ministries of Economic Development and Trade and Industry have been working together to ensure that the government procures goods/services locally. The policy position behind this is to encourage South African manufacturing by ensuring that Government’s own expenditure is enabling for the manufacturing sector. Market signals for this policy intention are plentiful. The local procurement accord, signed in October 2011, targets 75% local content in all Government and parastatal procurement. Further, the industrial policy action plan (IPAP) focuses on sector strategies and ‘designating’ products that are to be procured locally.

The renewable energy industry is included in this development strategy although the details are, as of December 2012, not finalised. The last piece of strategic documentation that elucidates the Government’s commitment to renewable energy is the green economy accord signed by labour,

government and business in November 2011, to encourage 300 000 'green jobs'. This accord seeks to unlock the job creation opportunities in the green economy.

It is clear from the political and policy leadership that the renewable energy industry will form part of South Africa's industrial future. Ensuring that there is sufficient coherence in the policy frameworks is a daunting task. The level of complexity and cross-cutting nature of any renewable energy roll-out makes it a considerable logistical, legal, financial and technical challenge. It will be in overcoming this challenge and understanding the policy levers that are available that the job creation opportunities in this sector will be realised.

The public-private-partnership unit at National Treasury, the DoE, Eskom, NERSA, the dti and Economic Development Department have worked together, and produced a well-managed, internationally lauded programme. The programme encourages iterative learning, and through this iterative learning it is possible to maximise that value of the renewable energy rollout to South Africa. The ability to add to policy and political frameworks will reassure manufacturers and promote the growth and job creation in all facets of the renewable energy economy.

## **1.2.2 Micro Overview South Africa**

The IRP2010 sets the targets for the amount of PV to be installed in South Africa for the next 20 years; over the period SA intends to integrate 8400 MW of photovoltaics into the national grid. This amount equates to approximately 20% of the currently installed grid capacity (Department of Energy, 2011). The first projects are being allocated through the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP). The REIPPPP is a DoE programme that is assisted by the National Treasury to ensure that these public-private-partnerships (PPP's) are awarded. In the first procurement allocation, running from 2011 to 2016, there are 5 bid windows for a total allocation of 1450MW of PV. These windows will continue to be bid until the full allocation of 1450MW is awarded to independent power producers.

In the 1<sup>st</sup> round of bidding there was no upper limit to the amount of PV that would be awarded, save the 1450MW overall allocation, and theoretically the full 1450MW could have been awarded in just the first round (Department of Energy, 2012). In actuality 631MW were allocated, representing all of the projects that met the qualifying criteria in time to bid in round 1. Realising that the market would benefit from certainty of what would be available in the future, the department of energy decided to 'smooth' the roll-out between rounds. In limiting the maximum amount to be awarded in round 2 to 450MW, they effectively ensured that there will be available capacity for round 3. The underlying motivation for this staggered allocation was to avoid boom and bust cycles.

A smooth and predictable market gives comfort to both developers and manufacturers, as there is some certainty in the future demands. A smooth market allows development finance institutions time to find partners and encourage the capital investments needed to establish manufacturing plants to supply this industry (Department of Energy, 2012). This smoothing was intended to reduce the overall uncertainty and decrease risk through clear allocations and time frames for the programme running until 2016. The windows for procurement and timeframes of this programme are outlined in the table below.

	Deadline for bid Submission date	Announcement of preferred bidders	Signing of PPAs, Financial Close and Connection and implementation agreements
Phase I	4 November 2011	6 December 2011	19 June 2012
Phase II	5 March 2012	14 May 2012	13 December 2012
Phase III	20 August 2012	29 October 2012	31 May 2013
Phase IV	4 March 2013	13 May 2013	13 December 2013
Phase V	13 August 2013	21 October	26 May 2014

Fig 4: The table above outlines the key milestones of the REIPPPP process. It adds certainty to the market by clearly defining future dates for procurement and financial close. (Department of Energy, 2012)

The detailed selection criteria for successful bidders are fully outlined in the tender documents. These tender documents are available on the REIPPPP website, but require the user to purchase them for the amount of R15 000. This cost provides a challenge in accessing the full bid details. There is, however, sufficient detail reported in the media and through public hearings so that a rich picture of the pertinent aspects of the bid can be understood. This public information, combined with the information made available to the researcher through the work of the GreenCape has led to a solid understanding of the process. This research paper will place an emphasis on the stakeholder consultations and public hearings held through the National Energy Regulator of South Africa's (NERSA) licensing process, this is a rich source of information that is public record. This public information will be used in conjunction with personal correspondence with the dti and the Department of Energy (DoE). This has produced a clear picture of the bid requirements.

### Certainty and financial close:

At the time of writing, November 2012, Round 1 financial close has just been achieved, after several months of uncertainty and delays. In addition, phase (round) 3 submissions have been pushed back to May 2013. The DoE tried to reduce uncertainty by publishing a timetable; however, the inability to stick to the timetable has actually increased uncertainty. This certainty is a key determinant for companies wishing to set up manufacturing.

To be competitive, a manufacturing operation requires certainty that there will be a multi-year market to supply, this means it can re-pay the investment in the facility over more than one set of orders, allowing a reduction in price.

## Structure of the REIPPPP

The bids are evaluated on criteria made up 70% on price and 30% on local economic development targets. The local economic development criteria include several minimum requirements: 35% local content requirement for PV; Setting up a trust, which receives at least 1% of turnover, whose beneficiaries are the local community (within 50km from the site); producing a socio-economic development plan; BBBEE etc. Within the criteria for these projects perhaps the most important are the binary thresholds, where applicants either pass or fail. The local content requirement is one such binary requirement, with 35% of spending required to be local. This paper will interrogate this local content requirement and consider in further detail the implications and obligations of such a requirement.

All these deals are structured as project finance public private partnerships. In order for National treasury, the guarantor from the government's side, to accept the risk, multiple contracts needed to be in place. These range from fully wrapped EPC agreements right through to shareholder agreements, social development plans, job creation indications, financial and technical submission etc. The submissions for these projects were extremely onerous with anecdotal stories of the paper submitted in a single bid weighing in the order of 300 Kilograms and consisting of over 22 000 pages(SAWEA, 2012).

The permissions and processes, appendix A, to develop a project to bid stage were complicated and it typically took developers about 2 years to get the necessary permissions for a site to be bid-compliant. In the 1<sup>st</sup> window of bids, 18 bidders were successful, totalling 631.54 MW of PV (Department of Energy, 2012). The distribution of these projects is concentrated in the Northern Cape, the primary reason for this is that the Northern Cape has the highest levels of insolation<sup>1</sup> in the country.

By the end of 2011 the bids were evaluated and the preferred bidders announced; the resulting provincial allocations for PV are below.

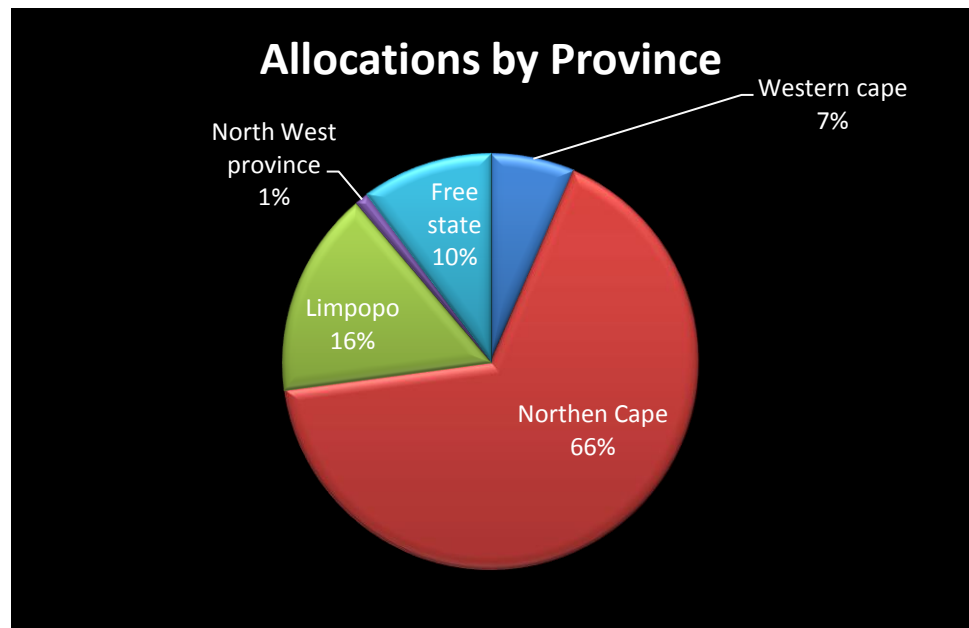


Fig 5: The figure above shows the allocation of PV projects in the first round of bidding. The break down is by province. Source: Author generated with figures from the IPP-Procurement programme

The geographical distribution of successful bidders is a function of price and economic development criteria. The areas of the country where the resource, insolation, is the best will win the majority of the allocation. This is because the systems will be more efficient, yielding a greater production of electricity per PV panel – this translates into a more effective asset, and, consequently a lower bid price.

In round 1 the average price that was bid was R2.75 per kwh. The average price in round 2, just six months later, was R1.65 per kwh. This massive price drop will be more thoroughly analysed in the

<sup>1</sup>Insolation is the measure of solar radiation energy received on a given surface area recorded during a given time

body of the research paper to ascertain if this is in line with the international literature on price digression, or if round 1 was paid a premium. The bidders in round 1 had a first mover advantage, with the total qualified to bid in round 1 expected to be less than the allocation.

Results of round 1 and 2	Window 1	Window 2
Price: Fully Indexed (R/MWh)	R 2 758	R 1 645
MW allocation	632	417
Total project cost (Mil)	R 21 937	R 12 048
Local content value	R 6 261	R 5 727
Local content %	28.50%	47.50%
Job creation (Construction)	10 386	4 557
Job creation (O&M)	221	194

Fig 6: Full breakdown of the prices, allocations, job creation and local content of the bids in rounds 1 & 2. Source: Author generated, using Information from the DoE (Department of Energy, 2012)

South Africa is on the verge of integrating large scale renewable energy into the national grid and, for the first time, introducing a significant number of independent power producers into the energy generation mix. A huge amount of ground-work has been done to get the key role players to the point where projects have reached financial close and will begin construction in early 2013. South Africa has moved to a new electricity generation paradigm, one that includes renewable energy from independent sources. This liberalisation of the electricity market has happened through multiple policy efforts.

This programme, like any large Government infrastructure spends, has the potential to create many thousands of jobs. The creation of these jobs relies on getting the rules, incentives and goals of the Government clearly, confidently and consistently signalled to the market.

### 1.2.3 Overview of International policy mechanisms to support renewable energy's

The market for renewable energy has relied on policy incentives and subsidies. As the market grows the levelised cost of electricity decreases and it is predicted that the support through incentives and subsidies will decrease. The two paradigms of support come in the form of feed in tariffs or a fixed quantity competitive bidding process. Each of these processes has their own nuances, benefits and risks. The intention of these policy interventions is to create certainty in the market, which in turn will result in job creation and manufacturing.

#### Feed in tariff (FiT)

A feed-in tariff scheme involves an obligation on the part of electric utilities to purchase electricity produced by renewable energy producers in their service area, at a tariff determined by the public authorities and guaranteed for a specified period of time, typically 15-20 years (Menanteau, Dominique, & Lamy, 2003). Under the FiT scheme all commercially exploitable sites will be developed, right up until the point that the marginal cost of production is equal to the tariff offered. Feed-in tariffs are widely used as a mechanism to add price certainty to the renewable energy market.

## Competitive bidding:

In a competitive bidding processes, the regulator defines a reserved market for a given amount of renewable energy, inter or intra technology, and organises a competition between renewable producers to allocate this amount. Electric utilities are then obliged to purchase the electricity from the selected power producers. Competition focuses on the price per kwh proposed during the bidding process. Proposals are classified in increasing order of cost until the amount to be contracted is reached. Each of the renewable energy generators selected is awarded a long term contract to supply electricity at the pay-as-bid price (Menanteau, Dominique, & Lamy, 2003).

## Policy prevalence internationally:

The below table is an excerpt from the United Nations Environment Programme’s (UNEP) global status report. It has broken down the different types of support offered internationally to renewable energy into regulatory policy, fiscal incentives and public financing support. There are varying degrees of support across developed, middle income and developing economies, but when aggregated, the spread of policy support is captured in the following basket.

	REGULATORY POLICIES						FISCAL INCENTIVES				PUBLIC FINANCING	
	Feed-in tariff (incl. premium payment)	Electric utility quota obligation/RPS	Net metering	Biofuels obligation/mandate	Heat obligation/mandate	Tradable REC	Capital subsidy, grant, or rebate	Investment or production tax credits	Reductions in sales, energy, CO <sub>2</sub> , VAT, or other taxes	Energy production payment	Public investment, loans, or grants	Public competitive bidding
■ HIGH-INCOME COUNTRIES												
▲ Some states/provinces within these countries have state/provincial-level policies but there is no national-level policy.												
Australia	▲			▲		●	●				●	
Austria	●			●		●	●	●			●	
Belgium		▲	●	●		●	●	●	●			
Canada	▲	▲	●	●			●	●	●		●	●
Croatia	●						●				●	
Cyprus	●						●					
Czech Republic	●			●		●	●	●	●			
Denmark	●		●	●		●	●	●	●		●	●

Fig 7: Global status report, showing the prevalence of various policy instruments used around the world to encourage renewable energy technologies (REN 21, UNEP, 2011).

This UNEP table can be further simplified into the fundamental support policy techniques. These fundamental policies focus on the same goal, namely, creating a market for renewable energy. These two policy choices have different starting points with one focussed on price and the other on quantity. In the first case, a feed in tariff (FiT), the price is set, and the quantity that can be supplied is determined by the market. In the second instance, competitive bidding, quantity is set and the price is determined by the market.

Separating the fundamental techniques used internationally these can be aggregated into the following matrix.

Fundamental types of regulatory strategies		
	Price Driven	Capacity Driven
Investment focussed	Rebates/ Tax incentives	Bidding
Generation Based	Feed-In-Tariff/ Rate based incentives	Quotas

Fig 8: Fundamental focus on price or quantity (Haas, Eichhammerb, Huber, & al, 2004).

Looking further into the market clearing price, the graphs below show the uncertainty resulting from each fundamental policy technique. Understanding where the uncertainty is allows policy makers to design a system that best fits the broader requirements of that government.

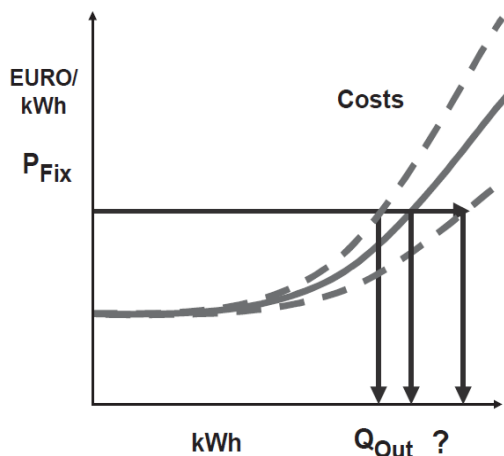


Fig. 1. How a feed-in tariff works.

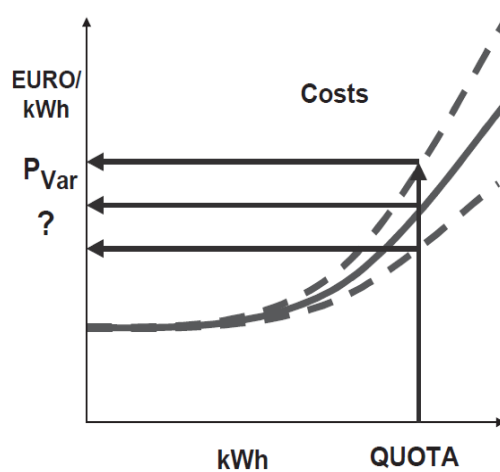


Fig 2: Quota/Bidding system

Fig 9: Understanding the market clearing point for renewable energy under the policy instruments of setting prices or setting quantities. (Haas, Eichhammerb, Huber, & al, 2004).

There are benefits and costs to each of these systems. Graphically these can be seen by identifying where the uncertainty lies. In the FIT, fixed price example the quantity that will be provided at the set price is uncertain. This is a result of several factors including the resource at the site, the cost of the equipment and the cost of capital. The final price is known but there can be inefficiencies created by large price digressions. These digressions result in a higher than necessary price and huge quantities being installed. In this market it is very difficult to set a 'fair' price for renewable energy.

In the fixed quantity/quota system there is the risk of bidders not completing projects as they have underbid the true costs in order to win the bid. These 'low' bids often bank on some technology price digression over the 6-months between bidding and construction. This results in projects being awarded, but not constructed. These sites are effectively sterilised and are lost to the system. These are typically sites with the best resources and sterilising them is an inefficiency in the system design.

### 1.2.4 Infant industry protection:

Alexander Hamilton and Daniel Raymond are credited with the formulation of the infant industry protection concept. In its simplest form, the argument for infant industry protection is graphically represented,

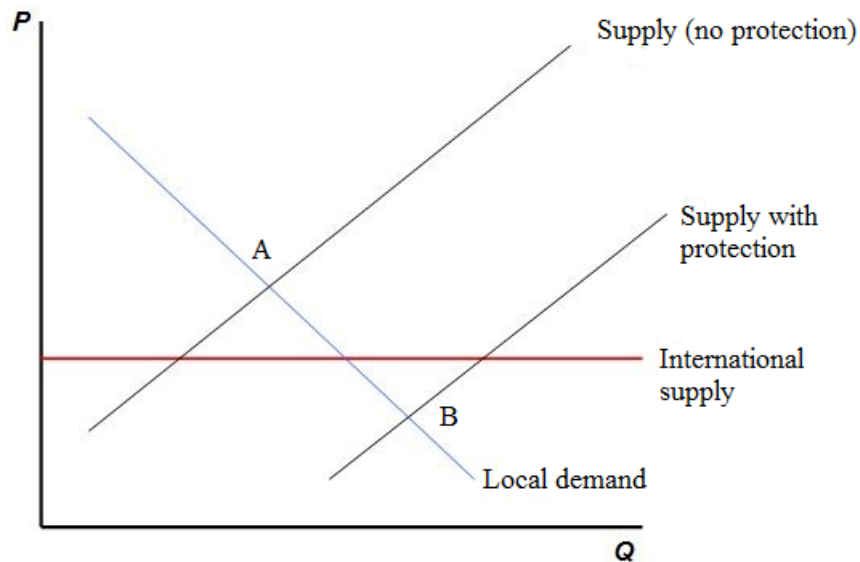


Fig 10: Diagram demonstrating the theory of infant industry protection

There are a number of assumptions that underpin this model; domestic supply does not impact the international price, demand increases with a decrease in price, there are economies of scale associated with a higher output quantity sufficient to drop below the world price, the world price is at a stable equilibrium, these economies of scale are realisable and can be achieved by stimulating local demand making it feasible to move from point A to point B.

The model contends that, through the economies of scale associated with manufacturing, an infant industry can be moved from point A (uncompetitive with the global price) to point B, a higher quantity output at a lower price. The temporary subsidy is designed to move from one long run equilibrium supply curve to a new, lower price, equilibrium. This protection can be through a host of policy tariffs and incentives, including stimulating local demand through local content requirements, protectionist policies through import tariffs, concessionary finance, soft loans or grants to increase supply.

In South Africa this argument has been used by the dti to establish an automotive manufacturing sector (Department of Trade and Industry, 2012). This sector has created major employment on the back of this protectionism. Further, it is clear that the South African government is looking for ways to encourage a local manufacturing industry for renewable energy.

The seminal works on technology localisation and innovation concentrate on the need for protectionist policies and incentives for renewable energy. The protections that are offered by sovereigns to create an industry can, at the margins, begin to compete with each other – driving the international price down.

## 1.2.5 Protectionist policies in PV

The most recent international developments in protectionist policy have seen the US adding import protection to their bouquet of PV policies. This was to combat the perceived dumping of Chinese panels. This topic has been hotly contested over recent months and a trade dispute lodged at the World Trade Organisation (WTO). The US department of Commerce investigated and found that there was sufficient reason to impose duties on incoming Chinese PV panels.

On March 20, 2012 Green tech media reported;

*The Department of Commerce's preliminary verdict on unfair subsidies for Chinese solar panels was handed down today, along with what amounted to surprisingly low tariffs. The preliminary determination indicates the DOC's intention to impose a countervailing duty of 4.73 percent on U.S. imports from Trina Solar, 2.9 percent from Suntech, and 3.59 percent from all other remaining Chinese manufacturers (Wesoff, 2012).*

By May 2012 the situation had become irreversible when the US commerce department made public the finding that there had been dumping of Chinese panels on the US markets. The dumping rates were approximately 31% for SunTech, Trina Solar and 59 other exporters and 249% for all other Chinese manufacturers (Department of Commerce (USA), 2012). The EU is busy investigating similar anti-dumping measures. This became a hot topic at the World Economic forums annual meeting of new champions, September 2012. China exported over \$25bn in PV panels and products to Europe last year. According to Xu Ruilin, head of the Solar Industry Association in Jiangsu province, this case will be the largest trade dispute involving China (Daily, 2012).

Clearly renewable energy and the incentives that are offered to stimulate industry have become a contested space. The manufacturing, job creation and economic opportunities afforded in this new industry are driving this competition. In 2011 Stanford University produced a study to compare the localisation incentives and benefits in China and the US. The results are captured in the table below.



Manufacturing Subsidies for PV in the US and China		
		
<b>Domestic ownership requirements</b>	No	Yes
<b>Sales/VAT waiver</b>	Yes	
<b>Property tax credits</b>	100%	NA
<b>Subsidised cost of debt</b>	3-4%	3-4.5%
<b>Subsidised debt limit (D/D+E)</b>	60%	80%
<b>Fee ride on subsidised Debt</b>	1 Year	1 Year
<b>Facilities Grant</b>	100%	100%
<b>Land grant</b>		Discount purchase (land use right)
<b>Training grant (mil USD)</b>	0.5-4.5	
<b>Effective corporate income tax</b>	28%	21%
<b>Income tax credits</b>	5-7 Year holiday	20 Year holiday

Fig 11: Comparison of the manufacturing subsidies between China and the USA Source: (Goodich, James, & Woodhouse).

The table above leaves shows that both of these super-powers are actively and aggressively pursuing a competitive PV manufacturing sector through incentives. It is evident that there are numerous interlinked incentive policies which will now be joined by countervailing duties, and anti-dumping policies.

### 1.2.6 Local content requirements in the rest of the world

As we have seen above, the contestation over trade in the PV industry is increasing with the USA imposing both countervailing and anti-dumping duties on Chinese PV manufacturers. Looking further afield to the global markets the table below illustrates the most common policy support measures for localisation and which of the large markets use these policies.

Policy and support measures for Localisation	
Policy Instrument	Countries using these
Local content requirements	Spain, China, Brazil, Canadian provinces,
Financial and tax incentives	Canada, Australia, China, US states, Spain, China, Germany, Denmark
Favourable customs duties	Denmark, Germany, Australia, India, China
Export credit assistance	Denmark, Germany
Quality certification	Denmark, Germany, USA, Japan, India, China

Fig 12: International policy support mechanisms for localisation – specific focus on renewable energy. Source: Author generated table: Based on, (Lewisa & Wiser, 2007).

These policy support mechanisms are often used as a bouquet, with multiple layers of industrial protection being applied.

Critics of Renewable energy technologies have called it “a perpetual infant industry,” with its competitive viability always somewhere on the horizon (Bradley, 1997). However, with the price of new build renewable energy already cheaper than new build coal, this argument seems to have lost its momentum.

### 1.2.7 Support mechanisms: Case studies

#### a) Spain: The evolution of the Spanish support mechanisms and employment figures for PV.

Spain has had several iterations of renewable energy support policies. The first came in 1997 after the adoption of the Electric Power Act which introduced a special tariff regime for renewable energy and combined heat and power. The second evolution of the Spanish renewable energy policy framework was in 2004, when a royal decree (4361/2004) allowed generators to choose between i) a Feed-In-Tariff (FIT) or ii) a market price plus premium. A further change in 2007, introduced floor and cap prices for some technologies; the tariff and structure of this policy proved to be highly attractive for PV developers. This, combined with a strong Euro, a plateauing housing market and decreasing cost of solar PV, led to a massive growth in investment in the Spanish PV market in 2008 (IEA, 2009).

Spain experienced a boom and bust cycle in its PV sector with the tremendous growth of 2007 and 2008 being sharply curtailed in 2009. In megawatt terms Spain installed 544MW in 2008, 2708MW in 2008 and then only 155MW, less than 6% of 2008, in 2009. The growth in this PV market was driven by systems slightly smaller than 100kw. These 'small' systems accounted for 80% of the total installed capacity during 2008. The prevalence of these small systems was no co-incidence, 100kw was the cut off between separate tariff regimes with the smaller "solar orchards" receiving the most attractive tariff – 44 euro cents kwh, almost double the incentive offered for larger systems (Gonzalez, 2008). This growth in capacity in 2008 put significant financial burden on the Spanish electricity system. As the market became aware that the strain was too much for the system to bear, more and more developers crowded in to take advantage of the lucrative incentives before they were changed, over 500MW of PV was installed every month in the last 3 months of 2008, just before the regulations changed (Del Rio & Mir-artigues, 2012).

This incredible boom led to stringent new regulations in late 2008. The salient points of these regulations were to limit the capacity for each technology. This quota system was administered on a first come first served basis. The second key change was the redefinition of small scale generation, this was split into rooftop and facade systems bigger and smaller than 20kw. This redefinition of the rules collapsed the Spanish PV market, with only 155MW installed in 2009, less than 6% of what had been installed the previous year (Scallenberg-Rodriguez & Haas, 2012).

Over the past 10 years Spain has included various premium tariffs to complement the FIT regime, however Solar photovoltaic can only apply for the fixed-FIT system (Scallenberg-Rodriguez & Haas, 2012). The evidence in Spain demonstrates that the market is much faster in exploiting opportunity than the Government is at regulating it. This has placed a significant burden on the Spanish electricity system.

In the Spanish case it was a high-priced, no-quota, feed-in-tariff for PV systems smaller than 100kw that led to an incredible boom and bust cycle. These high tariffs drew investors and developers to Spain; it also drew manufactures and researchers to Spain. The Spanish government used a suite of incentives including local content requirements, regional investment subsidies, soft loans and high FIT's to establish a vibrant PV manufacturing industry in Spain with over 500 companies involved in the manufacture of PV (Mani, 2010) (IEA, 2009). This manufacturing industry created many of the jobs in the Spanish PV market.

The employment figures below, predicted and observed, are taken from the Asturias region in the North of Spain. These figures indicate the split of jobs between operation and maintenance and construction and installation.

Employment ratios for Photo Voltaics			
Construction & installation	Operation & maintenance ratio	Units	Study
7.1	0.1	MW	Electric Power Research Institute California
6.2	1.2	MW <sub>a</sub>	Renewable Energy Policy Project 2001
5.8	4.8	MW <sub>a</sub>	Greenpeace 2001
1.3	0.3	MW <sub>p</sub>	Renewable Energy Policy Project 2001
1.2	1	MW <sub>p</sub>	Greenpeace 2001
82.8	0.4	MW <sub>p</sub>	Spanish Renewable Energy Development Plan 2010
34	2.7	MW <sub>p</sub>	Observed

Fig 13: Predicted and observed employment figures in Spain, and the corresponding study. Source (Moreno & Lopez, 2008).

The table above reflects on some of the projected job creation targets and observed job creation results of the Spanish system. The table shows a huge variation in predicted versus observed job creation figures in Spain. Clearly the Spanish had focussed on the job creation possibilities that stem from the installation of many, smaller systems. The fact that well over 21 000 systems were installed in 2008 alone speaks to the job creation potential of having a small “solar orchid” system (Del Rio & Mir-artigues, 2012). While the real results of construction and installation did not meet the ambitious targets of the Spanish renewable energy development plan, they did exceed the amounts predicted in the other studies. This is a result of the numerous small systems that were installed, resulting in a higher number of jobs.

#### **b) Germany: The German PV market; Incentives, manufacturing and Job creation**

Germany is the country that has the most PV installed world-wide. The policies and support mechanisms for PV in Germany have run since 1991. The Electricity Feed-in Act (Stromeinspeisegesetz 1991–1999/2000) was the first policy to provide incentives for renewable electricity generation in Germany. A project called the ‘1000 Solar Roofs Initiative’, which was applied between 1991 and 1995, was the first PV-specific support scheme (Grau, Hou, & Neuhoff, 2012).

On the back of the successes and lessons from the 1000 solar roofs the ‘100 000 Solar Roofs Initiative’ followed in 1999–2003. The structure of these programmes were similar, they provided loans at low interest rates for small scale PV installations. These loans were granted by the state-owned German development bank (KfW). It was only in 2000 that a feed-in tariff scheme with PV-specific support levels was established through the Renewable Energy Sources Act (Grau, Hou, & Neuhoff, 2012).

The German photovoltaic industry supports around 70 manufacturers (of silicon, wafers, solar cells, and modules) and more than 100 PV equipment manufacturers. It employs more than 57,000 people in the manufacturing and installation of PV. German PV industry sales surpassed the €9.5 billion mark in 2008. The graph below gives an indication of the portions of the value chain that have attracted high and low concentrations of companies in the German PV industry. It is clear that as one

moves up the value chain more companies enter the market. The graph below shows that the highest number of companies operate in the module manufacture/assembly portion of the value chain.

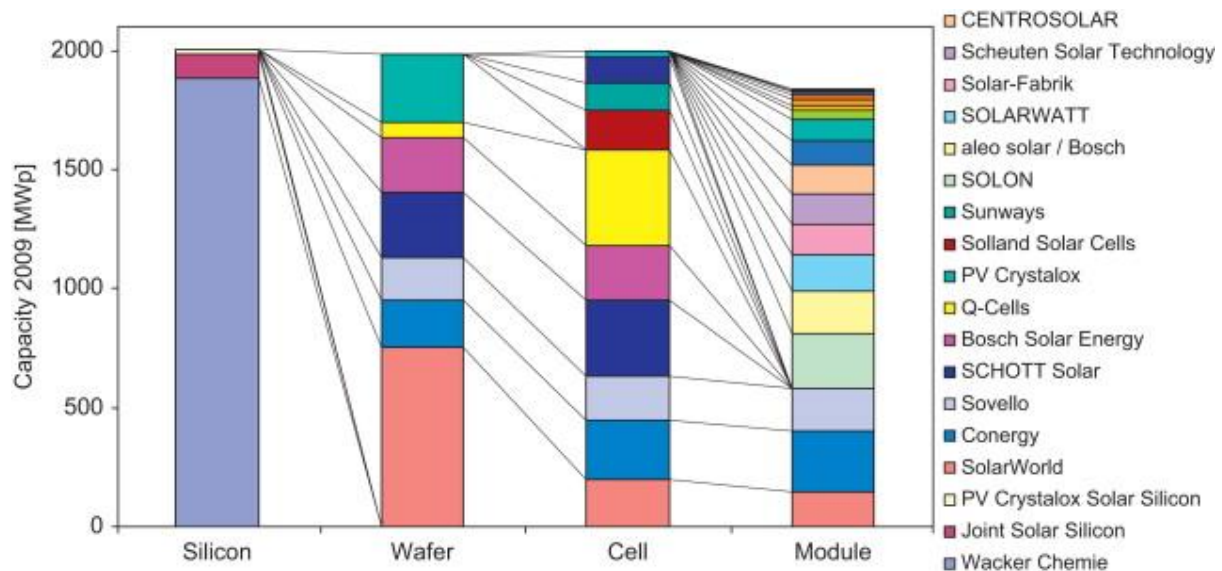


Fig 14: Break down of the firm activity per value chain item in Germany. Source: (Grau, Hou, & Neuhoff, 2012).

The stimulation, growth and success of the German PV manufacturing industry was the result of a three-pronged approach to incentives.

- Grants/cash incentives (including the Joint Task programme and the Investment Allowance programme);
- Reduced-interest loans (at national and state level); and
- Public guarantees (at state and combined state/federal level).

For all manufacturing operations, German or foreign, the same conditions and incentive apply. The funding is provided through the German federal government, the European Union (EU), and the individual federal states within Germany. A myriad of specific criteria within each programme determines individual investment incentive rates, but as a rule of thumb the highest incentive levels are usually offered to small and medium-sized enterprises (Grau, Hou, & Neuhoff, 2012).

Germany also invests significant resources in research and development through the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU). The IEA reports that the BMU invested close to 40 mil euro towards PV research and development in 2008. When added to the 163mil Euro that the private sector invested in 2008, this meant that over 200mil Euro was spent on PV research and development in Germany in 2008. According to Grau, more than half of the BMU funding is focused on silicon wafer technology, a portion of the value chain that is highly capital intensive.

According to the International Renewable Energy Agency (IRENA), in 2011, Germany had in excess of 107 00 direct and indirect jobs in the PV industry, which translates into about 28 FTE jobs per MW.

This was on the back of a record year in 2011 with 7.5 GW of PV being installed, bringing the total PV capacity in Germany to almost 25GW (REN 21, UNEP, 2011).

### c) United Kingdom: Review of the UK competitive bid

The UK has had several specific delivery programmes for the generation of electricity from renewable energy sources (RES-E) since 1990. There were two main policy instruments, the first of which, the Non-Fossil Fuel Order (NFFO) was a centralised bidding system for renewable energy (1990-8). The second was the Renewables Obligation (RO) – a tradable green certificate (TGC)/quota system that came into effect in April 2002 (Mitchell, Bauknecht, & Connor, 2006).

In 2007 under increasing evidence that the renewable energy target set in the UK would not be reached, the UK government published the White Paper on energy. The primary change introduced in this paper was differentiated levels of support for different renewable energy technologies (Wood & Dow, 2011). Wood and Dow provide a strong analysis of the internal and external problems with the system that was used in the UK. The table below is a summary of their results.

*G. Wood, S. Dow / Energy Policy 39 (2011) 2228–2244*

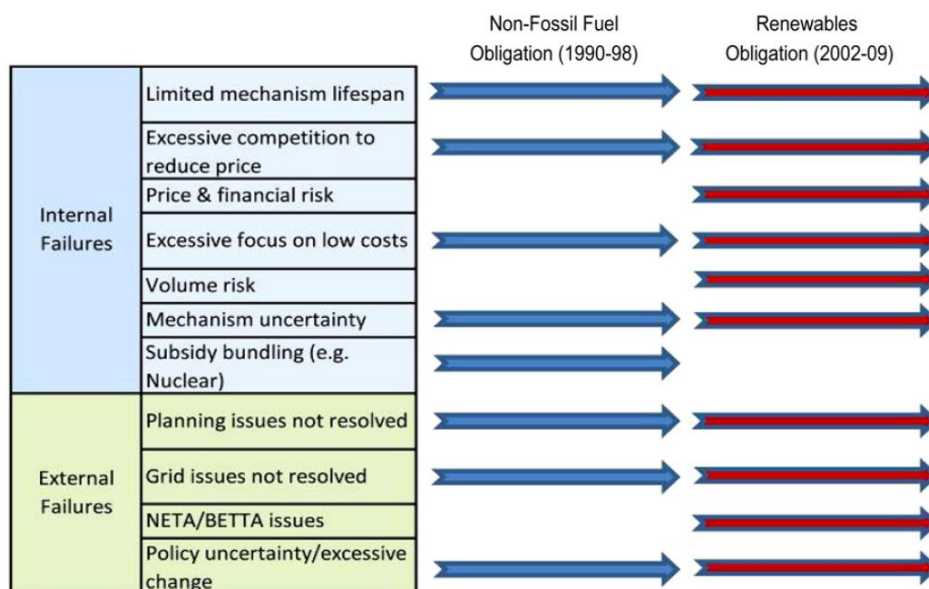


Fig 15: Graphic representation of internal and external failures in the UK’s renewable energy roll-out. Source: (Wood & Dow, 2011).

Further review of the UK competitive bidding systems points to many “sterilized” sites. Sterilization occurs when a site is developed and then bid at an unrealistically low tariff in order to win. This site will eventually not be built, owing to the unrealistic price of the bid. The table below shows some of the results from the UK. It is clear that less than half of the contracted projects are ever commissioned (Wood & Dow, 2011).

A. Total numbers and capacity of projects offered in the NFFO by contacts given and commissioning in 2004				
Technology	Contracted projects		Commissioned projects (March 2004)	
	Number	Capacity <sup>a</sup>	Number	Capacity <sup>a</sup>
Biomass	32	256.0	9	10.5
Hydro	146	95.4	68	47.4
Landfill gas	329	699.7	226	474.8
Municipal/industrial				
Waste	90	1398.2	20	235.5
Sewage gas	31	33.9	24	25.0
Wave	3	2.0	1	0.2
Wind	302	1153.7	93	219.8
<b>Total</b>	<b>933</b>	<b>3638.9</b>	<b>441</b>	<b>1109.2</b>

Fig 16: Number of projects bid vs number of projects successfully commissioned in the UK. Source: (Wood & Dow, 2011).

In addition to this creating a problem for the policy makers to hit their targets, it results in sites with very good natural resources being excluded (sterilized) as the developers with the necessary permissions are unable to deliver to the price at which they bid.

The UK's strategy to focus on capacity driven policy tools rather than the price driven options has seen the UK trailing the other OECD countries when it comes to installed renewable energy capacity. It is clear from the literature that there were additional internal and external structural problems with the UK system, and that the inability to translate licensed projects to commissioned projects is not solely as a result of the quota system.

### Summary

It is evident from the variety of policy interventions that there is no single, universally applicable 'best' support mechanism or policy for the bundle of different technologies known as RES. Mixtures of various policy instruments have been tailored to the particular RES and the specific national situation to promote the evolution of the RES markets. These policy interventions have evolved with the technology (Haas, Eichhammerb, Huber, & al, 2004). The case studies above have shown the pros and cons of a competitive bid and a feed-in tariff. While the international market has shown a preference for FiT, South Africa one of a number of countries that have decided to follow a competitive bidding approach.

### 1.2.8 Competitive Bid vs Feed in Tariffs in South Africa:

In July 2009 NERSA announced that South Africa would follow a REFIT (Renewable energy Feed—in Tariff) scheme to encourage Renewable energy generation. There was considerable excitement in the market and the tariffs originally announced are in the table below.

**Table 1: REFIT Phase I Tariffs – 2009 (R/kWh)**

Technology	Unit	REFIT
Wind	R/kWh	1.25
Small hydro	R/kWh	0.94
Landfill gas	R/kWh	0.90
Concentrated solar	R/kWh	2.10

Fig 17: Prices originally advertised by Nersa as feed-in-tariffs, 2009. Source: (NERSA, 2012)

These tariffs were attractive by international standards – and shortly after these phase one tariffs were published by NERSA, photovoltaics were included at R3.94 kWh. These tariffs coupled with the abundant resources in South Africa triggered a rush of developers seeking sites. The count by late 2011 saw over 400 environmental impact assessments registered with the Department of environmental affairs for renewable energy projects across technologies. (Appendix A contains an abbreviation of the steps required to bid in the South African renewable energy programme, the EIA being the most onerous). This considerable interest was, in large part, generated through the lure of highly attractive returns of a FIT in the SA renewable energy market.

What followed in the next two years was a dramatic shift in policy. South Africa overhauled the REFIT process and announced a competitive bidding system. By 2011 South Africa had a fully fledged competitive bidding system. The drivers of this policy shift are not well documented, but from the statements made by ESKOM, NERSA, and developers, it is possible to elicit an understanding of the course of events. This is a highly simplified overview of the highlights of the drivers of the change in process. There was extensive consultation, public participation, Parliamentary participation and comments during this process. These additional steps have been left out to distil the abbreviated drivers of the shift in policy as outlined below;

- i) The commercial banking sector was unwilling to lend against a 20-year Eskom power purchase agreement, unless that contract was underwritten by the South African National Treasury. National Treasury agreed to get involved in the process, but they would review the REFIT.
- ii) National Treasury got involved through the PPP unit, but was uncomfortable with the non-competitive process of a feed-in-tariff.
- iii) The Department of Energy and National Treasury, with a team of researchers and consultants, redesigned the process for renewable energy in South Africa to include price competition.
- iv) The weighting of price to social economic criteria was split 70-30. This is in contrast to the more typical 90-10 scoring split.
- v) The result was an overhaul of the REFIT system and the introduction of the currently implemented REIPPPP.

South Africa had made public international commitments to renewable energy, and there were expectations from both the local and international community. These commitments, combined with hosting the Congress of Parties 17 (COP17) in Durban, resulted in a tremendous amount of political

pressure for this process to succeed. South Africa wanted to announce that they were committed to renewable energy on the global stage of COP 17. This pressure culminated in the successful bidding for, and announcement of, the first 28 projects. These projects were now known as preferred bidders. They had met the bid requirements and, theoretically, should be able to reach financial close. These 28 projects were expected to reach financial close on the 19<sup>th</sup> of June 2012. However, there were delays and the final sign-off for financial close was only reached in the 2<sup>nd</sup> week of November 2012.

### **1.2.9 Localisation strategies that have been suggested for South Africa**

There is only a small body of work available in South Africa that talks to the localisation strategy for PV. The following section will critically review some of the work that has been used to inform the localisation strategy for PV in the South African context.

#### **a) Towards a PV Policy for South Africa – Potential Development & Impacts of PV**

The first piece to be reviewed was published in 2010; the GIZ commissioned PV policy strategy written by Dieter Holm (Holm, 2010). The thrust of the paper calls for strong policy support and a clear roadmap to the implementation of renewable energy. The paper considers a REFIT to be non-negotiable in the effective roll-out of renewable energy. It talks to the significant resource endowment in Africa and South Africa and elaborates on the opportunities for high levels of renewables to be installed in rural, un-electrified areas.

The portion of the paper that is most pertinent to industry and localisation is chapter 5: Value chain and benefits of PV. Here Holm makes the strong assertion that PV localisation in South Africa is not the best path, and that the job creation opportunities are largely downstream of manufacturing in the installation, operation and maintenance of systems. The author referenced the 2003 Agama energy study on job creation to talk to these job creation figures (Agama Energy, 2003). Holm compares the need for the nascent PV industry to form an industry association similar to that in the Solar water heating world.

Criticisms of the conclusions drawn in Dieter Holms work:

- i) In an industry where there is an annual price digression of between 17-64% (Winkler, Hughes, & Haw, 2009), it is imprudent to use a job creation analysis from a study conducted 7 years earlier. The value chain may have shifted, and the employment intensity will no doubt have shifted too.
- ii) There is no mention made of the then R1bn module export market in SA. This market consisted of Tenesol and SolaireDirect as the large players. Holm's failure to recognise the size, skills and employment in the existing, unsubsidised, export oriented manufacturing sector undermines the conclusion that local manufacture is not desirable.

Holm's localisation strategy for South Africa focuses largely on creating a market for independent power producers, rather than creating an enabling environment for manufacturing. He focuses on the installation, operation and maintenance jobs. It appears counter intuitive to have focussed only on the IPP developer portion of the value chain when, at the time of his writing, the only involvement South Africa had in utility scale renewable energy was in a manufacturing industry that was exporting over 100MWp per annum. Holms paper suggests that there would be no progress in

the utility scale renewable energy front in the absence of a FiT. This has been disproved with the closing of round 1.

### **b) The localisation potential of photovoltaics (PV) and a strategy to support large scale roll-out in South Africa**

In August 2012 the dti in collaboration with SAPVIA and the WWF commissioned a research paper into a localisation strategy for South Africa (dti/Escience/WWF/SAPVIA, 2012 (unpublished)). The inaugural meetings were held in the GreenCape offices on the 15<sup>th</sup> of August. The results of this work are only expected to be made public in late 2012 or early 2013.

However, from the perspective afforded the author as an observer to the process, the following points have become clear.

- i) The dti is serious about understanding the role of PV manufacturing in the value chain, and identifying where opportunities exist for job creation,
- ii) The information available to the dti to make decisions and develop a strategy for about localisation has typically been the result of conversations with developers, not manufacturers. This paper is an attempt to correct this imbalance and to engage manufacturers across South Africa.
- iii) It is critical to get manufacturers to participate in these types of studies. Policy is designed based on what is perceived as industry intelligence, but is often representative of only a segment of the industry.

The final findings of this paper will be used to suggest the design of the PV localisation strategy for South Africa. The importance of an accurate reflection of the industry and its potential is critical for the country to make well designed policy decisions to complement the bouquet of existing industrial support offered to the manufacturing industry.

### **1.2.10 Current policy support for localisation in South Africa**

The Department of Trade and industry is the policy advisor on preferential procurement. The Renewable Energy Independent Power Producer Purchase Programme (REIPPPP) is a public private partnership and as such falls under the policy stewardship of the dti.

The dti's Industrial Policy Action Plan (IPAP) is the pertinent policy document. The IPAP 2012/13-2014/15 is the policy document that outlines the type of support PV will receive, and the rationale for supporting this sector. The report suggests that as many as 50 000 direct jobs could be realised over the next 15 years, and that localisation of key elements in the value chain could establish South Africa as a regional hub for photovoltaic's and renewable energy generally. The nature and outcome of the support is phrased as follows;

**“Nature:** Increased local content of renewable energy projects linked to the REIPPPP; continuous rollout of renewable energy to sustain the industry 1000MW per annum; strengthened industrial financing programmes to promote the local components industry, inclusive of IDC funding, the 12i Tax rebate and the dti incentives” (Department of Trade and Industry, 2012).

**“Outcome 1:** Increased local content threshold for renewable energy projects in line with the development of a competitive local industry” (Department of Trade and Industry, 2012).

This localisation strategy is supported through a bouquet of incentives, tax deductions and minimum requirements. This package of incentives is designed to achieve the final result of 50 000 jobs in the renewable energy sector.

#### **Accelerated Depreciation (Tax incentive):**

National Treasury in South Africa has approved a tax incentive using accelerated depreciation. Under this incentive, machinery and plant relating to electricity generation from wind, sunlight, gravitational water and from biomass (comprising organic wastes, landfill or plants) is depreciable. All assets are depreciable over a three-year period at a 50:30:20 percent rate. The purpose of this accelerated depreciation regime is to stimulate investment in these assets, thereby encouraging investment in renewable energy projects. The lower the cost of electricity generation, the higher will be the profit margin for taxpayers involved in electricity generation from renewable energy (Parker & Vereshnie, 2012).

The South African institute of Tax Practitioners is working through the finer points of this incentive to understand precisely what falls under the definition “machinery and plant”.

#### **Financial Incentives:**

The Industrial Development Corporation, IDC, is a development finance institute which funded 27 of the preferred bidders announced in rounds 1 and 2. The spread of project involvement combined with the IDC’s role as a development finance institution puts it in a fairly unique position to encourage local content. In Parliament in 2012, Rentia van Tonder (Head: IDC Green business unit) indicated that the IDC would be doing just that. Conceptually, the IDC would give a better borrowing rate to bidders with high local contents. The lower rate would allow the bidders to become more competitive and have a higher chance of success (Van Tonder, 2012).

#### **Tariff protection, South Africa:**

PV is currently a zero rated import in South Africa, and as such attracts no import duties or tariffs. This is a policy tool that is available to the dti through ITAC should the local PV industry in South Africa apply for and motivate import tariff protection. As of September 2012 no such application has officially been filed at ITAC. However, there have been rumours and talk from both dti and NUMSA (NUMSA, 2011) that this may not remain the case. An import duty remains one of the tools that is at the dti’s disposal to support local manufacturing. A duty would effectively increase the price of products entering the South African market, and would be in line with measures followed by the USA to protect its local PV industry.

### Tariff Code and Category for PV

854140	- Photosensitive semiconductor devices, including photovoltaic cells whether or not assembled in modules or made up into panels; light emitting diodes.	<b>Renewable Energy</b> , Renewable Energy  <b>Renewable Energy</b> , Renewable Products and Energy Source
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Fig 18: World trade organisation tariff codes and categories for PV Source: (International Trade Administration Commission of South Africa, 2012)

#### Local content requirements, as applied to the REIPPPP:

The Department of Trade and Industry is mandated to set the industrial policy for South Africa. The Industrial Policy Action Plan (IPAP) is the policy tool used to develop and implement these strategies. The dti acts as advisor to National Treasury and the Department of Energy as to what local content is possible, and how the targets should be implemented, monitored and achieved. The dti is the

Making local content declarations and the audits there of is a process. The costs of reporting are not insignificant. It is beyond the scope of this paper to investigate these, but future research could be to review of the transaction costs associated with local content reporting and auditing in the South African context.

department with the mandate to set local content requirements for the REIPPPP. For the first 3 windows the targets have been accepted and published. These targets or changes to the targets are communicated to the bidders through briefing notes. There is a minimum qualification threshold and a target local content percentage. The score for achieving high local content is worth 10 points of the 100 points allocated to economic development. The weighting of economic development, toward the allocation of preferred bidder status, is 30%. The remaining 70% is based on the price. This effectively means the weighting afforded to local content is 10% of 30%, or 3% over all. It is expected

that in subsequent rounds there will be a further increasing of the minimum qualification threshold for local content.

	Min	Target
Round 1	35%	55%
Round 2	35%	55%
Round 3	45%	65%

Fig 19: Local content requirements and targets for the REIPPPP. Source: (The dti, 2012).

The dti has done considerable work to split these local content percentages into balance of plant and key equipment. The intention is that there will be different local content requirements for each of these categories. While this has not been formally finalised, it is expected that the final split will look something like the following (The dti, 2012):

## Possible split of local content targets and thresholds

Technology	Local Content			
	Threshold		Target	
	Balance of Plant	Key Equipment/ Components	Balance of Plant	Key Equipment/ Components
Onshore Wind	80%	13%	90%	50%
Solar Photovoltaic	80%	20%	90%	50%
Solar CSP Without Storage	80%	20%	90%	50%
CSP with storage	80%	13%	90%	50%
Biomass	80%	13%	90%	50%
Biogas	80%	13%	90%	50%
Landfill gas	80%	13%	90%	50%
Small scale hydro	80%	13%	90%	50%

Fig 20: Possible split of local content targets and thresholds. Source: (The dti, 2012).

The dti's motivation for separating the balance of plant from key equipment is to try and ensure that key equipment is manufactured in South Africa.

### Defining Local content

The definition for local content is critical as this will be used by the bidders to report their level of achievement in the thresholds and targets. The definition that is currently used in the REIPPPP is as defined by the South African Bureau of Standards (SABS). In the simplest explanation, local content is defined as the percentage of the bid price attributed to local spending: (SABS)

$$LC = (1 - x/y) * 100$$

Where,

x is the imported content in Rands

y is the bid price in Rands excluding VAT

Effectively the local content is reflected as a value of what has been sold less the components or portions of the product that have been imported. The reporting requirements for local content require supplier receipts from 3 suppliers back, and a number of fairly onerous auditing steps to ensure the local contents are accurately recorded.

In the context of the bid the local content requirements are often met through the site establishment and civil works costs. Below is a reproduction of the local content submission made by Mulilo for their site in De Aar (All categories and figures as reported at the Nersa Public Hearings):

Construction	Item	Percentage Spend	Total
Local content spend	Construction Costs	29.14	39.27
	Electrical Submission	6	
	Professional Fees	1.47	
	PC Sums	2.66	
Imported Components	Controlling	47.13	60.73
	OHS	13.6	

Fig 21: Example of actual commitment to local content and how it is broken down. As reported at the Nersa public hearings for a generation license. (Independent Power producer licensing public hearings , 2012).

From the table it is clear to see that Mulilo/Gestamp exceeded the local content requirement of 35% without actually buying the panels, inverters or structures locally. All of the PV panels, inverters and structures are fully imported in this scenario – yet there is a local content of almost 40%. While there are certainly job creation opportunities in the construction of all of these plants, a far greater economic impact can be realised if both manufacturing and construction jobs can be created in this roll-out.

### 1.2.11 Job Creation in PV:

South Africa is a country with high unemployment. The renewable energy rollout has been identified as an opportunity to create 50 000 jobs (Department of Trade and Industry, 2012). It is important that there is an analysis of where in the value chain jobs in the PV industry will be created. It is critical to target policy interventions at the portions of the value chain that will yield an optimum allocation of resources or Pareto efficiency. The dynamic optimisation of externalities and price is the role of policy makers. They intervene in the market to design a procurement procedure that creates an optimal outcome for the country.

*Bloomberg New Energy Finance* (BNEF) made a presentation to the South African renewable energy industry in Cape Town in 2012. They presented a generic slide on job creation in the PV value chain. This slide indicates that in 2011 there were about 30 Jobs per MW of PV installed and about 36% of these jobs come from the portion of the value chain focussed on module assembly (Bloomberg New Energy Finance, 2012).

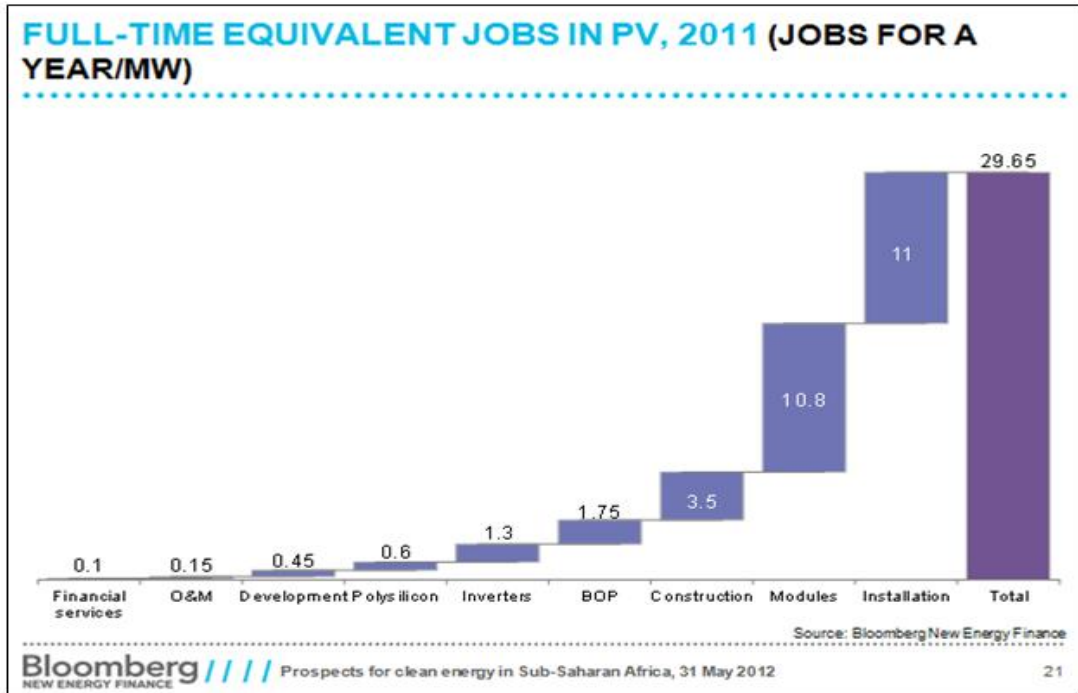


Fig 22: Breakdown of job creation along the PV value chain, Bloomberg

The *UCLA: Berkley* came to a similar conclusion; they found the breakdown of jobs and job creation opportunities in the PV industry to be as shown in the following diagram (Ban-Weiss, 2004). The Berkley study found that an average of 33 jobs are created per MW of PV, and that 10 of these (roughly 30%) are found in the module assembly portion of the value chain.

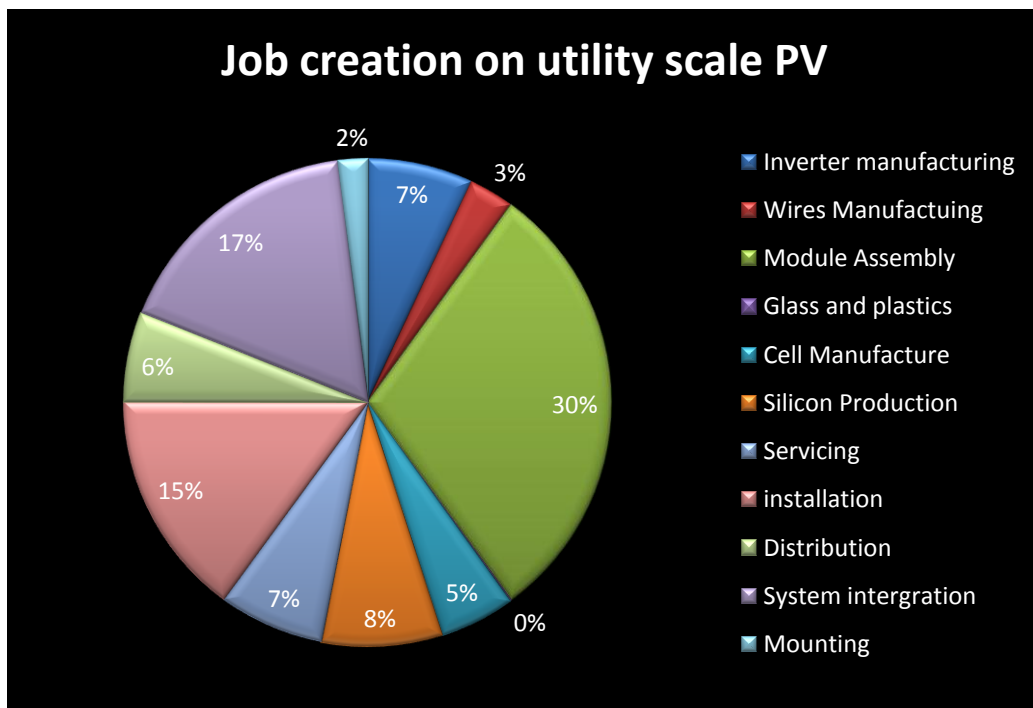


Fig 23: Breakdown of job creation along the PV value chain, University of California. Source: (Ban-Weiss, 2004).

*Agama Energy* is the only available South Africa based job creation study for renewable energy. Agama suggests that 30 jobs per MW are found in construction, manufacture and installation jobs. Another 0.4 jobs per MW are found in operations and maintenance (Agama Energy, 2003). While the Agama study was conducted in 2003, the total number of jobs per MW that it suggested will be created, matches fairly accurately with the Bloomberg New energy finance numbers as well as the Berkley numbers.

The IDC published the Green Jobs report in 2011 (IDC, 2011) which identifies 16.8 full time equivalent jobs resulting from PV manufacture.

**Summary Table of job creation figures:**

Study	Jobs per MWp	Jobs in Module assembly
Bloomberg	29.65	10.8 (36%)
Berkley	33	10 (30%)
Germany observed	28	- Not disaggregated
Spain observed	36.7	- Not disaggregated
IDC Green Jobs report	-	16.8
Agama (South Africa)	30.4	- Not disaggregated

Fig 24: Summary table of job creation along the PV value chain. Source (IDC, 2011).

**Note:** In all of the studies module assembly is not disaggregated and includes, module assembly and the jobs manufacturing laminate, backing plates, glass, junction boxes etc. These smaller value components of the panel are typically manufactured close to the module assembly to enjoy transport advantages. Currently in SA, Tenesol uses a local junction box manufacturer but SolaireDirect does not. PG glass has invested in the capacity to manufacture glass of the correct specification locally. If both of these factories were to run at full capacity there would be a market to manufacture several more of the smaller value components.

The summary job table above shows a fairly tight band of job creation opportunities across the full range of PV. The studies that specifically disaggregate jobs into module assembly indicate that about a third of all PV jobs are as a result of the module assembly portion of the value chain. It is clear that understanding the cost associated to relative labour intensities along the value chain is critical to design policy targeted at job creation.

**1.2.12 Renewable energy jobs – no net benefit, a criticism**

In recent years there have been waves of literature focused on Spanish and German renewable energy investments. The criticism that renewable energy’s “green jobs” are more expensive than conventional jobs is supported by research coming out of the Universidad Rey Juan Carlos in Spain (Alvarez, Jara, & Julian, 2012). These researchers suggest that for each renewable energy job that

was created in Spain, 2.2 other jobs are lost. Further, they suggest that for every 1 MW of PV installed, 8.99 jobs are destroyed in the economy.

There are similar studies that have been put forward in Germany where it is suggested that it costs about 175 000 euro for each Green Job created (Frondele, Ritter, & Vance, 2009).

It is beyond the scope of this research paper to fully interrogate these claims, and this is an area where additional research is required. It is highly plausible that the increased cost of electricity, in addition to the allocation of government spending and resources to FiT's and other renewable energy incentives, would lead to a smaller allocation of incentives to other industries.

The similarity between these studies is that they draw on the wider economic impact of supplying electricity, and the effect that the higher costs of supplying electricity generated through renewables will have on downstream businesses. This is an attempt to model the real cost of the renewable energy sector compared to other sectors.

It is in this comparison that the researchers raise a false dichotomy. The authors compare the incentive costs of renewable energy with 'other sectors'. The inconsistency here is clear; a comparison between energy generation sectors and the broader manufacturing sectors has yielded a highly contestable result. Considerably more work is required to extend that comparison to other energy generating technologies. Still further work is necessary to model and understand the full costs (including externalities) of nuclear energy or fossil fuels and to understand the comparisons between new build, project financed, energy projects across technology types. The results of the studies on jobs, while plausible, are highly misleading. These studies are selectively comparing sectors without recognising the need for energy as an input to the economy. If there is no electricity, huge incentives in other sectors mean very little.

At an energy portfolio committee hearing in August 2012, the National Energy Regulator (NERSA) said that the levelised cost of electricity from the new build coal power station, Medupi, is expected at R0.97 kwh. This is significantly higher than the R0.89 kwh levelised average cost of wind projects bid in the 2<sup>nd</sup> round. A stringent investigation into the full ambit of externalities associated with renewable energy as compared to other energy generation techniques is beyond the scope of this paper, but a note of caution and doubt is raised on the studies that suggest renewable energy decreases jobs in an economy without a comparison to other electricity generation technologies.

### **1.2.13 Conclusions from the literature review**

South Africa has made the policy decision to introduce utility scale renewable energy into its national grid. The introduction of this renewable energy will be managed through the IRP2010 and the Department of Energy. In 2009 Nersa released a list of feed-in tariff prices. These prices acted as a signal to the international market that South Africa would shortly begin a procurement process for renewable energy using a feed-in tariff. In late 2010 the market was shocked by a change in the approach. The programme would no longer be a feed-in tariff, but rather a competitive bid. This change was necessitated by National Treasury's desire for price competition in the awarding of contracts, but resulted in an increased uncertainty in the market.

The change was initially met with resistance from the developers, as bidding systems internationally had very limited success. However, as the bid documents and structures in the REIPPPP were made available, the confidence and certainty began to return to the industry. The comprehensive, considered design of the bid was well received by the industry. Despite requiring a herculean amount of paper work to submit bids, certainty and confidence in the process increased. One step removed from the developers were the manufacturers looking to supply into these projects. As the bid changed from a FiT to a competitive bid and the market was uncertain, the existing manufacturers were uncertain too. The absence of certainty meant that the manufacturers did not know where, when, and how much, the market would support; making it impossible to plan supply chains, operations and staff requirements. The impact of the reduced certainty resultant from the change from a FiT to a bid will be examined in the next section.

Job creation is a corner stone of government policy in South Africa. With high unemployment and particularly high unemployment in rural areas, part of the design of the REIPPPP focused on job or employment creation. There have been suggestions that 50 000 jobs could be created from the renewable energy industry. Certainly, internationally there have been many jobs created in the PV industry. In Germany over 100 000 are said to be formally employed in the PV industry. In South Africa, part of the bid requirements obligates developers to make representation of their job creation. From the literature above, we can see that internationally, about a third of all jobs in PV come from the module assembly portion of the value chain. The literature shows that this is a portion of the value chain that is highly contested internationally with the US raising tariff barriers. Spain and China, two of the biggest PV markets, now demand local assembly. With the intensity of international focus on this portion of the value chain, this dissertation explores the relative cost of job creation in this portion of the value chain. This will help to understand why it is so hotly contested internationally and what South Africa's interventions could be to realise this basket of manufacturing jobs.

The Department of Trade and Industry is responsible for incentives and trade in South Africa, the IPAP2 is the policy document that is used by the department to optimise domestic industrial policy. Around the world the renewable energy industry has shown robust growth in the face of challenging international economic conditions. South Africa is making its first foray into this field and the dti is responsible for ensuring that the country has sufficient protection and incentives to optimise the price, job creation and economic development tri-lemma. This tri-lemma is set against the back drop of international trade politics in the US, Germany, Spain and China. The localisation strategy of the dti needs to explore the tools that can be used to encourage industrial growth. Currently the dti has used minimum local content thresholds as its support strategy, but as we will discover, the definitions of local content may carry structurally perverse incentives. Finally, the dti, DoE and National Treasury will have to justify that the policy mechanisms put in place deliver 'value for money'.

The main themes that can be distilled from the literature review are those of efficiency and certainty; these twin concerns are the foundation of a successful renewable energy roll-out.

The literature unpacks efficiency in terms of prices for energy and myriad socio-economic goals, job creation, local manufacture, broad based black economic empowerment, rural development, grid stability, energy security, carbon etc. All of these interests are weighed in the design of the energy

policy. The ability for a country to be able to understand the efficiency trade-offs and make the correct policy decision is a complex function of information and politics. This research paper will attempt to review what efficiencies were achieved in rounds 1 and 2, and highlight areas where greater efficiency could be achieved.

The literature review alludes to certainty several times, the need for policy certainty, price certainty, scheduling certainty, local content certainty, contracting certainty. The roll-out in South Africa has been beset by changes and uncertainty in all of the areas mentioned above. The current, changeable nature of policy increases the possibility of cycles of boom and bust, or a stop – start allocation in renewable energy. The policy does not provide the certainty that the market needs to establish supporting industry. In attempts to increase efficiency, policy makers can sacrifice certainty. This was clearly the case when the country moved from a REFiT system to a competitive bid system. Given that the industry is in an embryonic state, are there efficiency gains that can be made without sacrificing more certainty?

The primary research paper is to delve into the structure of the REIPPPP with a focus on these twin issues of efficiency and certainty. The research paper question is: What could be improved on, in terms of price, job creation and economic development?

## **Section 2: Research questions & objectives**

### **2.1: To what degree has the REIPPPP resulted in local manufacture?**

The objective of the REIPPPP is to introduce renewable energy to the grid. The bid focuses on risk, price and economic development. Tension is created in the trade-offs between these categories. The scoring process and criteria define how the bidders behave. How did they behave in rounds 1 and 2, what was the local content in these first rounds, and would this have been different under a FiT process.

### **2.2: How do the costs of locally manufactured panels compare to imported panels?**

What were the prices relative to the other projects? Were premiums required for projects using local panels?

### **2.3: Where in the PV value chain can jobs be created?**

The international benchmarks for manufacturing jobs are established by looking to the literature, but where are there high concentrations of job creation, and can policy in South Africa unlock opportunities for this job creation?

#### **2.3.1 Subsection on employment creation**

What employment creation has been identified by the bidders? What is the employment potential in this programme?

#### **2.3.2 Subsection: Impact of the current generic definition of local content.**

South Africa has recently published a standard, generic definition of local content – this is used to count and monitor the local content contribution. What is the impact of this definition on the PV market?

### **2.4: How could future rounds of REIPPPP be improved to maximise employment while still delivering value for money?**

The Public Finance Management Act (PFMA) is concerned with ensuring that public monies are efficiently spent (National Treasury - Republic of South Africa). This includes a fair, competitive, price as well as the associated economic development and employment opportunities. Can this process be further refined to yield a better result than at present?

## **Section 3: Methodology**

### **3.1 Research Design**

The research design follows an inductive method as described by William M. Trochim (Trochim, 2006). This method relies on observations, noting patterns in the observations, and then using the patterns to propose a hypothesis which ultimately yields a theory.

In the context of this research paper the observations are a combination of international literature and data gathering from a variety of sources. These observations will allow the researcher to induce patterns from the bid behaviour of renewable energy developers in South Africa. From the patterns observed, and in the research questions, a tentative hypothesis will be formulated. This hypothesis will be used to inform the theory.

This research design is appropriate for this context. The intention of inductive research is to form a view or theory based on a collection of observations of behaviours and patterns. The data available in the field of job creation, local content and renewable energy is a collection of observations. It is the role of the researcher to identify the pattern and submit an underlying theory.

This inductive research will be based on a comparison of the international context to the South African one. The literature will weigh the international best practices. The data that is available to the researcher is from the NERSA public hearings, interviews and correspondence with existing manufacturers, collaboration with the dti and WWF's PV localisation team. An analysis of the bidding rounds, value for money, prices and job creation will all form part of the data. The information required for this is largely in the public domain but is, disparate; it will be pieced together into a coherent picture by the author.

In addition, the author will gather information for the two existing PV manufacturers, Tenesol and SolaireDirect. The interviews and correspondence with these local manufacturers will add primary observation points and direct data. The sample size of existing utility scale PV manufactures in South Africa is limited to two manufacturers. These two companies represent a census of the utility scale manufacturing market in SA at this time. Such a limited sample, despite it being a census, does not allow statistical analysis but rather lends itself to the inductive research method.

Limitations: While considerable effort was invested to obtain additional primary data from National Treasury, these data were not forthcoming. In a practical sense this lack of a full and complete data set, limits the paper to a reliance on the formal public participation processes for its data analysis. However, if the observations made from the available data are assumed to be a reasonable proxy for the full set – a robust theory will result. In a practical sense this is not an overwhelming limitation as the public hearings, as presentations from the dti and press releases from DoE are rich sources of information.

### **3.2 Assumptions**

There are several built in assumptions in this paper, the primary of which are:

- i) It is assumed that there is no significant performance difference between PV modules. Further inter-changeable design is assumed. This is a justifiable assumption when talking in general terms about large PV developments. However, in a practical sense there are performance, design and layout differences between panels and it is not quite as straight forward to do direct comparisons. All the projects are larger than 5MW (sufficiently large to make an assumption that a price per watt peak installed, or a bid price per kilowatt hour, are comparable despite some technology and design differences).
- ii) It is assumed that there are no huge economies of scale to be realised after a PV assembly factory is producing more than 20MW per year, while there are economies of scale in terms of ordering, transport and delivery. This is reasonable as the manufacturing process of PV comes in fairly modular ‘assembly lines’.
- iii) It is assumed that the job creation figures, as applied by this research paper, focus on utility scale installations and do not include small scale, embedded generation. This is due to the nature of the REIPPPP structure which limits bidders to installations between 5 and 75MW. This is a size that is utility scale.
- iv) It is assumed that the information that was given at the NERSA public hearings was a true reflection of the commitments made by bidders. Similarly it is assumed that information made available by manufacturers (primary sources) are true reflections. The author has very little ability to authenticate these statements. However, the NERSA license hearings are made under oath.
- v) It is assumed that there will be a consistent policy path as outlined by the DoE, dti and National Treasury, i.e. that there will be a market for PV in South Africa for the next 20 years.

### **3.3 Epistemological and ontological concerns**

The author works for an organisation called the GreenCape initiative. This organisation was established to promote the green economy, and has a specific focus on local manufacturing of products to supply the renewable energy industry. In the context of academic work this has both hugely positive benefits, in terms of access to information, and possible epistemological and ontological concerns. The potential bias of the author, particularly in using the inductive methodology, is recognised. This methodology requires the author to explore patterns and possible theories. The validity of the theories and hypothesis of the research paper will be influenced by the author’s inherent bias. However, the intention of inductive research is to present observed data and identify patterns in that data. While bias may influence the researcher’s relative ability to identify specific patterns within the data, it cannot influence the existence or non-existence of a pattern.

### **3.4 Data collection**

The data for renewable energy projects in South Africa is available but typically, the data is disaggregated, disparate and untidy. Understanding the complex REIPPPP is critical in knowing where and how to obtain data. To obtain and collect various dispersed points of data and assemble them into a coherent picture has taken considerable time and effort. The data collected is a result of sifting through EIA applications, NERSA licence hearings, Parliamentary sessions, Chamber of Commerce presentations, grid connection applications, dti statements and presentations, and the

Department of Energy website. This broad analysis and collection has provided a rich picture of where, who and how these renewable energy projects were bid, and will be developed.

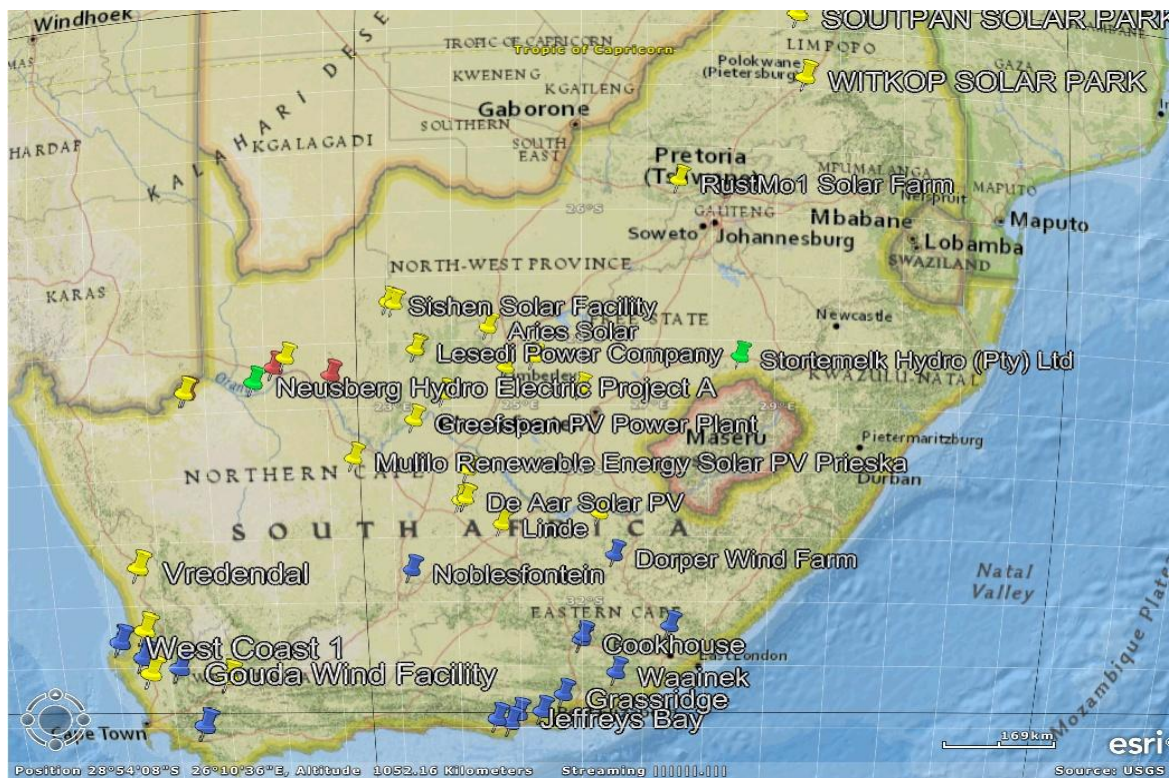


Fig 25: Map indicating the location of all of the round 1 and round 2 renewable energy projects in South Africa  
 Author generated map - Key: Blue = Wind farms; Red = CSP; Yellow = PV; Green = Hydro

The data used in this research has come from several sources;

- i) The public hearing held by NERSA to interrogate the licensing of RE power plants. In these hearings the participants make a sworn statement at the outset.
- ii) Interactions with key stakeholders, including dti, WWF, National Treasury, GreenCape, developers, Chambers of Commerce, Energy portfolio committee etc. These interactions range from formal proceedings in Parliament to fairly informal interaction discussing the market.
- iii) Interviews, communication and emails with the existing manufacturers in South Africa.

The data from the public hearings was tabulated in Excel and sorted into categories representing the technology provider, Engineering Procurement and Construction (EPC) companies, the operation and maintenance providers and the socio-economic responsibility contributions of each project. The most important data that was gathered – where possible – was the information around pricing of bids by the successful applicants, and the percentage local content.

Developers count everything spent in South Africa as local content, from buying the land to the site development and establishment costs. It is not possible for the author to accurately separate the marginal portions of local content. For example, control of the land is one of the requirements to bid and the mechanism for controlling the land, either a lease or purchase, was counted as local

expenditure and local content. The counting of these obligatory local content purchases skews the focus on local content in manufacturing. The author will show the projects have made equipment procurement decisions that include locally manufactured hardware.

### **3.4.1 Sampling**

From the data available through the public hearings and public communication channels the author has the following data-sets available:

- i) 12 of the 18 projects in the first round made sufficient representation about job creation, price etc to be used as complete data sets and round 2 data was accidentally published by the DoE – and the full pricing and ranking data was thus made available.
- ii) The information released by the DoE and dti around the average prices, bids, employment creation etc. represent full, but aggregated data sets; the combination of these two portions allow a rich picture to be developed.
- iii) Information was gathered from both of the local PV manufacturers that are supplying into rounds 1 or 2. This represents a census sample as there are currently only two local PV manufacturers. This is an accurate and fully representative sample.

## **3.5 Data analysis methods**

The primary method used for this data analysis was observation. The researcher has collected and collated all available data from the sources mentioned above. This data was examined to isolate the common themes and patterns. These patterns were loosely grouped under the four objectives identified above. The data was systematically analysed, read and reflected upon, in order to address the objectives of the research paper.

The data is presented in the form of tables, charts, direct quotes, anecdotes and thought experiments. All of these methods of data analysis were used to understand the observations and to tease out patterns and ultimately to answer the research paper question.

The data that is available to the researcher at this point in time is somewhat limited as this is a process that is currently unfolding. In several years time, once hard data are produced it will be possible to test these theories retrospectively. The inductive method, selected for the data analysis, matches the data available and complements the intention of the research paper. The core of this research paper is to interrogate if value for money and job creation opportunities have been maximised. There will be tangible results in terms of actual job creation figures in the next few years to test the correlation between what is expected and what has been realised.

## Section 4: Results

### 4.1 To what degree did the REIPPPP result in local manufacture

In round 1 there were 18 preferred bidders, of which, 2 projects used locally manufactured PV panels. In round 2 there were 9 preferred bidders, of which, 2 projects used locally manufactured PV panels.

The table below elucidates the projects that have been supplied by locally manufactured panels, as well as the manufacturers that supplied those projects, and the associated prices.

(An indexed price for the Tenesol projects was not available. However, the developer AE-AMD indicated to the author that both projects had been bid at under the average indexed price of the round - in the first round, R2.75).



Locally assembled panels and their projects			
 A SUNPOWER COMPANY		Indexed price	Average fully indexed price
Round 1 Projects	Size		
Herbert	19.9	less than R2.75	<b>R2.75 kwh</b>
Greefspan	10		
 The energy that changes it all			
Round 2 Projects	Size		
Aurora	9	R 1.49	<b>R1.65 kwh</b>
Vredendal	8.8	R 1.40	

Fig 26: Table indicating the project, prices, sizes and suppliers for the projects using locally supplied modules

References used to put the above table together, (Department of Energy, 2012) (Gouzil, 2011) (McGillivray, 2012) (AE-AMD, 2012) (Lalla, 2012).

Of the 27 PV projects that will be constructed over rounds 1 and 2, only 4 projects are using locally manufactured panels. The other projects are using imported international products from well recognised suppliers, including Suntech, BYD, Chint, Moncada (Thinfilm) and Soitec (Independent Power producer licensing public hearings , 2012).

Despite having a nominal 4 of 27 projects supplied by local PV in the first 2 rounds, South African manufacturers have contributed less than 5% of the overall megawatt quantity of PV required. The

remaining 95% of panels will be imported. The first 2 rounds of the REIPPPP yield was only a small market for South African PV panels.

#### **4.1.1 Subquestion: Would a FiT strategy have yielded a higher local content?**

This cannot be answered with certainty. A FiT is an internationally supported mechanism to roll-out renewable energy and, as such, staying with the FiT as announced in 2009 would have avoided much of the uncertainty that was introduced by the change in process.

A FiT would have presented an opportunity for the existing manufacturers to bid on enough projects to reach full production, if they could meet the FiT price point. A FiT would have also increased the ability of local manufacturers to lobby for high local content requirements citing the employment creation opportunities as a distinguishing benefit. In this scenario the fixed price allows the local manufacturer a stronger voice to differentiate his product, through the additional job creation.

A FiT, however, would not guarantee that the local manufacturers would have had sufficient projects to run at full capacity, unless this was part of the FiT conditions. The results of the competitive bid process show that module manufacturers, acting as EPC contractors, have had limited success. It is not certain that the FiT system would have yielded a different result.

From a manufacturing perspective, uncertainty in the market is bad for business. The nature of manufacturing is such that there are lead times required to scale up production. The uncertainty around local content requirements, and the process, left manufacturers with the choice of building up stock, or shutting down until a market emerged.

Considerable work has been, and will be, put into lobbying for higher local content requirements. It is argued that if there was a higher local content requirement, regardless of a FiT or REIPPPP programmes, a larger manufacturing benefit would have accrued to the South African economy (NUMSA, 2011).

#### **Summary:**

In the first two rounds of bidding 27 photovoltaic projects were allocated; of these projects a total of 4 are using locally manufactured panels. There were 2 projects awarded in round 1, and 2 projects awarded in round 2.

The switch to a REIPPPP process increased uncertainty in the market, and particularly for manufacturing. It is unclear if a FiT would have resulted in more projects being supplied with local panels.

## **4.2 How do the costs of locally manufactured panels compare to imported panels?**

NERSA recently (2012) held public hearings for the issuing of generation licenses to the 47 independent power producers that were selected in the first 2 rounds of bidding. In these public hearings NERSA generally sought the following common answers;

- i) Ownership structure,
- ii) Site specifics,

- iii) Clarity on the job creation figures, distinguishing between temporary and long term jobs,
- iv) Explanation's of the benefit to the local community.

Local manufacturers, acting as EPC contractors, have been allocated two projects in each of rounds 1 and 2. These project allocations were done on a price competitive basis, which implies that any premium required by local manufacturers was absorbed into the overall costs and remained competitive, or that there was an under subscribed bid which allowed uncompetitive projects to succeed as the quota was not filled.

The ability to access very cheap, distressed or dumped panels on the international markets exists; the slowdown in Spain and import protection in the USA have led to an oversupply of PV in the market. This oversupply can be exploited in South Africa reducing the overall cost to the end user of electricity. However, most of the cheap international panels are being bid at higher levelised costs than the locally manufactured panels. This creates a strong argument that the job creation benefits of locally manufactured panels can be accessed without inflating the prices that are bid.

The data (fig 26 above) in the South African case shows that in round 1, the locally supplied projects had a bid price less than the average bid price at R2.75 kwh (AE-AMD, 2012). Round 2 was expected to be more competitive; this competition resulted in lower average fully indexed prices. The second round prices and scoring is displayed in the graphic below showing that the two projects using local modules were in fact the cheapest, with the remaining 7 projects using imported components scoring lower, and having a higher fully indexed price.

## Supply chains, risk, price and new suppliers:

The EPC contractors carry construction, performance and operation risk for the PV plants they build. Juwi, one such EPC, indicated that should they be required to buy, for example, the cabling for their PV installations from local suppliers, this would increase their risk and price. The supplier is unknown and this increase in risk will be passed onto the final cost of the EPC.

This means, that even if a South African manufacturer can match the price of an international OEM, the additional risk of a new supplier will push the price higher than if the existing supply chains were used. This supply chain risk factor is present for all the international EPC contractors as they do not have established supply chains in South Africa.

The IDC is conscious of this 'new supplier risk' and is trying to find mechanisms to overcome this situation (Van Tonder, 2012).

## DOE REIPPPP Round 2 Solar PV

IPP	Project Name	Province	MW	Fully Indexed EAT	Partially Indexed EAT	Fully Indexed Price	Partially Indexed Price	Portion Indexed	Part C – Financial Score	Part C - ED Score	Part C – Total Score
375	Vredendal Solar Park	Western Cape	8.8	2 370.3	2 036.8	1401.3	1 897.2	20.0%	70.00	27.24	92.54
373	Aurora Solar Park	Western Cape	9.0	2 523.4	2 147.9	1491.9	2 000.7	20.0%	66.18	26.55	88.72
764	Upington Solar PV	Northern Cape	8.9	2 462.1	2 346.9	1530.0	2 012.0	48.0%	59.35	22.54	81.75
168	Solar Capital Aggenys	Northern Cape	75.0	2 688.8	2 496.2	1590.0	2 290.0	22.2%	54.21	22.54	81.45
207	Sishen Solar Facility	Northern Cape	74.0	2 746.7	2 486.8	1622.0	2 218.0	30.5%	54.53	19.55	81.08
750	Boshoff Solar Park	Free State	60.0	3 251.3	2 648.6	1920.0	2 500.0	23.0%	48.97	19.51	75.51
562	Jasper Power Company	Northern Cape	75.0	2 873.4	2 643.1	1698.0	2 146.0	44.0%	49.16	24.68	73.84
523	Linde	Northern Cape	36.8	2 959.4	2 535.7	1771.0	2 379.0	19.0%	52.85	26.54	72.40
527	Dreunberg	Eastern Cape	69.6	3 006.4	2 584.6	1779.0	2 444.0	18.0%	51.17	22.40	70.68
			417.1								



Fig 27: Comparison of the bid prices for the projects bid in round 2. Source: (McGillivray, 2012).

There are a total of four projects that are using locally manufactured panels. In the first round when most projects were expected to be bid at, or close to, the ceiling price – the projects using locally assembled panels did likewise bidding slightly below the average bid price. In the second round of bidding, where the bids were known to be competitive, the projects using South African panels bid at the cheapest price.

There are several possibilities as to why the local panels are bid at a lower price:

- i) The sites using locally manufactured panels are significantly better and could bid at a lower price due to higher yields associated with the superior resource.
- ii) The prices of local panels are actually lower than international panels, either through manufacturers under-pricing, or through market efficiencies in the local manufacturing.
- iii) Lower returns were accepted by the project developers who bid with local panels.
- iv) The financing arrangements for the projects using local panels yielded a more competitive bid price.

It is unlikely that the unit price of South African modules is lower than the international market. The international market is over supplied and highly subsidised, as the American case for dumping protection shows. Similarly it is unlikely that the sites bid would have high enough differences in

yield that the bid price would be significantly lower, as there are many high yield sites still available. It is more likely a combination of financial arrangements and accepting lower returns.

Regardless of the final mechanisms used to bid at the lower prices, the conclusion remains. The 4 projects using locally manufactured panels were bid at lower than the average price of their bidding rounds. These cheaper bid projects only represent a small fraction, 5%, of the overall PV market in South Africa, and about 20% of what could be produced by the existing South African manufacturers.

**Capacity:**

A local manufacturing company, Tenesol, was awarded preferred bidder status on two projects in round 1. These projects have a combined capacity of 29.9 MW. Tenesol has an internal manufacturing capacity of 100-120MW (depending on how they organise shifts). These projects account for less than a third of their available capacity. Further, since their market in France has disappeared, they have almost all of this capacity ‘spare’. The price that was bid for the Tenesol projects was below the average bid price, i.e below R 2,75 kWh (Gouzil, 2011). Similarly in round 2, the project supplied by SolaireDirect had the lowest bidding prices.

When asked about extra capacity to supply Fabian Gouzil, of Tenesol, replied:

“Our current capacity = 100 MW,  
 Free capacity remaining = 65 Mega Wp per year on coming 3 years.  
 To increase capacity by 80 MWp = 3-6 months  
 To increase capacity with 100MW more = 9 months to 1 year  
 Tenesol can reach 280 MWp annual capacity in less than 1 year” (Gouzil, 2011).

Gouzil further added this graphic contribution to understanding the cost break down of a PV installation.

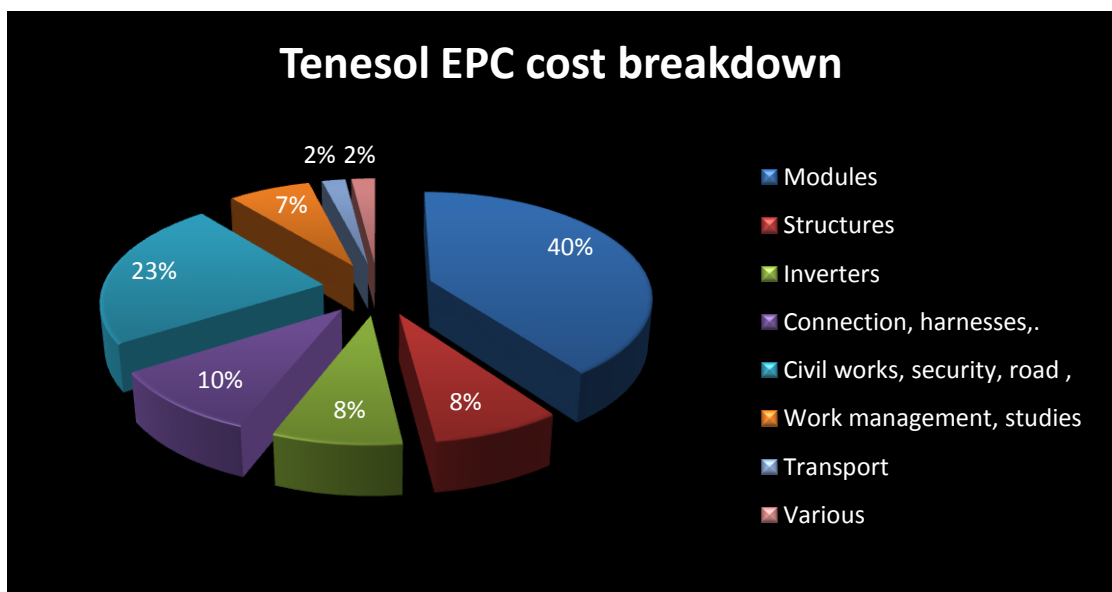


Fig 28: Graph indicating the cost break down for projects that are put together by the EPC Tenesol. Source: (Gouzil, 2011).

The breakdown above shows the percentage values of the projects that Tenesol is building in round 1. The value assigned to the modules is 40%. This represents the final value of the module. Within that final value, only a very small percentage is the cost of assembly – somewhere between 5-7%. The bulk of the cost is made up of the silicon cells themselves, which are imported.

SolaireDirect's current capacity is about 40MW per annum, but they have not re-opened their factory for production in 2012 as there was no demand. The machinery and labour force were placed on standby as there was no market to supply and uncertainty about where and when the market would emerge in the future (Lalla, 2012). The delays and uncertainty caused by the switch from a FiT to a bidding system caused a hiatus in the manufacturing operations at both Tenesol and SolaireDirect. When the REIPPPP bid documents were made public and some certainty returned to the market, the expected increase in manufacturing did not occur. Rounds 1 and 2 had local content requirements that were too low to 'force' developers to procure all or a portion of their panels locally.

Round 3 will introduce a higher minimum threshold for local content. This shift to a higher local content requirement was welcomed by manufacturers "Efforts starting to pay off, it's a start" (Lalla, 2012) when acknowledging the work done by the dti to increase the local content threshold. Still higher local content or designation in this sector was asked for in order to support the local assemblers to stimulate the market.

#### **Summary:**

The data that has been gathered shows that the levelled cost of electricity that was bid is cheaper when locally manufactured panels are used. In addition there is available, unutilised manufacturing capacity and this capacity can be increased in relatively short periods of time. Clear, certain signals and an increased local content threshold will benefit the local manufacturers.

### **4.3 Where in the PV value chain can jobs be created**

Tenesol has provided a breakdown of their job creation figures; they create about 300 jobs to manufacture 100MW of PV a year. This is a labour intensity of 3 people per MW (Gouzil, 2011). Understanding where in the value chain jobs are created is critical for policy makers to be able to understand which portions yield high job creation potential with small or no increases in costs.

The economic multipliers of manufacturing are well researched in the academic world. It is beyond the scope of this research paper to speculate on the multiplier for the PV industry in South Africa. However, it is clear that a manufacturing job in an economy has a wider benefit than just the job itself. The dti has identified renewable energy as a targeted area for manufacturing in its Industrial policy action plan (Department of Trade and Industry, 2012). This drive is an attempt to simultaneously increase employment and growth in the South African economy.

In order for an appropriately targeted industrial strategy to be developed it is critical to understand the portions of the value chain, and which areas yield high value from intervention. The graphic elucidates the portions of the value chain that are labour intensive. This pie chart below represents an average PV installation (Ban-Weiss, 2004). While the study by Ban-Weiss is considered old in an

industry that has such a high annual price digression, it is a reasonable proxy of the cost components.

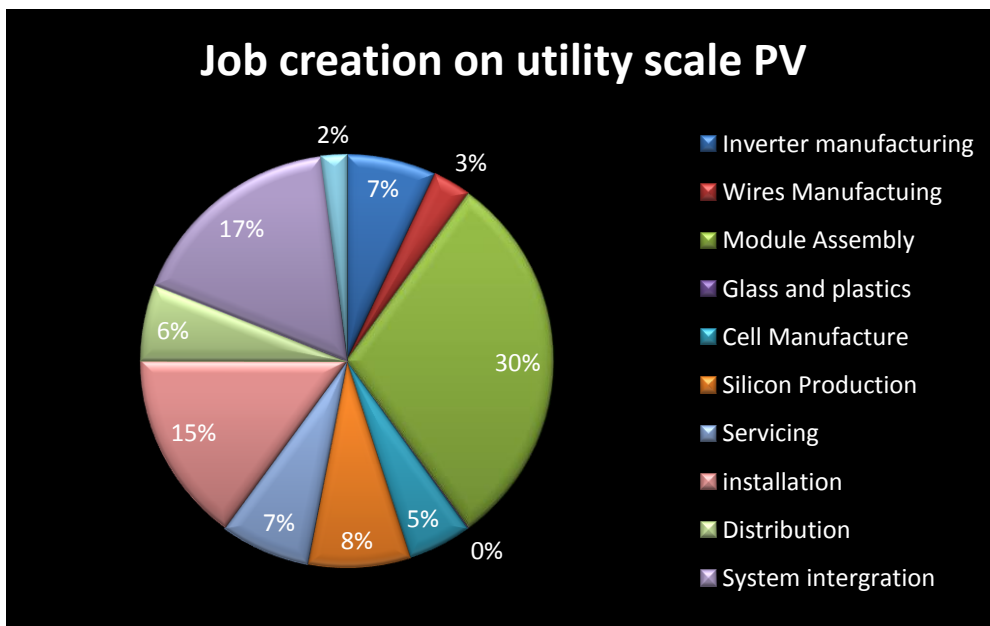


Fig 29: Job creation on utility scale PV systems – from mining silicon sand to grid tied PV (Ban-Weiss, 2004).

If this graphic is further manipulated to exclude ‘non-manufacturing’ items, removing the installation distribution and servicing parts of the value chain, a clear picture emerges in terms of where in the manufacturing process the jobs are created. The graphic below shows that the module assembly portion of the value chain is by some distance the most labour intensive. This warrants further investigation to understand how this labour intensive portion of the process interacts with the overall cost of the installations.

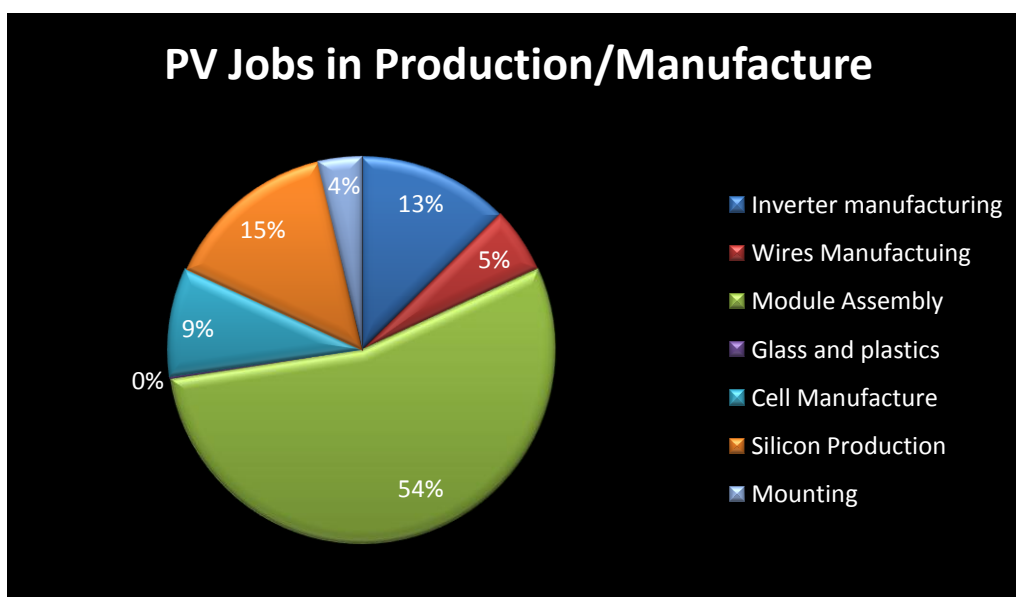


Fig 30: Job creation in the manufacturing/production of PV, Where are the jobs created? Source: Author generated, based on Ban-Weiss.

More than half of the job creation in the PV manufacturing value chain comes from the module assembly. The labour costs on assembling a PV module accounts for only 6% of the full value of the project internationally (Kirkegaard, Hanemann, Weischer, & Miller, 2011). That means that 30% of the jobs are created in a portion of the value chain that only represents 6% of the overall value. In this sense module assembly represents a portion of the value chain with a very high ratio of employment creation to value, and is a big opportunity for policy makers to target job creation.

This paper will not attempt to identify an appropriate economic multiplier for manufacturing jobs. Instead it submits that, based on the current figures from established PV manufacturers in South Africa, if 400MW of PV was sold into the South African REIPPPP programme every year, and the modules were assembled in South Africa, there would be 1200 direct, full time, decent jobs.

#### 4.3.1 Subsection: Employment creation in South Africa

A 2003 report by *Agama Energy* is currently the only South African study on job creation potential from renewable energy, including PV. When the speed of the learning rates and cost digression is taken into account, this study is outdated, having been written in 2003. However, they are the theoretical figures that were used by policy makers. Agama suggests that 30 jobs per MW are found in construction, manufacture and installation jobs. Another 0.4 jobs per MW are found in operations and maintenance.

The table below reflects the job creation figures that were included in the submissions to the Department of Energy. The figures below are an indication of the average job creation potential in this industry.

	Round 1	Round 2
Job Creation (per MW construction)	<b>16</b>	<b>11</b>
Job Creation (per MW operation)	<b>0.35</b>	<b>0.47</b>

Fig 31: Job creation figures from round 1 and round 2. Source: Author calculated figure from the NERSA public hearings and DoE Presentation (Department of Energy, 2012) (Independent Power producer licensing public hearings , 2012)

**NOTE:** During the public hearings clarity was asked for on the Job creation figures provided by Lesedi Power. Lesedi's representation of their job creation potential was a factor of 10 higher than the other projects. This outlier may account for the large difference in construction jobs from round 1 to round 2. At the time of writing, the 'actual' figures are not available to the author – but part of the agreement with DoE includes a firm commitment to job creation, so these figures should be available in the future (NERSA license hearings, 2012). If the Lesedi figures are excluded from round 1 the job

creation average for that round is reduced to 13 jobs per MW, this is much closer to the round 2 figures.

Prima facie, the evidence suggests that there are less than the 30jobs/MW suggested by Agama and by the international literature. It appears that the number of installation jobs is closer to

12jobs/MW (excluding manufacture). This compares favourably with the Bloomberg research which indicated approximately 11jobs/MW in this phase.

Bloomberg also suggests that there are over 10jobs/MW in the module assembly portion of the value chain. This figure includes assembly line workers involved in module assembly, glass production, backing sheets, junction box production, laminate production, transport and logistics.

In the South African context Tenesol fits into this at slightly less than 3 Jobs/MWp. SolaireDirect at about 2.2Jobs/MWp (Independent Power producer licensing public hearings , 2012).

The international literature does not disaggregate the jobs figures further than module production. It assumes if there is sufficient module assembly much of the low value components will be manufactured in the vicinity of the assembly operation to enjoy a transport cost advantage. The job creation that has been reported by Tenesol and SolarieDirect is actual pay rolled staff at these facilities – should they be at full capacity.

The status quo in South Africa is that SolaireDirect has not re-opened its assembly lines in 2012, as there is insufficient demand (Lalla,

## Thought experiment:

If South African module assembly was, hypothetically, 50% more expensive than imported modules, what would be the impact on the final price?

If this was the case we would expect the final bid price to increase by 3%. Module assembly makes up 6% of the total value of the project, so 50% price increase in this component pushes the overall cost up by 3%. This 3% premium would result in South Africa getting 30% of the jobs associated with the entire value chain, as 30% of the jobs come from assembly.

## Anecdote on local content:

A Spanish inverter manufacturer has set up a distribution warehouse in Gauteng. This facility will fully import the inverter stacks, control systems etc. Everything in their inverter is imported other than the backup control system, and the container it is put into. The result is almost no local job creation.

The company is claiming a 30% local content for this inverter under the current definition. This 30% consists of the mark-up, the back up control system and the warranties. Effectively this company is transfer pricing the inverter into South Africa. This complies fully with the legal requirements of the local content definition, but not the intention.

The intention of the local content requirements and definitions is to maximise local job creation, which has not been achieved here (The GreenCape Sector development agency, 2012).

2012). Tenesol is running at only 30% and employs just under 100 staff (Tenesol, 2011). Running at full capacity of 100MWp they employ about 300 staff.

These job creation figures will become clearer when the projects are actually installed, but on the face of it, it appears that South Africa’s job creation is to be expected to follow the international norms.

Real job creation observations from the undertakings at NERSA and observed:

	Jobs per MW	Jobs per MW (excluding the outlier)
Promised by developers (O&M/Installation)	13.5	11
Tenesol (observed)	3	3
SolaireDirect (observed)	2.2	2.2
Total	16.5	14
<b>Percentage of total jobs attributable to module assembly in SA</b>	<b>16%</b>	<b>19%</b>

Fig 32: Job creation figures and percentages observed and undertaken from round 1 and round 2

The observed job creation figures in South Africa seem to indicate lower job creation intensity than in the rest of the world, this is due to the absence of local supply for the low value items in module assembly (Junction boxes, laminate, glass, backing plates etc). The actual full time equivalent job creation that will be realised in the construction of the projects in round 1 and 2 is an area of future research. The numbers that were made available by the developers at the licensing hearings were estimates. It would be useful to know if these representations were accurate.

The extrapolations for the total to be supplied in rounds 1 and 2 are easy to make, if all the 1048.91 MW allocated in rounds 1 and 2 were to be locally assembled, under the current labour intensities described by Tenesol and SolaireDirect – the job creation expectation could be between **2308 and 3147**. If the anticipated ancillary manufacturing of glass, junctions boxes etc were to occur the job creation expectation expected would be between **11 323 and 17 622**.

**Summary:**

The reported job creation in manufacturing in South Africa for renewable energy seems to be slightly lower than the international experience. This is a result of the jobs reported in SA being pay rolled employees while the contract and indirect jobs were not counted. However, in the job creation value chain of PV in South Africa, the assembly line pay rolled employees counts for 16-19% of the total jobs. This is a high labour intensity portion of the value chain as this 16-19% of the jobs only represents a small fraction, 6%, of the over-all cost. This high labour intensity portion of the value chain is an area that the policy makers can leverage to increase employment opportunities in the country.

**4.3.2 Subsection: Impact of the current definition of local content**

The SABS definition of local content has generated considerable controversy. It is clear that the intention of the definition is to try and generate a universal definition for local content, to ensure

that government entities procuring goods, services and technologies have a standardised metric to evaluate the local content contributions. The underlying principle of this endeavour is to ensure local companies get access to preferential procurement, leading to job creation and employment.

This paper submits that the current definition of local content is structurally unsupportive of the national priorities of job creation in the context of PV. A high job creation portion of the value chain is in the module assembly. Furthermore, this portion of the value chain accounts for only 6% of the overall value of a project. The current definition of local content rewards only high value interventions, not high job creation interventions.

**Thought experiment: *This example is hypothetical and will attempt to reveal the flaw in the local content definition (South Africa does have module assembly, but does not have wafer production).***

**Scenario 1:** Company A is based in South Africa and assembles modules. Its business is local 'assembly' of PV panels, and Company A imports wafers. The cost component of its imported wafers is 90% of its overall cost, 10% is labour electricity etc. The company adds a 20% margin onto this cost base. This company employs more than half of the total number of people employed in manufacturing for PV, as discussed above.

$$\text{Company A's local content: } LC = (1 - x/y) * 100 = 25\%$$

**Jobs created in South Africa in scenario 1: 54% of all possible jobs in the PV value chain.**

**Scenario 2:** Company B is based in China and assembles modules. Company B imports wafers from a South African wafer manufacturer. The assembly of the panels takes place in China, with an identical cost structure and employment to that of Company A. The panels are then exported to be installed in SA, and for ease we assume no tariffs or shipping costs.

$$\text{Company B's local content: } LC = (1 - x/y) * 100 = 75\%$$

**Jobs created in South Africa in scenario 2: 15% of all possible jobs in the PV value chain.**

Scenario 2 yields a significantly higher local content percentage, yet it results in only a fraction of the jobs that scenario 1 realises. The overarching goal of national government is job creation. This is a hypothetical example of the importance of understanding the structure of the value chain and where jobs can be created. Jobs are created along the value chain, but with varying intensities; the different intensities of job creations should play a critical role in designing coherent policies. The above example is intended to illuminate the negative impact of the current definition of local content for the PV industry. While the intention of having local content and defining local content is to maximise job creation, in this instance there is a perverse effect and a disconnection between the policy intent and its impact.

This example is specifically designed to show that a Chinese assembly plant, importing high value – low job wafers from South Africa scores higher for local content than a South African assembly plant, importing wafers and creating a large number of jobs. It is a hypothetical scenario as no wafer manufacturing currently exists in South Africa, so there is no 'scenario 2', scenario 1 does exist.

Currently in South Africa there are two local utility scale PV panel manufacturers, Tenesol and SolaireDirect. They fall exactly into this policy divide where, despite creating a significant percentage of the possible jobs along the value chain, their panels are considered to have low local content under this definition.

When these module assemblers were asked how they would define local content, the suggestion was to count PV as 100% locally manufactured if the panel is laminated in South Africa (Gouzil, 2011). This definition effectively means that the wafers, the highest value component, can be imported but the job creation opportunities in South Africa can be maximised.

The dti has the task of trying to design policy parameters that encourage economic development and job creation. The reality is that much of the policy nuance can only be understood through a thorough evaluation of the value chain, and an understanding of the concentrations of job creation opportunities along that value chain.

**Summary:**

The current definition of local content yields a perverse incentive. The definition does not effectively encourage manufacture in the portions of the value chain that have a relatively high labour intensity. The sub-optimal definition of local content is a hindrance to job creation in the PV industry.

**4.4 How could future rounds of REIPPPP be improved to maximise employment while still delivering value for money?**

The steep decrease in price between round 1 and round 2 of the bids prompts questions about the value for money in round 1. National Treasury defines value for money as “the provision of the institutional function by a private party in terms of the public-private partnership agreement results in a net benefit to the institution, defined in terms of cost, price, quantity, or risk transfer, or a combination thereof” (National Treasury - Republic of South Africa).

The prices that were bid in round 2 were significantly lower than in round 1. Given the price digression discussed in the introduction, a digression is consistent with international norms. The literature found that the annual price reduction in PV was between 17% and 24% across 95% of the literature. In the South African context with the bids only 6-months apart a reduction in price of between 9% and 12% would be considered ‘normal’. However, the difference in the South African context was a massive 40%, or an annualised decrease of approximately 60-80%. This is several times what the literature suggests is the expected price decrease.

	Round 1	Round 2	Difference
Average Price (kwh)	2.75	1.65	40%

Fig 33: Price digression from round 1 to round 2. Source (Department of Energy, 2012)

There are a number of possible reasons for this rapid price decline (The GreenCape Sector development agency, 2012).

- i) Lack of competition in round 1.  
It was generally anticipated by participants that the market in round 1 would be underbid. The DoE had no inter-round smoothing of allocations for the bid at that point,

and hypothetically the full allocation of 1450MW of PV could have been awarded in the first round. Further, it was known to the bidders that there would be insufficient projects in the first round to make the 1450MW upper ceiling. The information available to the market left the bidders with no incentive to 'compete' on price. If they met the qualification criteria, they were assured an allocation. The result was that as anticipated all rational bidding happened at, or very close to, the ceiling price.

- ii) Significant decrease in risk in round 2.  
Decreases in risk generally lead to a drop in price as financial institutions become more comfortable with the overall project development programme. While this is a plausible explanation for a significant decrease in pricing between rounds, as the uncertainty on procedures, construction and grid connections are reduced, it is not plausible here. In this case the reduced risk hypothesis is rejected. There was insufficient time for significant learning or risk reduction between rounds. By the time the round 2 projects were bid round 1 project's had not yet reached financial close, let alone begun construction. It is not possible that the risk was reduced enough to make a significant contribution to the price decreases.
- iii) Significant improvement of financial arrangements.  
In order to be price competitive in round 2, bidders would have put significant effort into getting the cheapest financial structure in place. Financing is one of the key areas that can lead to such significant savings. The projects that SolaireDirect won in round 2 used self-financed equity; this self-financing equity could be through on balance sheet debt from the parent company, or through cash reserves of the parent. The advancement in financial structuring contributed to the price decrease in round 2. While the final structural and financial arrangements remain unknown at this time, it is not far-fetched to suggest that the round 2 projects would have had significantly different financial arrangements to round 1.
- iv) Sunk Costs.  
Daniel Kahneman and Amos Tversky have done a large amount of work on the behavioural economics around sunk costs. In this scenario it applies to developers who have typically spent between R2 million and R4 million getting a site ready to bid (The GreenCape Sector development agency, 2012). These sunk development costs will contribute to developers bidding at lower tariffs in order for them to recoup some of the risk capital invested in developing projects. This was particularly prevalent in the UK where the winning bids came in at prices that were so low that the projects could not go ahead, effectively sterilising the sites.
- v) World prices  
There has been a slowdown in the international PV market, particularly Spain and France. This means that there is a surplus supply of panels in the market. This is one of the contributing factors to driving the price of panels down.

#### **Data: Average Prices Bid (PV)**

Round 1	275 c/kwh
Round 2	165 c/kwh

Fig 34: Average bid price from round 1 to round 2. Source (Department of Energy, 2012).

This price difference between round 1 and round 2 is significant, with the price in round 2 only 60% of the price bid 6 months prior.

	Competitive bid round 1	Competitive bid round 2
Price (Ave)	R2.75/kwh	R1.65/kwh
Job Creation (per MW construction)	16	11
Job Creation (per MW operation)	0.35	0.47
Ave cost per MW (mil)	34.77	28.89
Local content	28.50%	47.50%
Total spent per MW locally (mil)	9.9	13.7

Fig 35: Comparison of prices, job creation, construction costs, local content, local spend between round 1 and round 2.

Source: Author generated table: Based on NERSA Public hearings and DoE presentation

The further point for review is the decrease in average price compared with the decrease in average cost per MW.

The average cost per MW (the hardware cost) is only down 16%, while the average price is down 40%. The price digression of the hardware (ave cost per MW) is a better fit into the price digression range described above, the 17-24% (Winkler, Hughes, & Haw, 2009). It is clear from the above data that the savings in price were not entirely savings in hardware. There were significant savings made in the financing arrangements and margins, used to put these projects together.

Further, this research report would argue that the financing arrangements in round 1 were inflated due to the absence of competitive bidding. It was known that there were insufficient bids to induce competition. This amounts to a leakage or inefficiency in the system. This leakage, created through the absence of competition, resulted in the first round of bids being tantamount to a feed-in tariff system.

Further research is required to ascertain if this inefficiency was indeed a necessary incentive to allow the renewable energy industry enough contingency to proceed with project development. It has been argued by several developers, and associations, that the higher prices in round 1 will compensate for the 'learning by doing' the industry will experience in the construction of the round 1 projects.

The original intention in shifting from a FIT to a competitive bidding system was to ensure that there was price competition. In round 1 there was no price competition and this goal failed. However, by setting a ceiling price that Treasury was willing to pay, it is possible that the overall risks associated with a competitive bid have been reduced. The literature suggests that in the UK a competitive bidding system was unsuccessful. The bid requirements in the REIPPPP were considerably more onerous than in the UK, but time will tell whether or not the hybrid system employed by the DoE will yield the anticipated results.

When the prices of round 1 are examined in the context of manufacturers operating at less than 30% capacity, a theory put forward is that there was both price and manufacturing inefficiency within this system. If these manufacturers were allocated additional projects to supply the capacity exists to have done so.

If the round 1 determination had demanded local content to the extent that the existing factories were operating at 100% capacity, there would have been in the region of 310 additional direct jobs created in the PV industry in South Africa. Further, if there was a condition that all modules must be locally assembled, there would be in the region of 3000 new direct jobs in PV assembly. It is theorised that in the case of round 1, this would have increased job creation without increasing prices.

The stated goal of this procurement process was to ensure that there was a competitive bid which balanced price and socio-economic development criteria. It is evident from the data that there are areas where this process could have been improved.

If the process is to maximise job creation and simultaneously deliver value for money, the following can be improved,

- a) The local content definition should take into account the nuances of this industry,
- b) Policy should focus on maximising the high job yields that accrue at the module assembly portion of the value chain even though this portion of the value chain represents a small amount of the overall value.

**Summary:**

Round 1 exhibited no price competition, and was effectively a feed-in tariff. In round 2 there was a price digression of 40%, this is larger than expected. This price digression was made up partially of decreases in the price of equipment, but also in the financial structures of projects.

If the process seeks to maximise job creation while delivering value for money, the local content requirements and definitions will have to change and an increased focus will have to be placed on the high job creation portions of the value chain.

## Section 5: Conclusion

South Africa has embarked on a development path that includes renewable energy in its energy mix. This is a new technology for South Africa which has typically relied on cheap and plentiful electricity from coal. A plan to follow the internationally popular feed-in tariff approach was designed in 2009. The process was halted, and a new competitive bidding process was designed for South Africa. The renewable energy independent power producer procurement programme was initially critically received, with many in the local and international community believing that a FiT was a better option. However, as the programme has unfolded there is increasing confidence in its ability to deliver on schedule, competitively priced, renewable energy.

Despite the intended competitive bidding process in the REIPPPP, the first round of bidding in South Africa was in effect a feed-in tariff. Only a limited number of projects had all the necessary permissions to submit bids. Further, it was known that the total mega-watts to be bid by these projects would be less than the total amount allocated to the round, effectively negating any competition.

The process has experienced delays which have increased the uncertainty around the renewable programme in South Africa. When the first round projects reached financial close, late 2012, confidence in the process was reinvigorated. The process has been applauded both domestically and internationally.

The theory examined in this research suggests that there are improvements and adjustments that can be made to the process to maximise the benefits of this infrastructure spend. There are job creation opportunities in manufacturing that remain unrealised. Understanding the value chain and understanding the cost break-down of the projects will allow authorities to optimise this process.

The critical issues of defining local content, setting minimum thresholds that encourage manufacture and understanding the cost structures, remain elusive. There is a large amount of industrial strategy work that is happening at various institutional levels in South Africa. Co-ordination of these efforts will result in a better understanding of the areas where the benefits of a renewable energy roll-out can be maximised for the South African economy.

This research submits that for no price increases there can be a significant increase in the local production and job creation in utility scale photovoltaic installations under the REIPPPP. This increase in local production will result in thousands of additional manufacturing jobs in the South African economy.

Using the information available from the first rounds of bidding there are several observed results that are put forward as the patterns in this research:

- i) The South African renewable energy market has been exposed to policy uncertainty and this has created hesitation in the manufacturing sector.
- ii) Round 1 was tantamount to a feed-in tariff, with the market aware that there were insufficient projects available to make the round competitive. The round was underbid

- with project bid prices close to the ceiling price. All qualifying bids were awarded preferred bidder status.
- iii) If a higher local content, or designation, had been enforced in round 1, there would have been higher value to the South African economy for no increase in bid price.
  - iv) Round 2 saw steep price digression as a result of price competition in the bid.
  - v) The price digression of projects in round 2 was at a significantly higher rate than the literature averages, prompting speculations of and overpriced round 1.
  - vi) The data shows that the projects using local panels were cheaper than the average price in both rounds. Correspondingly, the projects using imported panels had a higher average price than locally manufactured projects in both rounds.
  - vii) If the imported PV panels have a cheaper unit than locally assembled panels, then the price savings were not passed on to the end user, the South African public, who will pay the blended price of energy.
  - viii) The current definition of local content yield perverse incentives in the PV industry as it may actually discourage job creation in the high labour intensity portions of the value chain.
  - ix) Manufacturing (assembling) PV in South Africa creates 220-300 direct jobs for each 100MWp of panels assembled.
  - x) It is further theorized that local suppliers for glass, junction boxes and other material inputs (excluding wafers) would set up if there was a local market. This would push the job creation in module assembly to between 10.8-16.8 Jobs/MW.
  - xi) Based on the current, observed, employment creation potential for PV, if the entire amount to be supplied in round 1 and round 2 was to be locally produced in the current supply format, as many as **3146** direct manufacturing jobs could have been created.
  - xii) Based on the international literature – if these volumes of manufacturer were to occur, there would be further localisation of the supply chains pushing the job creation figure to between **11 323 and 17 622** direct jobs.

Round's 1 and 2 exhibited inefficiencies and the opportunity to increase the number of local manufacturing jobs through prescriptive local procurement requirements was not taken. Tenesol and SolaireDirect are supplying locally assembled panels to projects with a cheaper than average bid price. South Africa, through more effective and certain policy intervention, could have created more jobs for no increase in price if the local content requirements had been higher.

Extrapolating from the patterns in the observations, the theory is put forward that South Africa could have demanded a higher local content, or designated that local panels were to be used, in both round 1 and round 2. This regulation would have resulted in more local spending and job creation, without increasing the price that was bid. South African policy makers are reviewing the localisation strategy for PV that takes the job creation intensity of value chain activities into account. This will allow the design for a strategy where job creation can be maximised.

The ability for South Africa to realise jobs from local manufacture in future rounds is critical to achieving the job creation targets that have been set by national government. The theory, put forward by this research is, that despite a well-designed and well run procurement programme, South Africa did not realise the full potential of 'value for money'. The patterns in the data suggest that more local jobs and a higher local content could have been achieved without increasing the

price of successful bids. The price of these inefficiencies in the South African system is borne through a combination of missed employment opportunities and higher energy prices.

## 5.1 Areas for future research:

This research paper gives rise to several possible areas of future research. While many of these areas have been flagged in the body of the text, this section is a brief summary of possible areas:

i) A retrospective quantitative analysis of the job creation from the REIPPPP process. This research would only be able to take place several years into the future when this data are available. This research could compare the number of jobs actually created to the number of jobs projected at the license hearings.

ii) Renewable energy, no net benefit. This hypothesis was put forward and briefly criticised. There is scope for a full economic review of the life-cycle costs associated with producing renewable energy vs. conventional energy. The hypothesis that Government's financial incentives may be better spent in other areas of the economy undervalues the underlying need for energy. A comparison between various types of energy and which provide the highest benefit for an incentive is a worthwhile field of research.

iii) Transaction costs in the South African economy. The section on local content touched very lightly on the reporting, monitoring and compliance burden of local content. Further research into the additional transaction costs associated with compliance is an area that could be researched. There is very clearly a tipping point at which the cost to comply becomes significant and a handicap to the industry.

iv) Economic multipliers associated with renewable energy manufacturing. Research into the South African case of understanding the multiplier effect of manufacturing, and specifically manufacturing for renewable energy, is an area that has not been well covered and additional research into this field is encouraged.

v) Round 1 inefficiencies and market: There is scope for research into the impact of the inflated prices in round 1. Are the inflated prices a windfall for round 1 developers, a first mover advantage, or are they a necessary contingency fund to pay for learning during construction that will take place. This research would only be possible once the round 1 projects are grid tied and final costs, and cost over-runs are known.

vi) Drivers of the policy shift from a feed-in tariff to a competitive bid in South Africa. A short section of this research paper touches on the key drivers of the dramatic change in policy. An interview based research paper on what the key drivers of this shift were, would be an interesting area of research. Ideally this should focus on the perspectives of the developers, the lenders, the regulators and the various lobby groups.

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## **Appendix A: How to become an IPP in South Africa**

### ***Becoming an Independent Power Producer (IPP) in South Africa – A guide to the permissions and processes required – Produced by the GreenCape Sector Development Agency 2012***

#### **1. Find a site (Purchase outright or lease sub-division)**

After locating a suitable site for wind or solar energy, the first step towards acquiring a Purchase Power Agreement (PPA) from The Department of Energy depends on whether the investor intends on purchasing the land outright or leasing a portion of the land from the land owner. If the first is true then the investor can proceed directly to acquiring planning permission. If a lease is intended, the process becomes slightly more rigorous.

#### **2. Obtain Department of Agriculture approval for the lease agreement**

Act 70/70 governs the sub-division of agricultural land. Agricultural land may only be sub-divided if it can be argued that both sub-divided portions will be economically viable independent entities. A lease of longer than 9 years is deemed by the act to require the same approval process as sub-division. The department of agriculture, forestry and fisheries (DAFF) has decided that it will not allow sub-division in order to build renewable energy plants but will allow leases of up to 25 years under certain conditions. An investor wishing to lease land should however apply for Act 70/70 approval of the lease prior to signing such a lease. The application requires a draft of the lease agreement, a lay-out of potential wind turbine or solar sites, and a soil analysis from an agronomist to indicate the cultivation potential of the site.

DAFF has indicated that they will require the lease to meet certain conditions in order to get Act 70/70 approval. These are as follows:

- a) The farmer is entitled to continue farming
- b) The lessee is responsible for any erosion of land or soil damage incurred during the lease period.
- c) At the end of the lease all equipment will be removed and the land restored to the original condition
- d) The land owner should be made aware that the existence of the lease could affect the value of his land
- e) There can be an option to renew the lease
- f) The lease may not affect the water rights of the farmer

#### **3. Apply for Planning Permission**

Planning permission needs to be obtained for any development and in the Western Cape; this is subject to the Land Use Planning Ordinance (LUPO) 15/1985. This ordinance requires that planning permission be applied for from the local authority in which the land is situated. The government has decided that the appropriate planning permission for a power plant on agricultural land is a “consent use”. A town planner who is used to working with the local municipality should do this application.

#### **4. Conduct an Environmental Impact Assessment**

An environmental impact assessment (EIA) will be required. This process requires the assistance of an EIA consultant and takes between 12 and 24 months. The department of environmental affairs will in all likelihood require the following specialist studies:

- Visual impact assessment

- Paleontological study
- Archaeological study
- Avifauna and bat study – there is a proposal which will require 12 months monitoring of bat and bird life both before and after construction
- Botanical, zoological, and environmental impact assessment
- Agronomy report

The department of Environment affairs (national and provincial) has been working on mapping the criteria that they use for assessing potential wind sites and solar sites so that potential developers can use this as a pre-selection criteria when looking for sites with wind or solar potential.

#### **5. Get a Tie-in agreement with Eskom**

In order to sell power via the grid, the potential IPP will need to get a tie-in agreement with Eskom. The process for this is currently as follows, although it might change in future:

- You will need to speak to the regional head of distribution for Eskom for the region in which your plant is expected to be built and determine:
  - Whether the grid at that point can take the power you wish to produce,
  - Whether Eskom is happy for you to tie in at the line or substation at that point and what the conditions would be.
- You will need to apply for a cost-estimate letter (at this stage Eskom will only negotiate and agree tie-in agreements with parties that have been selected by the department of energy (DOE) for negotiating a PPA). This cost estimate letter will give you an estimate of the costs involved in tying to the grid at the requested point, a quote on an upfront connection charge, and a quote on an annual agency fee.
- Once the IPP has been selected by the DOE and a PPA is being negotiated, then Eskom will update these costs and the IPP will need to accept responsibility for these costs before a tie-in agreement can be concluded.

#### **6. Apply for a generating license**

At present you can only apply for a generating license from the National Energy Regulator of South Africa (NERSA) once you have been preselected by the DOE and have agreed a tie-in agreement with Eskom. This procedure is a formality and should not prove an additional hurdle.

#### **7. How do you get your project selected by the DOE for a PPA?**

At present the indication is that the DOE and National Treasury (NT) will run a rolling request for proposal (RFP) process that will call for proposals from prospective IPP's regarding projects that have sufficiently progressed to the point that proof of financing is available. This rolling process will be run multiple times each year until the annual allocation of renewable energy projects according to the IRP2010 have been approved. Whilst every indication exists that it is intended this process be governed by repeated rounds of bidding, determined periodically.

#### **8. Civil Aviation Approval (Wind)**

The applicant will need to get civil aviation approval for the development of the site.

#### **9. Department of water affairs**

A letter of approval is needed from water affairs. They are interested in the water requirements during construction and operation of the site.

**10. Section 53 at Mineral resources**

It is prudent to apply for a sterilization of mining rights at the Department of Mineral Resources. (This is not a requirement to bid – yet it could be a problem)

**11. How much Renewable energy will be purchased**

The integrated resource plan of 2010 (IRP2010) specifies that a total of 9 200 MW of wind, 8 400 MW of solar PV 1200 MW of CSP, and 125 MW of landfill gas and small scale hydro power be built. The IRP2010 both empowers and obligates the department of energy to sign contracts for this power. The department of energy going forward can also amend the IRP2010 should circumstances change. In the 1<sup>st</sup> round there is appears to be more than suggested in the IRP2010 with 1850MW of Wind and 1450MW of PV.

## Appendix B: Successful bidders details, round 1 and 2

### Project Details:

KEY	ROUND 1	ROUND 2			
IPP_ID	Project Name	Name Bidder	Province	Technology	Allocation
IPPID031	Letsatsi Power Company	Consortium consisting of Kensani Capital Investments (Pty) Ltd, SolarReserve South Africa (Pty) Ltd and Oakleaf Investment Holdings 80 (Pty) Ltd	Free State	Solar PV	64
IPPID032	Lesedi Power Company	Consortium consisting of SolarReserve South Africa (Pty) Ltd, Kensani Capital Investments (Pty) Ltd and Oakleaf Investment Holdings 80 (Pty) Ltd	Northern Cape	Solar PV	64
IPPID035	WITKOP SOLAR PARK	Core Energy (Pty) Ltd	Limpopo	Solar PV	30
IPPID036	Noblesfontein	Coria (PKF) Investments 28 (Proprietary) Limited	Northern Cape	Wind	72.75
IPPID037	Touwsrivier Project	CPV Power Plant No. 1	Western Cape	Solar PV	36
IPPID043	Dorper Wind Farm	Dorper Wind Farm (Pty) Ltd	Eastern Cape	Wind	97
IPPID052	SOUTPAN SOLAR PARK	Erika Energy (Pty) Ltd	Limpopo	Solar PV	28
IPPID064	Mulilo Renewable Energy Solar PV De Aar	Gestamp Mulilo Consortium	Northern Cape	Solar PV	9.65
IPPID065	Mulilo Renewable Energy Solar PV Prieska	Gestamp Mulilo Consortium	Northern Cape	Solar PV	19.9
IPPID118	KaXu Solar One	KaXu Solar One Consortium	Northern Cape	Solar CSP	100
IPPID123	Dassiesklip Wind Energy Facility	Klipheuwel - Dassiefontein Wind Energy Facility (Proprietary) Limited	Western Cape	Wind	26.19
IPPID128	Konkoonsies Solar	Limarco 77 (Pty) Ltd	Northern Cape	Solar PV	9.65

IPPID138	MetroWind Van Stadens Wind Farm	MetroWind (Pty) Ltd	Eastern Cape	Wind	26.19
IPPID148	Red Cap Kouga Wind Farm - Oyster Bay	Red Cap Kouga Wind Farm (Pty) Ltd	Eastern Cape	Wind	77.6
IPPID155	RustMo1 Solar Farm	RustMo1 Solar Farm	North West	Solar PV	6.76
IPPID159	Kalkbult	Scatec Solar	Northern Cape	Solar PV	72.5
IPPID163	Aries Solar	Sevenstones 159 (Pty.) Ltd.	Northern Cape	Solar PV	9.65
IPPID164	SlimSun Swartland Solar Park	SlimSun	Western Cape	Solar PV	5
IPPID182	De Aar Solar PV	South Africa Mainstream Renewable Power De Aar PV (Pty) Ltd	Northern Cape	Solar PV	48.25
IPPID186	Jeffreys Bay	South Africa Mainstream Renewable Power Jeffreys Bay Pty Limited	Eastern Cape	Wind	133.86
IPPID202	Hopefield Wind Farm	Umoya Energy (Pty) Ltd	Western Cape	Wind	65.4
IPPID225	Cookhouse	African Clean Energy Developments (Pty) Ltd	Eastern Cape	Wind	135
IPPID443	Greefspan PV Power Plant	AE-AMD Independent Power Producer 1 (Pty) Ltd	Northern Cape	Solar PV	10
IPPID444	Kathu Solar Energy Facility	Kathu Solar Park Consortium	Northern Cape	Solar PV	75
IPPID564	Solar Capital De Aar	Solar Capital De Aar (Pty) Ltd	Northern Cape	Solar PV	75
IPPID572	Droogfontein Solar PV Project	South Africa Mainstream Renewable Power Droogfontein (Pty) Ltd	Northern Cape	Solar PV	48.25
IPPID696	Herbert PV Power Plant	AE-AMD Independent Power Producer 1 (Pty) Ltd	Northern Cape	Solar PV	19.9
IPPID798	Khi Solar One	Khi Solar One Consortium	Northern Cape	Solar CSP	50
IPPID002	Bokpoort CSP Project	ACWA Power Consortium	Northern Cape	Solar CSP	50
IPPID014	Gouda Wind Facility	Blue Falcon 140 Trading (Proprietary) Limited	Western Cape	Wind	135.2

IPPID168	Solar Capital De Aar 3	Solar Capital De Aar (Pty) Ltd	Northern Cape	Solar PV	75
IPPID207	Sishen Solar Facility	Windfall 59 Properties (Proprietary) Limited	Northern Cape	Solar PV	74
IPPID240	Amakhala Emoyeni (Phase 1) Eastern Cape	Amakhala Emoyeni RE Project 1	Eastern Cape	Wind	137.9
IPPID303	Tsitsikamma Community Wind Farm	Tsitsikamma SPV to be established	Eastern Cape	Wind	94.8
IPPID309	West Coast 1	Micawber 862 (Pty) Ltd	Western Cape	Wind	90.8
IPPID362	Waainek	InnoWind Pty Ltd / Industrial Development Corporation of South Africa Ltd / Makana Winds of Change BBBEE co (RF) Pty Ltd	Eastern Cape	Wind	23.4
IPPID364	Grassridge	InnoWind Pty Ltd / Industrial Development Corporation of South Africa Ltd / Grassridge Winds of Change BBBEE co (RF) Pty Ltd	Eastern Cape	Wind	59.8
IPPID372	Chaba	InnoWind Pty Ltd / Industrial Development Corporation of South Africa Ltd / Chaba Winds of Change BBBEE co (RF) Pty Ltd	Eastern Cape	Wind	20.6
IPPID373	Aurora	Solairedirect Solar Projects	Western Cape	Solar PV	9

IPPID375	Vredendal	Solairedirect Solar Projects	Western Cape	Solar PV	8.8
IPPID490	Stortemelk Hydro (Pty) Ltd	NuPlanet Project Development (Pty) Ltd	Free State	Small Hydro	4.3
IPPID523	Linde	Scatec Solar	Northern Cape	Solar PV	36.8
IPPID527	Project Dreunberg	Scatec Solar Consortium	Eastern Cape	Solar PV	69.9
IPPID562	Jasper Power Company	Jasper Power Company ( consortium)	Northern Cape	Solar PV	75
IPPID750	BOSHOFF SOLAR PARK	Firefly Investments 230 (Pty) Ltd	Free State	Solar PV	60
IPPID764	Upington Solar PV	Harvipax (Pty) Ltd	Northern Cape	Solar PV	8.9
IPPID815	Neusberg Hydro Electric Project A	Mulilo Renewable Energy	Northern Cape	Small Hydro	10
					<b>2459.7</b>

Fig 36: Full list of preferred bidders across technologies for both rounds 1 and 2