Energy Efficiency in Typical Caribbean Office Buildingsunities

By Erwin E. Edwards

The Outline

- Background
- Energy Consumption Trends in the Caribbean
- Energy Efficiency Estimation Strategy
- Main Findings
- Conclusion

Background

- Growing energy consumption and costs
  - Need long-term commitments from Caribbean
  - Need policy, economic, market, and R&D measures
  - Need to advance the deployment of RE technologies
- Varying responses
  - Slow progress in implementing RE solutions
  - Some discussion conserving energy as a ST solution
  - Is conserving energy an effective ST solution?

Background

- Some considerations
  - Economists have widely debated ‘rebound effect’
  - Will it lead to higher consumption from more hours
  - Will it lead to use of higher quality of energy services
- Some opportunities
  - Retained savings
  - Reinvestment to expand (commercial sector)
- We need to know our energy efficiency

Energy Consumption Trends

- Movement to high energy usage since 1990's
- During the period 1996 to 2002
  - Guyana increased by 33% (688 GWh to 875 GWh)
  - Jamaica increased by 5%
  - Trinidad and Tobago increased by 40%
  - Haiti decreased by 6% during the same period
  - Globally 85% (2094 B KWh in 1980 to 3879 B KW in 2008

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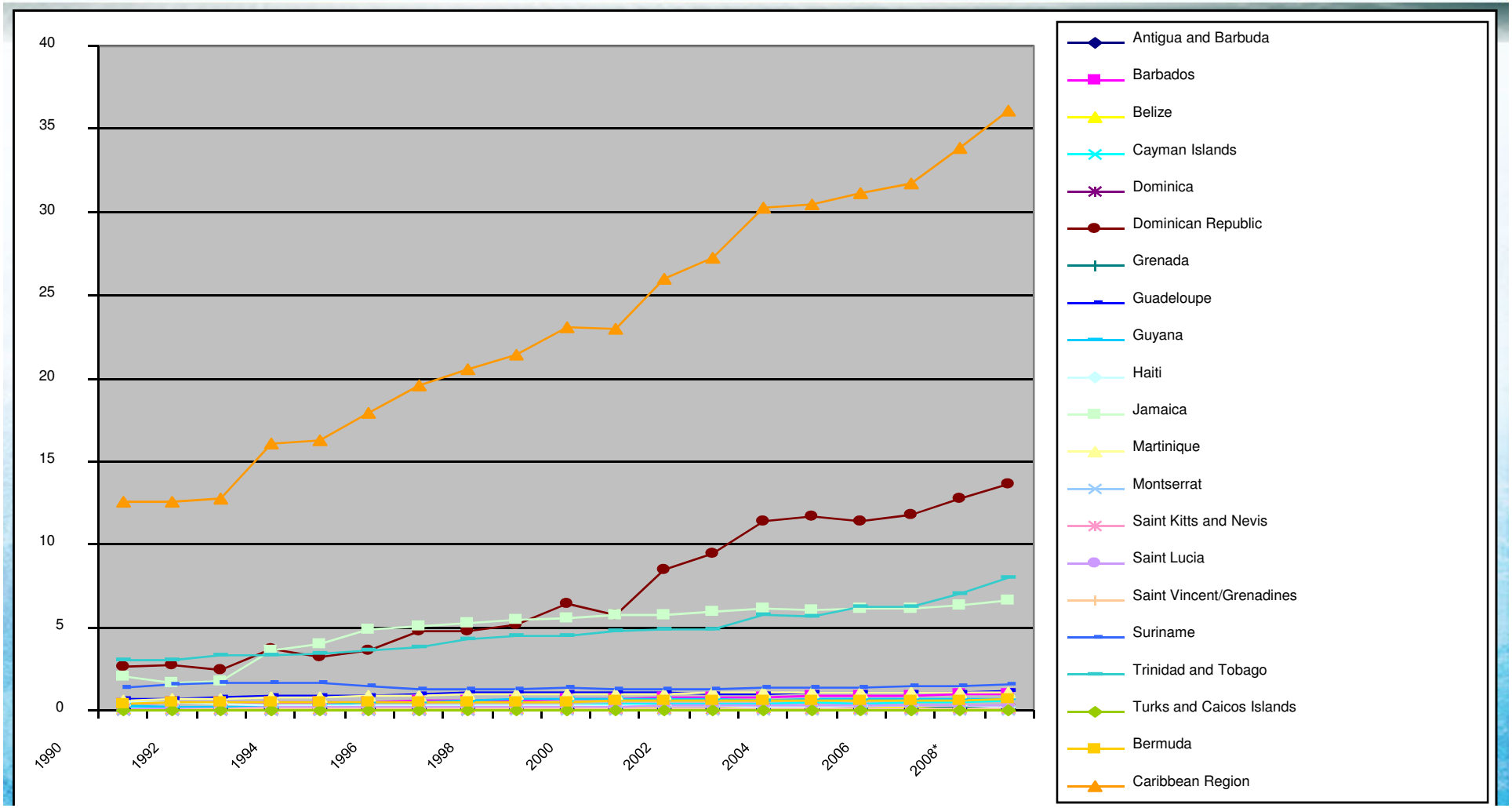
Energy Consumption Trends



Estimation Strategy

- Two approaches exist in the literature for energy
  - Compare actual energy consumption with the "best observable" consumption of that kind of a building

$$U_1 = \frac{E_{Best}}{E_A} * 100\% + v$$

  - Compare actual energy consumption with that of a theoretical best building of its kind

$$U_2 = \frac{E_{Opt}}{E_A} * 100\% + v$$

Estimation Strategy

- Selected five (5) typical office buildings
  - Multi storey
  - Between 30K and 60K sq. Ft
- Collected thirty-six (36) months of electric data
  - Fixed demand charges
  - Energy charges
  - Fuel charges
  - KW hours used

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Estimation Strategy

Building ID	Year 1 (MWh)	Year 2 (MWh)	Year 3 (MWh)	Average (MWh)
CP1	953,540	1,037,820	1,051,902	1,051,902
CP2	748,720	768,320	777,091	764,710
CTY	1,250,460	1,245,171	1,255,760	1,250,464
WEY	2,372,000	2,204,001	1,965,084	2,180,361
BPI	1,657,694	1,902,623	2,017,936	1,859,418

Estimation Strategy

- Expected variations make it necessary to normalize consumption for direct comparison

$$I_E = \frac{E_A}{A}$$

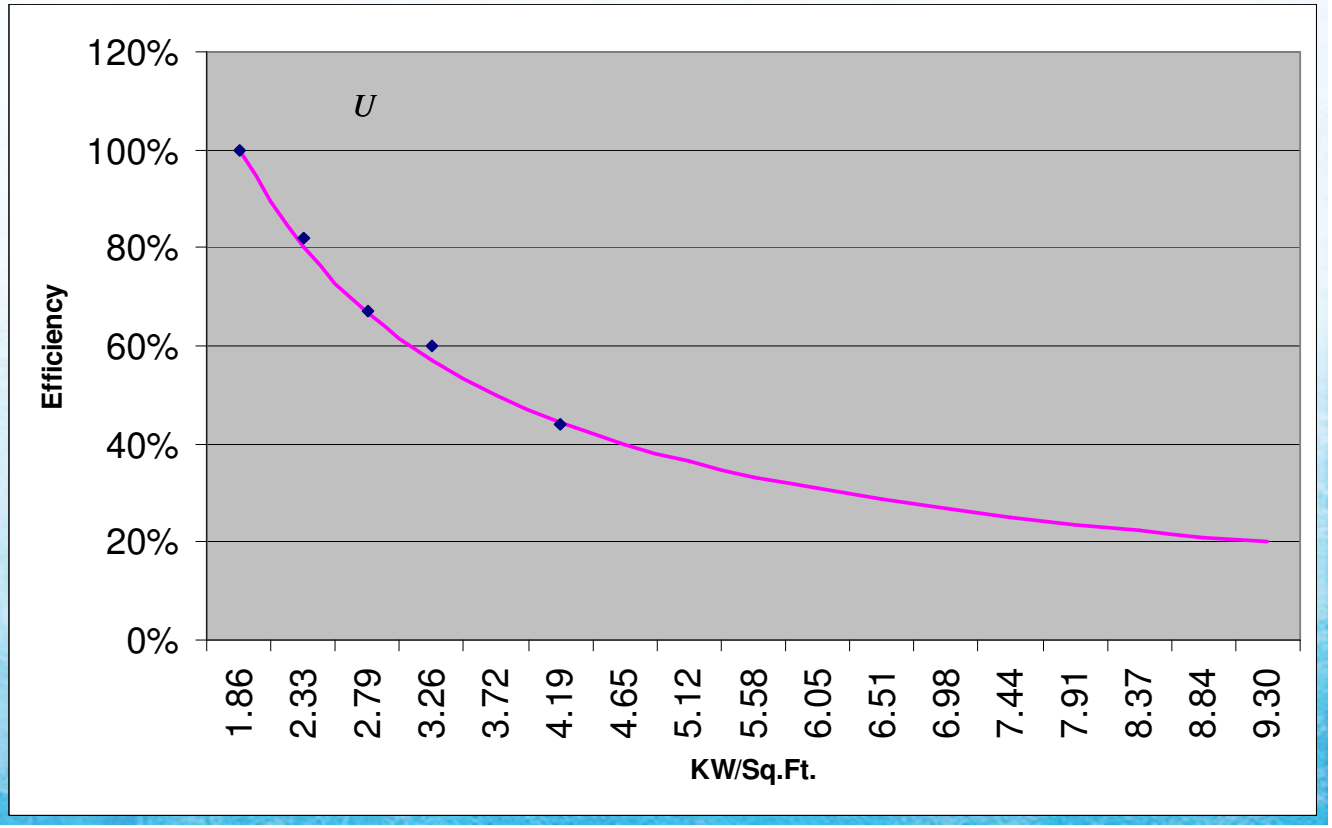
- Statistics for (Energy/Sq.Ft) for the 5 properties
  - Max 5.16 Min 1.60 Avg. 2.88
  - Std Dev 0.80 Variance 0.64

Estimation Strategy

- Energy efficiency and Inefficiency are determines by

$$U = \frac{I_{Best}}{I_E} * 100\,\%$$

100% - U



Main Findings

- Building CTY was the most efficiency
  - CTY efficiency = 100%
  - Other efficiencies fall on the curve and below 100%
- The inefficiency in buildings is due to two main contributing factors
  - Plant installed (Equipment & Technology (E&T))
  - Business Processes (Manag't & Operations (M&O))

Main Findings

- E&T inefficiency was normalized for the 'Best observable' building of its kind.

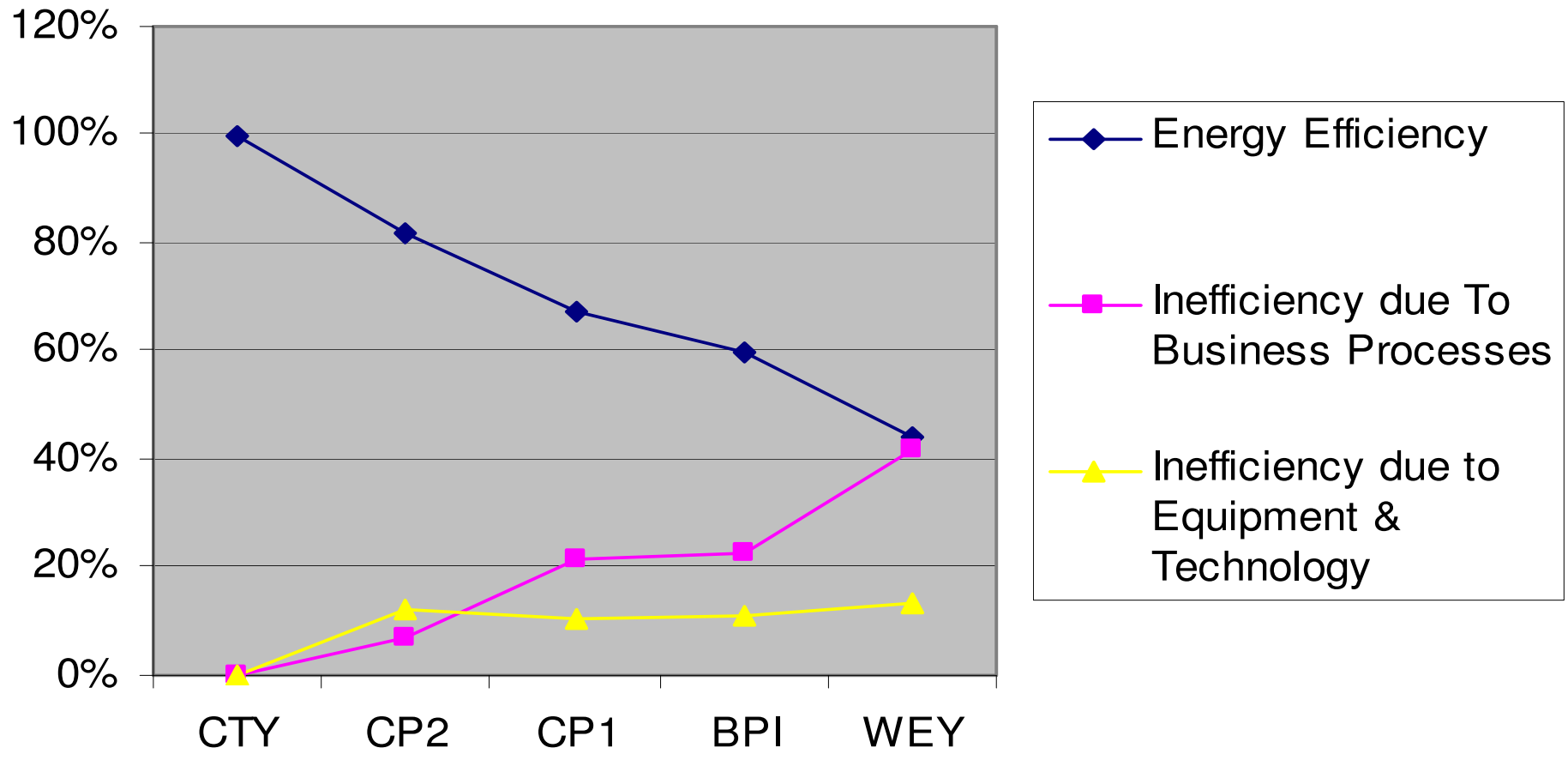
Building ID	Building Efficiency U	E&T Inefficiency	Normalized E&T Inefficiency (-10%)
CP1	67%	20%	10%
CP2	82%	22%	12%
CTY	**100%**	**10%**	**0%**
WEY	44%	23%	13%
BPI	60%	21%	11%

Main Findings

- M&O inefficiency was determined to be:- (100% = U + E&T_Inefficiency + M&O_Efficiency)

Building ID	Building Efficiency U	Normalized E&T Inefficiency	M&O Inefficiency
CP1	67%	10%	23%
CP2	82%	23	6%
CTY	**100%**	**0%**	**0%**
WEY	44%	13%	43%
BPI	60%	11%	29%

Main Findings



Conclusion

- E&T inefficiency stabilizes between 10% and 14% even when the overall inefficiency of a building continues to rise
- M&O inefficiency is the major driver behind gross inefficiency
- Beside technology, policies, management and operations all play a critical role in our quest to implement sustainable energy solutions in the Caribbean

Renewable Energy Opportunities

The End

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