# CAUSAL RELATIONSHIP BETWEEN ENERGY CONSUMPTION AND ECONOMIC GROWTH IN ZAMBIA

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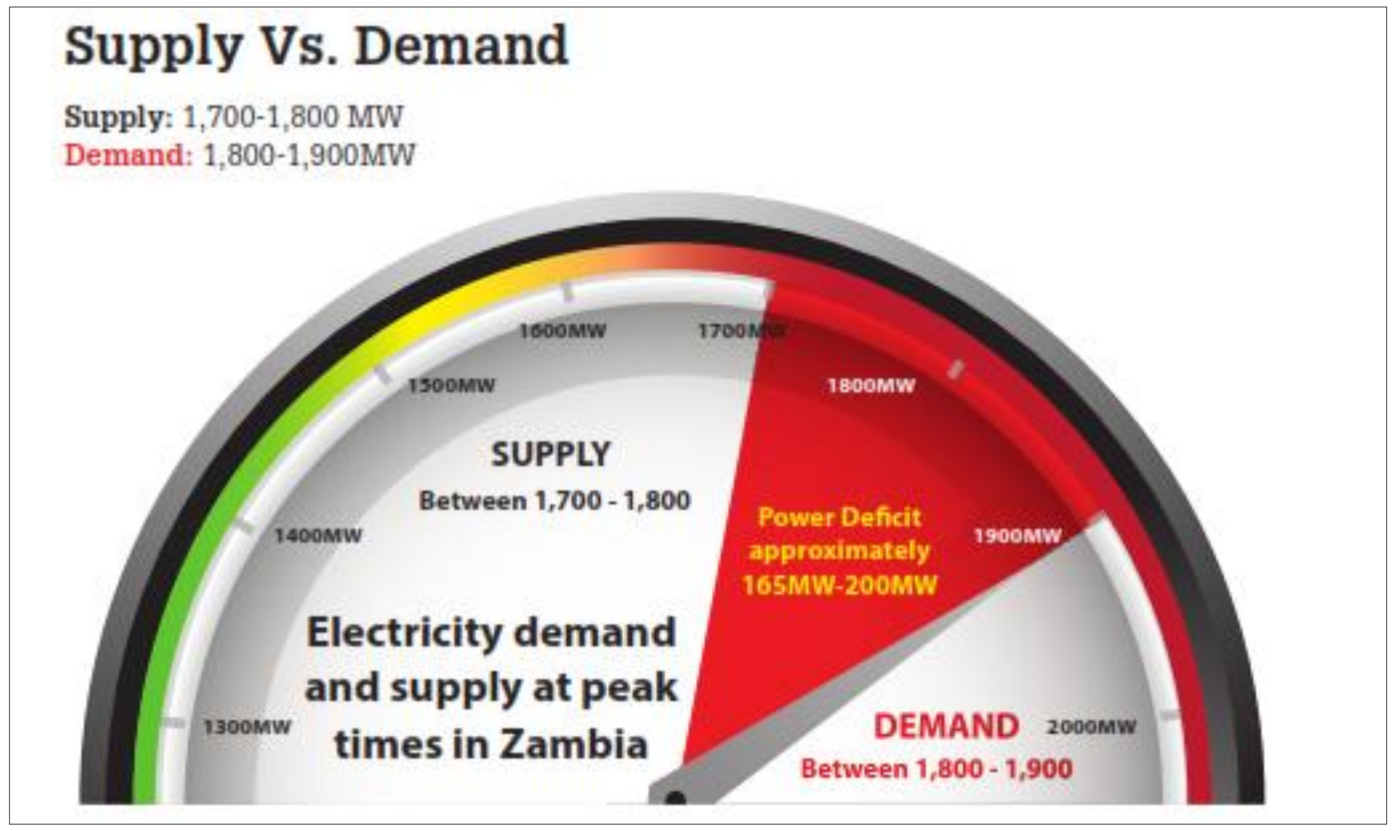
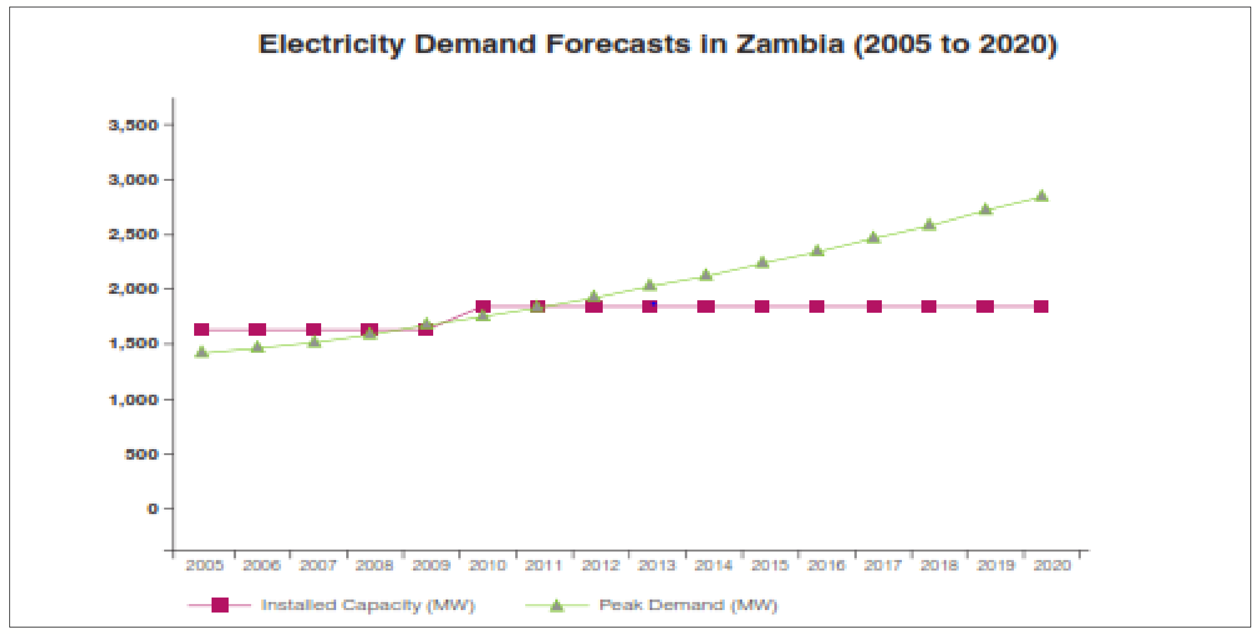
## INTRODUCTION

- Study examines Granger causality between energy consumption and economic growth in Zambia for the period 1973 – 2013
- Over the last years, Zambia has registered poor rainfalls causing severe water shortages in the country's hydropower plants




- The water shortage has caused power supply shortages with electricity deficit of 165MW – 200MW
- Households and Industries experience 8-hours power cut per day
- The demand since 2011 has been more than the installed capacity




## METHODOLOGY

- Initial data analysis: Stationarity and cointegration tests
- Long run and short-run relationship analysis: Vector Error Correction Model (VECM) and
- Least Squares Methods ( Granger causality, impulse response functions)

## RESULTS

- Energy consumption and GDP is cointegrated hence there is long-run relationship
- There is a unidirectional Granger causality running from GDP to energy consumption in the long-run
- There is no short-run Granger causality between energy consumption and GDP.

Dependent Variable: D(GDP)
Method: Least Squares (Gauss-Newton / Marquardt steps)

Sample (adjusted): 1976 2013
Included observations: 38 after adjustments
D(GDP) = C(1)*( GDP(-1) - 22743964.1348*EC(-1) - 32791243939.9 ) + C(2)*D(GDP(-1)) + C(3)*D(GDP(-2)) + C(4)*D(EC(-1)) + C(5)*D(EC(-2)) + C(6)

| | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C(1) | 0.103862 | 0.034438 | 3.015933 | 0.0050 |
| C(2) | -0.016688 | 0.203061 | -0.082185 | 0.9350 |
| C(3) | 0.090664 | 0.216858 | 0.418079 | 0.6787 |
| C(4) | -4915833. | 7228067. | -0.680103 | 0.5013 |
| C(5) | 33046.03 | 7539075. | 0.004383 | 0.9965 |
| C(6) | 1.97E+09 | 6.77E+08 | 2.908117 | 0.0066 |

| | | | |
|---|---|---|---|
| R-squared | 0.741610 | Mean dependent var | 2.16E+09 |
| Adjusted R-squared | 0.701237 | S.D. dependent var | 2.92E+09 |
| S.E. of regression | 1.60E+09 | Akaike info criterion | 45.36394 |
| Sum squared resid | 8.16E+19 | Schwarz criterion | 45.62251 |
| Log likelihood | -855.9149 | Hannan-Quinn criter. | 45.45594 |
| F-statistic | 18.36877 | Durbin-Watson stat | 1.924833 |
| Prob(F-statistic) | 0.000000 | | |

Dependent Variable: D(EC)
Method: Least Squares (Gauss-Newton / Marquardt steps)

Sample (adjusted): 1976 2013
Included observations: 38 after adjustments
D(EC) = C(1)*( EC(-1) - 4.39677091501E-08*GDP(-1) + 1441.75587622 ) + C(2)*D(EC(-1)) + C(3)*D(EC(-2)) + C(4)*D(GDP(-1)) + C(5)*D(GDP(-2)) + C(6)

| | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C(1) | -0.037032 | 0.019506 | -1.898425 | 0.0667 |
| C(2) | 0.108875 | 0.180012 | 0.604820 | 0.5496 |
| C(3) | 0.061694 | 0.187758 | 0.328584 | 0.7446 |
| C(4) | -7.72E-09 | 5.06E-09 | -1.526151 | 0.1368 |
| C(5) | -1.76E-09 | 5.40E-09 | -0.325775 | 0.7467 |
| C(6) | 9.429136 | 16.86502 | 0.559094 | 0.5800 |

| | | | |
|---|---|---|---|
| R-squared | 0.223282 | Mean dependent var | -10.90594 |
| Adjusted R-squared | 0.101920 | S.D. dependent var | 41.95498 |
| S.E. of regression | 39.75951 | Akaike info criterion | 10.34751 |
| Sum squared resid | 50586.19 | Schwarz criterion | 10.60608 |
| Log likelihood | -190.6028 | Hannan-Quinn criter. | 10.43951 |
| F-statistic | 1.839803 | Durbin-Watson stat | 1.912391 |
| Prob(F-statistic) | 0.133110 | | |

## CONCLUSION

- Unidirectional causal relationship running from GDP to electricity consumption
- The policy of conservation on electricity will have little/no effect on the economy
- There is need for investment and utilise the water resources available
- Investment in other energy sources is required as a way to reduce dependence on hydropower e.g. Solar system

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