April 2010

INPUT COST MONITOR

The Effect of Electricity Costs on Irrigation Farming

Foreword

The recent electricity tariff hikes as announced by the National Energy Regulator of South Africa (NERSA) in February 2010 are expected to have a significant impact on various levels of agriculture. In order to get a better understanding of the impact of the electricity hikes this report focus on the impact of electricity cost increases on the profitability and risk position of a typical grain irrigation farm in the Northern Cape Province. Electricity is an important cost component for irrigation farmers in the Northern Cape Province, where average rainfall amounts to approximately 250 cubic millimeters per annum. Farmers are dependent on electricity in order to pump water for irrigation from their surrounding water sources. Electricity cost is therefore a given variable in the input cost composition of an irrigation farmer in this province. This report was compiled in collaboration with the Bureau for Food and Agricultural Policy (BFAP) at the University of Pretoria.

Highlights

- Electricity costs are the second and fourth largest cost components, respectively, in the production of wheat and maize under irrigation on the typical farm investigated.
- While electricity costs have never exceeded 8 % of the total variable costs, it is projected to constitute almost 20 % of the maize variable costs in 2014 and 2015.
- In the case of wheat, electricity costs will increase to more than 18 % of total variable costs from 2012 onwards.
- In 2015, electricity costs are projected to amount to R3 551 for every hectare of maize planted under irrigation.
- Similarly, electricity costs for the production of wheat under irrigation are projected to reach R2 965 per hectare in 2015.
- The impact of increases in electricity tariffs will have a significant impact on the ability of maize and wheat irrigation farms to realise sustainable profits in the future average and adverse conditions.

1. Introduction

In order to determine the impact of the electricity tariff hikes on the profitability and risk position of an irrigation farm in the Northern Cape Province, a typical farm was identified that are representative of the majority of farms in this province. The impact of electricity cost was analysed by means of the Bureau for Food and Agricultural Policy's (BFAP) system of linked models. The BFAP sector model was used to simulate expected future market conditions, while the farm-level model indicated the effects of market conditions and electricity costs increases on the financial position of the typical farm for the next five years.

2. Farm background

2.1. Production activities

- While farming units in the Northern Cape vary significantly in terms of size, for the purposes of this document, the typical irrigation farm consists of 200 hectares under pivot irrigation.
- The typical irrigation farm is situated in the Douglas district of the Northern Cape Province. It produces mainly yellow maize and wheat. Water for irrigation is obtained from the Vaal River irrigation system.
- A typical production system involves the following production practices: Maize is planted during November/December and harvested during May/June the following year. Wheat is then planted directly after the maize harvest, and harvested during November/December.
- The typical farming unit represented in this input cost monitor also consists of a livestock production unit that contributes to the total turnover of the farm.

2.2. Income, cost and financial position

- The turnover of the typical farm for 2008 and 2009 is presented by **Figure 1**. Maize and wheat contributed almost equally (45 % and 46 % respectively) to the total turnover of the farm in 2008, while other farm income (e.g. livestock production) and non-farm income (shares, transport, etc.) contribute 4 % and 5 %, respectively, to the total turnover.

- Despite good yields in 2009, the contribution of wheat to the turnover of the farm declined to 43 % as a result of a lower wheat price.

- Other farm income and non-farm income increased to 5 % and 7 %, respectively, while the contribution of maize remained constant at 45 % of the total turnover in 2009.

- The fixed costs as a percentage of total costs are lower than the usual norm of 25 % to 30 % of total costs **(Figure 2)**. Input costs (especially fertilizer) surged in 2008, which resulted in higher variable costs relative to fixed costs.

- The input cost compositions of maize and wheat are presented in **Figures 3** and **4,** respectively. The actual data was provided by Griekwaland-Wes Koöperasie (GWK).

- It is important to note that despite a decline in fertilizer prices, crop insurance and fuel costs in 2009, all other variable cost components increased.

- The high proportion of fertilizer costs in the production of maize and wheat indicates that farm income is extremely sensitive with respect to the variability of fertilizer prices. This is also applicable to the costs of electricity, marketing and seed.

- Electricity costs are the second and fourth largest cost components, respectively, in the production of wheat and maize under irrigation.

- **Figures 5** and **6** indicate yields and prices for maize and wheat. Lower producer prices often counteract good yields, as can be seen in 2009, where increases in maize and wheat yields of the typical farm were offset by lower producer prices. This is especially true in the case of maize. For wheat, it is purely coincidental, since South Africa is a net importer of wheat and the local production of wheat has therefore no impact on the producer price.

- Higher profits that could have materialized in 2009 due to higher yields were marginalised by lower producer prices.

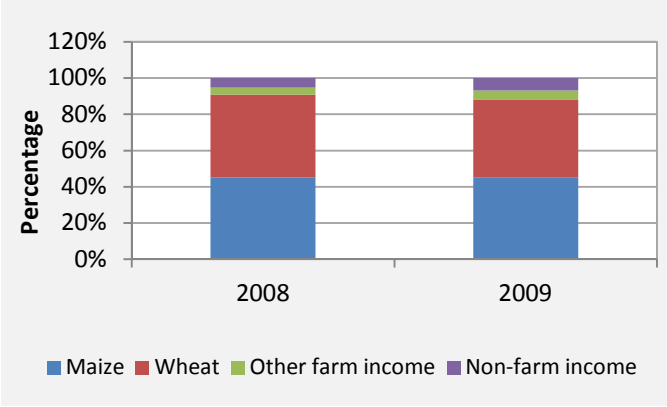

Figure 1:Turnover composition of the typical farm from 2008 & 2009

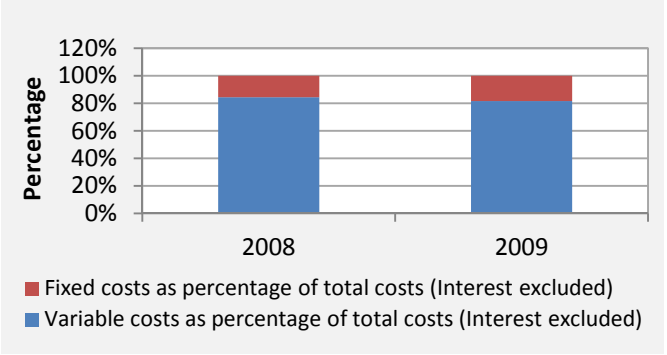

Figure 2: Cost ratios for the typical farm in 2008 and 2009

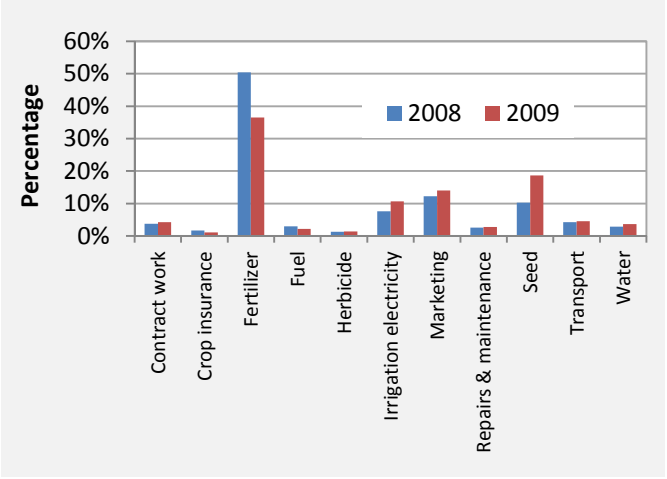

Figure 3: Input cost composition for maize production

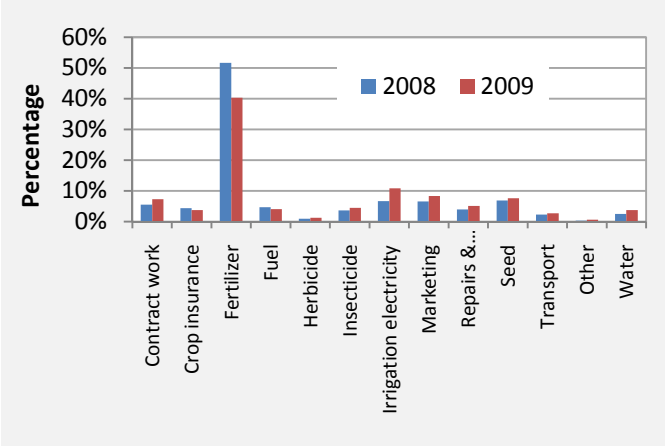

Figure 4: Input cost composition for wheat production

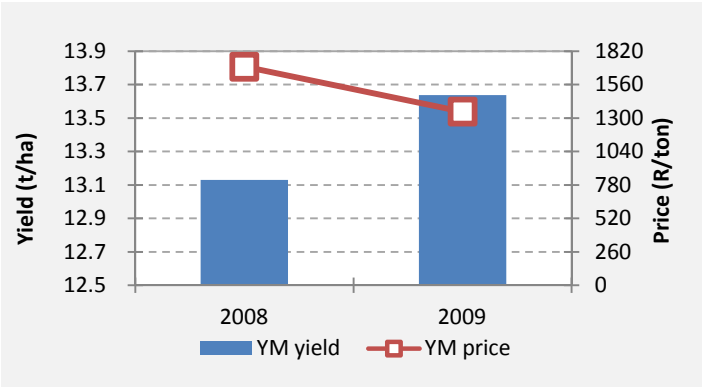

Figure 5: Yields and prices of yellow maize

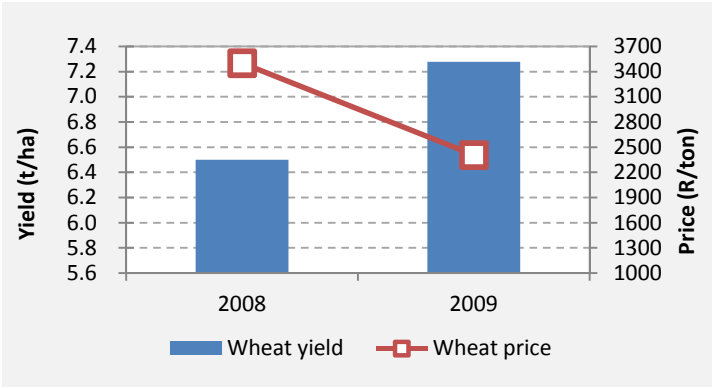

Figure 6: Yields and prices of wheat

3. Underlying key indicators and assumptions

In order to simulate the impact of electricity cost increases, the information in the previous section was used in conjunction with various assumptions. The latest outlook from the BFAP sector model is applied in the FINSIM model in order to simulate baseline projections for the NFI of the typical farm. Prices and yields of the typical farm follows the trends as projected in the latest projections by the BFAP sector model. The key macro-economic assumptions and baseline projections generated by the BFAP sector model are presented in **Table 1**.

Table 1: Assumptions and baseline projections

		2010	2011	2012	2013	2014	2015
Oil price: refineries acquisition	US $/barrel	79.6	90.00	80.77	86.43	86.00	80.65
R/USD	SA cents/ US $	743.9	780.35	814.43	847.49	880.58	909.55
SA Real GDP	Percentage	0.5%	3.5%	4.1%	4.2%	4.3%	4.3%
SA CPI	Percentage	6.7%	6.3%	7.6%	7.8%	8.1%	7.7%
Yellow maize yield	t/ha	13.71	14.03	14.15	14.26	14.38	14.49
Yellow maize producer price	R/ton	1210.2	1513.0	1455.6	1631.7	1690.3	1810.2
Wheat yield	t/ha	6.53	6.56	6.60	6.63	6.66	6.69
Wheat producer price	R/ton	2078.6	2350.9	2486.1	2696.0	2840.9	2924.3

Other assumptions

- The farm has a long-term loan as well as two medium-term loans, with subsequent instalments and interest payments.
- The interest rate for the long-term loan amounts to 9.5 % per annum, while interest rates for the medium-term loans amount to 10.5 % per annum.
- Asset replacement takes place every year at an average rate of 10 % for vehicles and 7 % for equipment.
- The farmer utilises 75 % of his production loan and overdraft facilities each year.
- The soil potential and quality, as well as water quality remain constant.
- The condition and productivity of equipment remain constant.
- The farm business structure remains unchanged.
- The quality of farm management remains constant.
- The electricity hikes as announced by the National Energy Regulator of South Africa (NERSA) in February 2010 are introduced in the farm-level model. The hikes are introduced as follows:
  - 24.8 % in 2010, 25.8 % in 2011 and 25.9 % in 2012.

- These hikes are applied in the analyses over and above the hike of 31.3 % in 2009.
- After imposing these projected increases in the model, the assumption is made that beyond 2012, electricity costs will increase in line with inflation.

4. Impact of electricity tariff increases on farm profitability

- The impact of the increase in electricity costs for maize and wheat production on the typical farm is shown in **Figures 7** and **8**.
- While electricity costs have never exceeded 8 % of the total variable costs, it is projected that it will constitute almost 20 % of maize variable costs in 2014 and 2015. In the case of wheat, electricity costs will increase to more than 18 % of total variable costs from 2012 onwards (**Figures 9** and **10**).
- In 2010, electricity costs will already make up 12 % of variable costs of maize production at R1 906 per hectare. In 2015, electricity costs are projected to amount to R3 551 for every hectare of maize planted under irrigation.
- Similarly, electricity costs for the production of wheat under irrigation are projected to increase from R1 516 per hectare in 2010 to R2 965 per hectare in 2015.

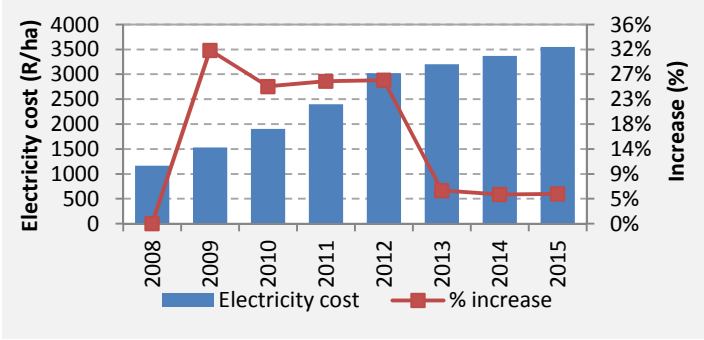

Figure 7: Electricity costs for maize production under irrigation

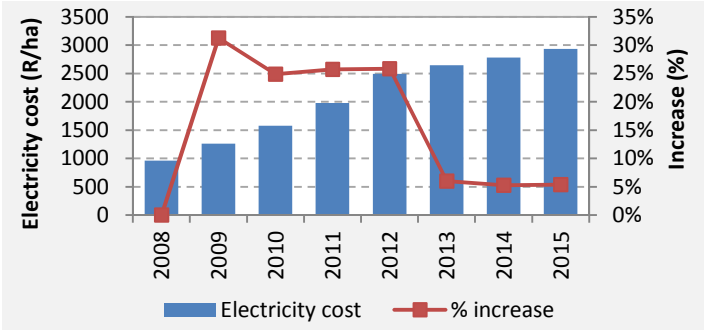

Figure 8: Electricity costs for wheat production under irrigation

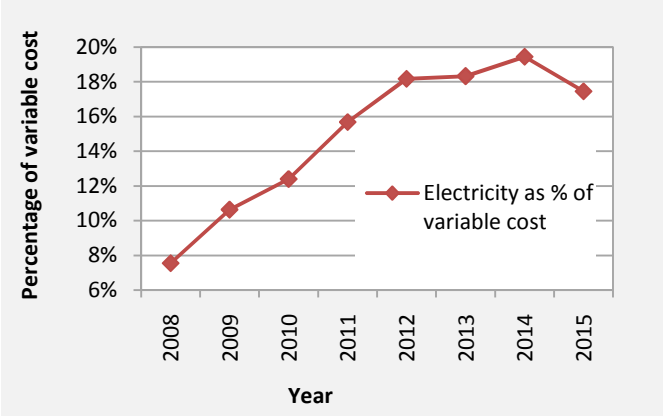

Figure 9: Electricity costs as percentage of variable cost for maize production

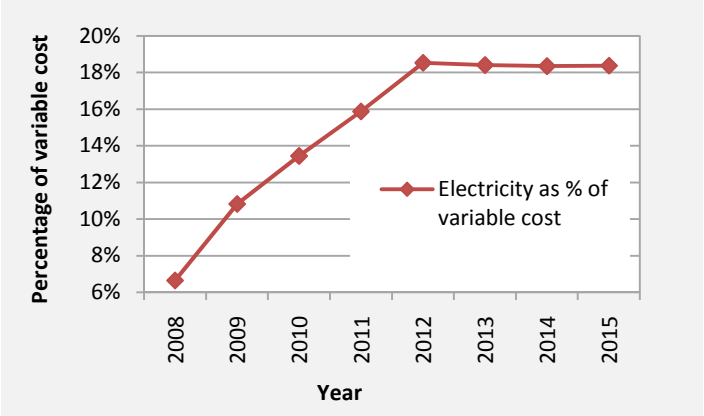

Figure 10: Electricity costs as percentage of variable cost for wheat production

- In order to determine the impact of electricity tariff increases on the profitability of the typical farm, the Net Farm NFI[1] is used as a proxy for farm profitability.
- **Figure 11** compares NFI for the typical farm with electricity tariff increases (blue line), with a NFI where no tariff increases were included (dashed red line).
- The negative impact of electricity tariffs can clearly be observed in **Figure 11** as the typical farm would have realised a NFI of approximately R300 000 higher in 2010 if electricity tariffs were not increased. It is further expected that as a result of the tariff hikes, the farm will realise a NFI approximately R829 000 lower in 2015.

[1] Net Farm Income (NFI) is calculated as gross income minus production costs, fixed costs, interest payments and depreciation.

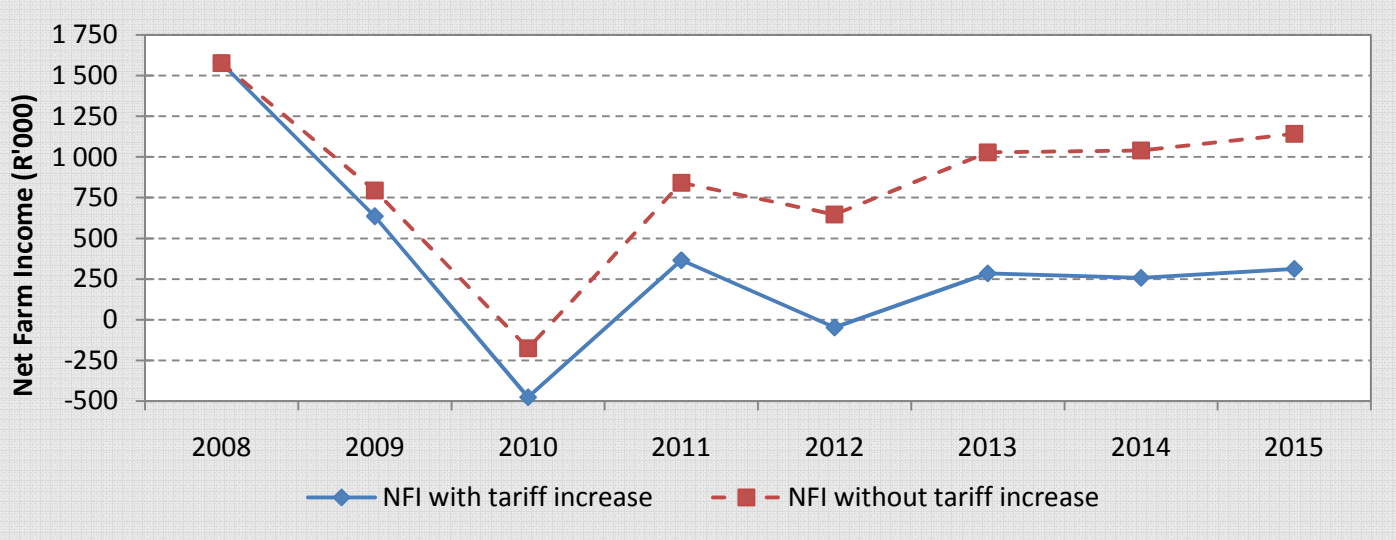

Figure 11: The impact of electricity tariff increases on Net Farm Income (NFI)

5. Impact of electricity tariff increases on the risk position of the typical farm

- Due to the volatile nature of agricultural markets, farm businesses are exposed to a high level of risk. Changes in commodity and input prices have a significant impact on the risk position and subsequent financial stability of a farm business. The effect of increasing electricity costs on the risk position of the typical farm is subsequently investigated in this section.
- In other words, if NFI is used as an indicator of the financial risks a farm business faces, one would expect NFI to vary over time as yields, prices of commodities and input costs vary. If there is a significant increase/decrease in one of these variables it will also have a significant impact on the variability of NFI. This in turn put considerable pressure on farm management. Within the context of this article, the impact of variability in maize and wheat prices, yields and input costs on NFI is simulated in the absence of the electricity price hikes. The simulation is then repeated by incorporating the increase in electricity prices.
- In order to generate different risk situations the values of the exogenous variables (i.e. prices, yields and input costs) are generated stochastically to calculate NFI for three different scenarios. These scenarios are
    - A situation where farmers obtain maximum yields, high output prices and pay low prices for inputs (denoted as "Max" in **Figure 12**),
    - A situation where farmers obtain low yields, low output prices and pay high prices for inputs (denoted as "Min" in **Figure 12**), and
    - A situation where there is an average outcome (denoted as "Mean" in **Figure 12**).
    - The increase in electricity prices is then combined with each scenario to illustrate its impact (see solid line in **Figure 12** for each scenario).

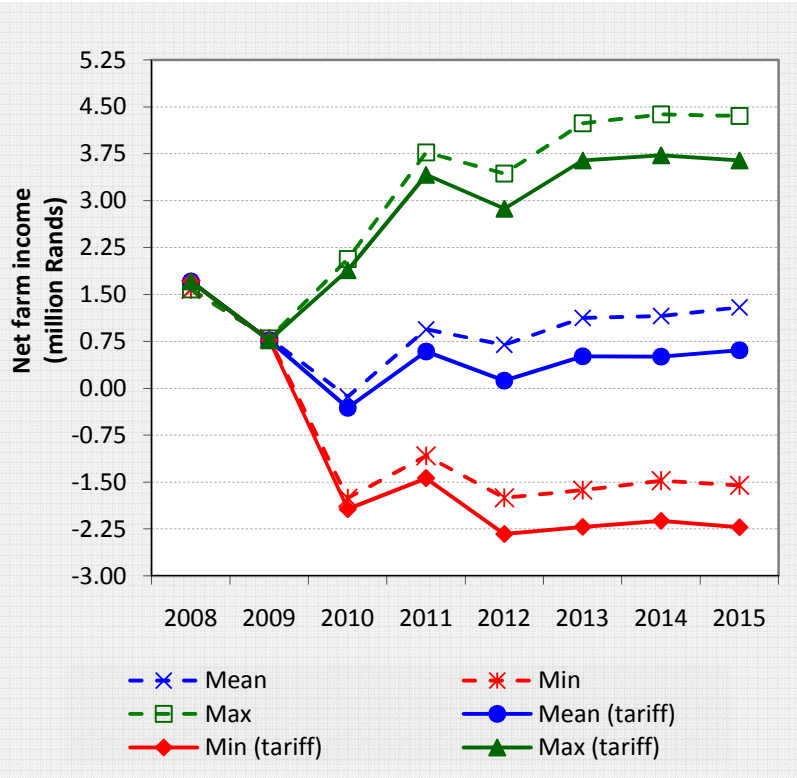

Figure 12: The Net Farm Income (NFI) as a proxy for the profitability of the farm

- Based on the assumptions applicable to the macro-economic variables, the variability in the mentioned exogenous variables and the electricity price hikes, **Figure 12** shows that the typical farm under consideration are expected to realise a negative NFI of R314 200 in 2010 under average (mean) conditions. The outlook towards 2015 is more positive. Note should be taken of the significant negative impact of the increase in electricity levels.
- In extreme favourable conditions, the typical farm will be able to generate a NFI that accounts for the impact of electricity tariffs of R1.9 million in 2010, which increases to R3.64 million in 2015. Without the electricity tariff hikes, the typical farm would have been able to generate a NFI of R2.07 million in 2010 and R4.35 million in 2015 under favourable conditions. On the other hand, losses of between R1.4 million and R2.2 million can be expected from 2010 onwards in the case of extreme adverse conditions.
- **Figures 13** and **14** represents the probabilities of the NFI being higher than R350 000 (green area), between R360 000 and R0 (yellow area) or below R0 (red area).
  - The amount of R350 000 is used as a benchmark to cover the expected family living costs. In order to cover the family living costs and still be able to sustainably continue with farming operations, the typical farm must generate a NFI greater than R350 000.
  - From **Figure 13** is clear that the typical farm has a good chance to incur losses in 2010 as a result of declining output prices and increasing costs. This probability of incurring a loss in 2010 is further amplified by the hikes in electricity tariffs (**Figure 14**).
  - The probabilities further suggest that from 2011 onwards, farmers will have better prospects for profitable farming. However, after the introduction of electricity tariff increases, farmers are expected to experience substantial pressure on profit margins with a relatively high probability that the NFI will fall below the critical level.

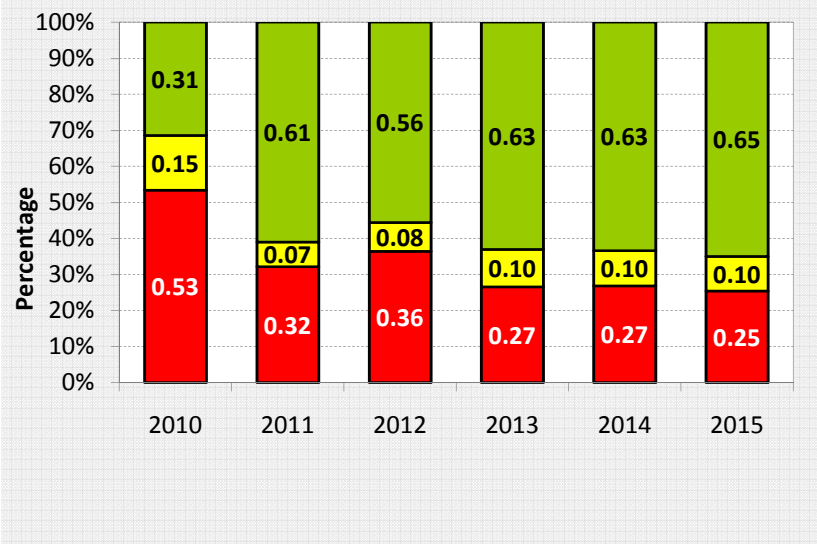

Figure 13: The probability of realising a certain NFI
Green area: Probability that the Net Farm Income is higher than R350 000
Yellow area: Probability that the Net Farm Income is between R0 and R350 000
Red area: Probability that a loss is made (the Net Farm Income is below R0)

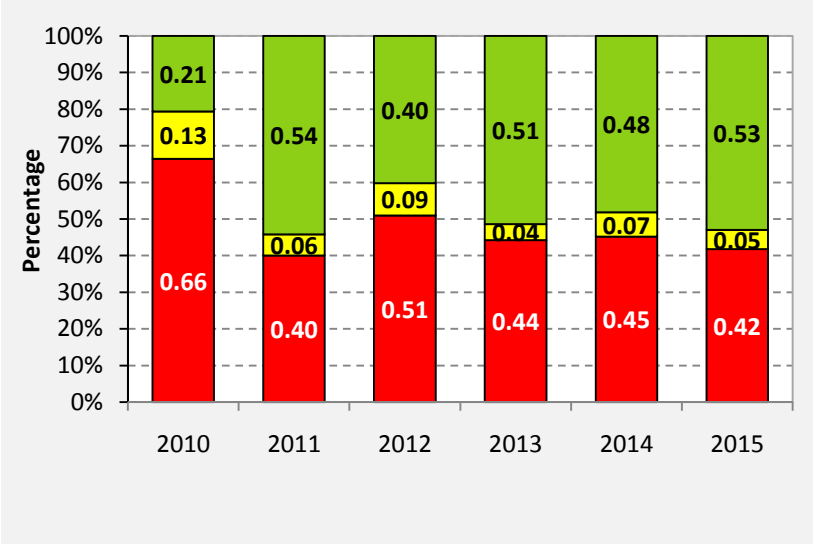

Figure 14: The probability of realising a certain NFI including the electricity tariff hikes

Green area: Probability that the Net Farm Income is higher than R350 000
Yellow area: Probability that the Net Farm Income is between R0 and R350 000
Red area: Probability that a loss is made (the Net Farm Income is below R0)