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Power Factor for CFLs and Policy Development: Can Results from the Last Two Decades Inform the Next?

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3rd lites.asia Meeting, 6 – 7 June, 2011, Sydney, Australia.

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ECO-Asia Report on Lamp Power Factor

Agenda:

- Overview and Defining the Issue
- Objectives and Approach of Report
- Overview of Literature Survey
- Policy Considerations
- Summary of Findings
- Recommendations

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ECO-Asia Report on Power Factor – Overview

Power Factor – Background:

- The question of power factor (PF) has been discussed ever since CFLs were first introduced to the market as replacement for incandescent lamps.
- Thirty years later, the same questions remain: Can the potential benefits to the electric grid of requiring high power factor (HPF) lamps outweigh the potential costs and risks that such requirements would produce.
- Ultimately, the choice to require HPF lamps or LPF (low power factor, also known as normal power factor – NPF) is left to policymakers.

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ECO-Asia Report on Power Factor – Overview

Power Factor – Defining the Issue:

- The information currently available to policymakers regarding this issue tends to take the form of complex technical papers.
- Technical papers usually do not address all of the relevant policy considerations.
- As a result, policymakers are ill-equipped with a clear basis on which to make policy decisions.
- This can result in policy implementation that may be unnecessarily cautious, expensive, and may not maximize the potential benefits that may accrue from the expansion of CFL (and LEDs) usage in Asia and elsewhere.

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ECO-Asia Report on Power Factor – Overview

Power Factor – Defining the Issue:

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ECO-Asia Report on Power Factor – Objectives

Conducted with the following purpose:

- Review available papers, articles and other material available to date on Power Factor.
- Summarize the relevant points and economic considerations for the policymakers in Asia.
- Identify related policy considerations, allowing policymakers to make informed decisions relevant to their specific policy goals.
- Present science and economic-based recommendations based on the best currently available information.
- Not take sides.

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ECO-Asia Report on Power Factor – Approach

Methodologies and Coverage:

- Conducted an international literature survey to identify and review papers, articles and other material regarding CFLs PF from both technical perspectives and economic perspectives.
- Reviewed policy positions, discussions of power factor impacts on transmission grid power quality and capacity, technical trade-offs, assessments of local conditions, and programmatic as well as economic issues.
- Examined documented research results from the last 15 years, both from laboratory research, experimentation, and simulation results, as well as from actual field installations and measurements.

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ECO-Asia Report on Power Factor – Literature Survey Summary

Laboratory Research/Simulation:

- Papers presenting results from: Egypt (2004), New Zealand (2006, Slovenia (2008), Switzerland (2009), Australia (2010), Sweden (2010a), Sweden (2010b), Columbia (2010), and Iran (2010).

Field Studies/Documented Programs:

- Papers presenting results from: Sweden (1997), Poland (1997), Sweden (2010).

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ECO-Asia Report on Power Factor – Literature Survey Summary

Other Field "Experience" & Policy Positions:

- Some notable on-going, large scale use of NPF CFLs:
  - California: Between 2006-2008, approximately 100 million LPF CFLs were installed in residential applications in California though utility rebate programs. No such issues are known to have been reported on from this major initiative.
  - China: Installed nearly 200 million CFLs in the last two years with plans to install another 150 million over the next year (2011).
  - Other large-scale CFL programs: Philippines, India (before 2009), etc.
- Documented Industry Positions on CFL Power Factor:

  US National Electrical Manufacturers Association (NEMA) 1999.

  European Lamp Companies Federation (ELC) 2009.

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ECO-Asia Report on Power Factor – Considerations for Policymakers

Based on review, power factor decision is not clear cut, and should be based on specific policy goals, after consideration of:

- Grid Capacity: Increasing the market penetration of CFLs to replace incandescent lamps will result an increase in the available capacity of the utility (and of the transmission and distribution grid) – regardless of power factor level.
- Technical trade-offs: The addition of a power-conditioning circuit to bring the PF from 0.5 (normal PF) to 0.9 (high PF) for CFLs have the potential to affect long-term CFL performance, reliability, can increase lamp size, and typically add to the cost of the lamp.

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ECO-Asia Report on Power Factor – Considerations for Policymakers

Power factor should be based on specific policy goals, and consideration of (Continued):

- Suitability for local conditions: It is difficult to make sweeping statements about how LPF devices can be expected to affect electrical grids. A technical review of the local grid should be considered before making decisions that relate to power factor requirements.
- CFL price elasticity: Consumer demand for CFLs is very closely tied to initial cost. Identifying the incremental costs of high-PF requirement can determine if additional funds should be spent on the HPF requirement, on power-conditioning equipment for the electrical network, or on a larger number of LPF lamps.

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ECO-Asia Report on Power Factor – Basis for Policy Considerations

Studies on the effect of LPF CFLs on the power grid's power factor and harmonics have had mixed results:

- Some laboratory studies and computer simulations have suggested that harmonic disturbances from CFLs are likely at higher CFL penetration rates.
- Other laboratory studies and simulations have downplayed these risks.
- The differences in conclusions can perhaps be traced to either differences in assumptions for the models and/or differences in local grid conditions from the field studies.

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ECO-Asia Report on Power Factor – Summary

The great bulk of field data reviewed, including studies specially designed to document grid impacts from LPF CFLs as well as more general observations of large CFL distributions, have failed to find any significant detrimental effects from LPF CFLs.

One thing that can be concluded with relative certainty is that the totality of the research to date, and especially field research, has not proved that HPF CFLs are needed or even beneficial.

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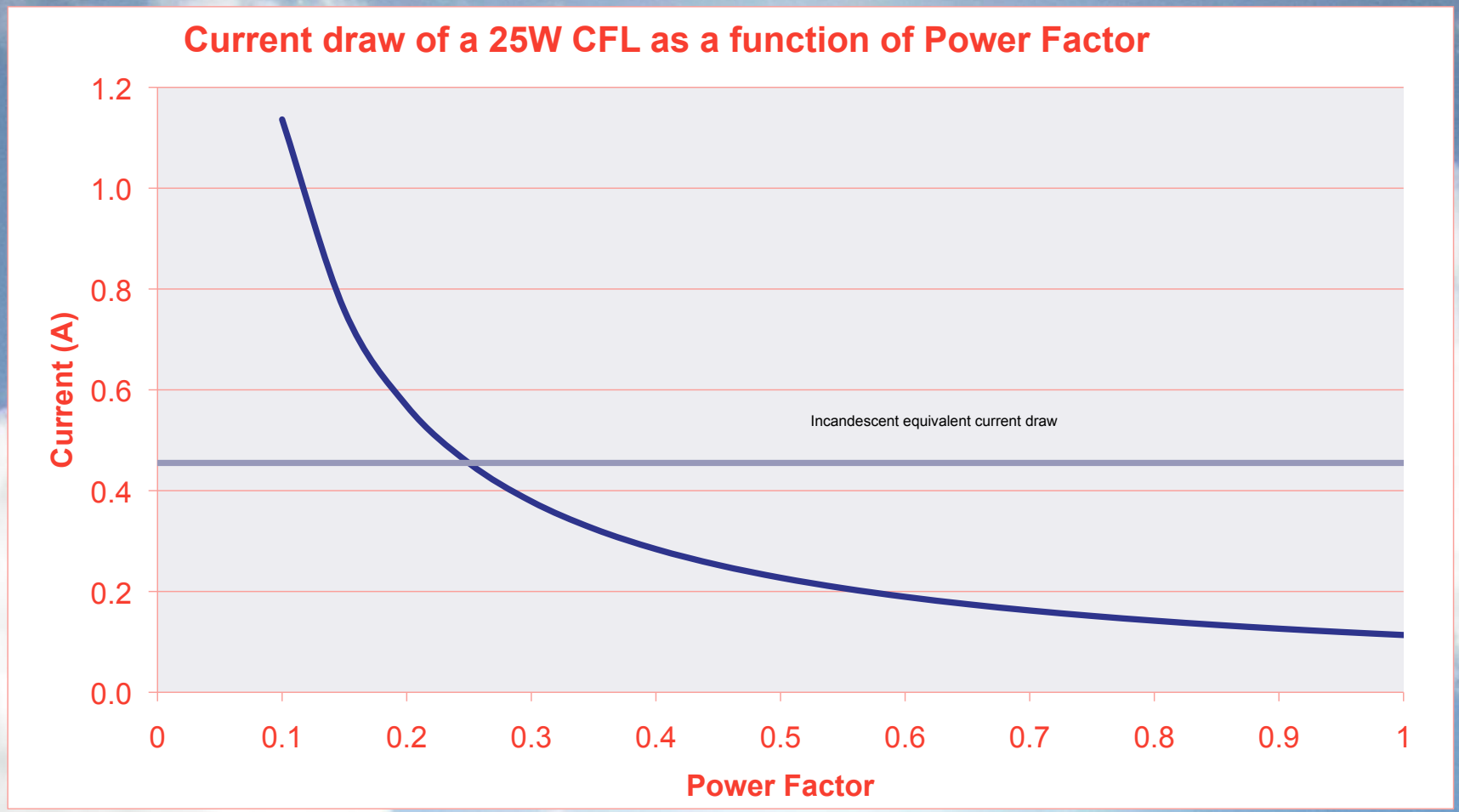
ECO-Asia Report on Power Factor – Summary



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ECO-Asia Report on Power Factor – Recommendations

Utility managers and regulators should not specify HPF lamps under the assumption that HPF lamps are "better":

- Trade-offs should be made based on a realistic evaluation of local grid conditions and recommended considerations.
- A HPF lamp does not deliver any additional value to grid-operator nor end-user under most conditions, except in cases of isolated, micro, or mini grids with high peak lighting loads.
- The selection of a lamp should be based on results of performance parameter tests, not just power factor.
- If HPF lamps are required, it is recommended that additional measures be considered to mitigate post-program effects on the market.

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ECO-Asia Report on Power Factor – Recommendations

Regulatory or procurement decisions relating to power factor should consider these following steps:

1. Clarify and prioritize policy goals. The appropriate actions to take with respect to CFL power factor requirements can vary based on the overall policy objectives.

3. Evaluate local electrical infrastructure conditions. Assessment should include a determination of the specific power quality issues faced by the electrical transmission and distribution system.

5. Evaluate local market conditions. It is also important to look at the market's ability to sustainably support CFLs or other energy-efficient products after a policy has been implemented or promotion program has completed.

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Questions & Comments?

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