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Incentives for green video streaming

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*To make digital consumption **smarter**, **greener**, and more **rewarding***

INTRODUCTION

In today's hyperconnected world, streaming media is second nature — but it comes with an invisible cost: **energy consumption** and **carbon emissions**. We are developing a framework that motivates ICT service consumers — focusing here on video streamers — to make energy-conscious choices. We tap into **behavioural incentives,** such as environmental points, peer recognition, and gamified challenges. These are complemented by **economic motivators**, thus constituting a balanced and holistic mechanism that appeals to both altruistic and self-interested users.

Environmental Points quantify the value of sustainable actions, e.g. choosing **lower video resolutions**, which can be redeemed for rewards or for recognition. Over time, this system encourages (and actually educates) users to adopt greener habits, **reducing the overall energy and carbon footprint of digital services**.

METHODOLOGY

To validate our approach, we have built **a user acceptance model** that simulates how individuals respond to incentives. Key elements of this model are depicted in Fig. 1. Each user is characterized by a **personalized greenness factor**, which reflects their environmental sensitivity, and a private **incentive threshold**, indicating the minimum reward needed to compensate for the perceived inconvenience of adopting energy-saving actions (e.g., choosing lower bitrate content).

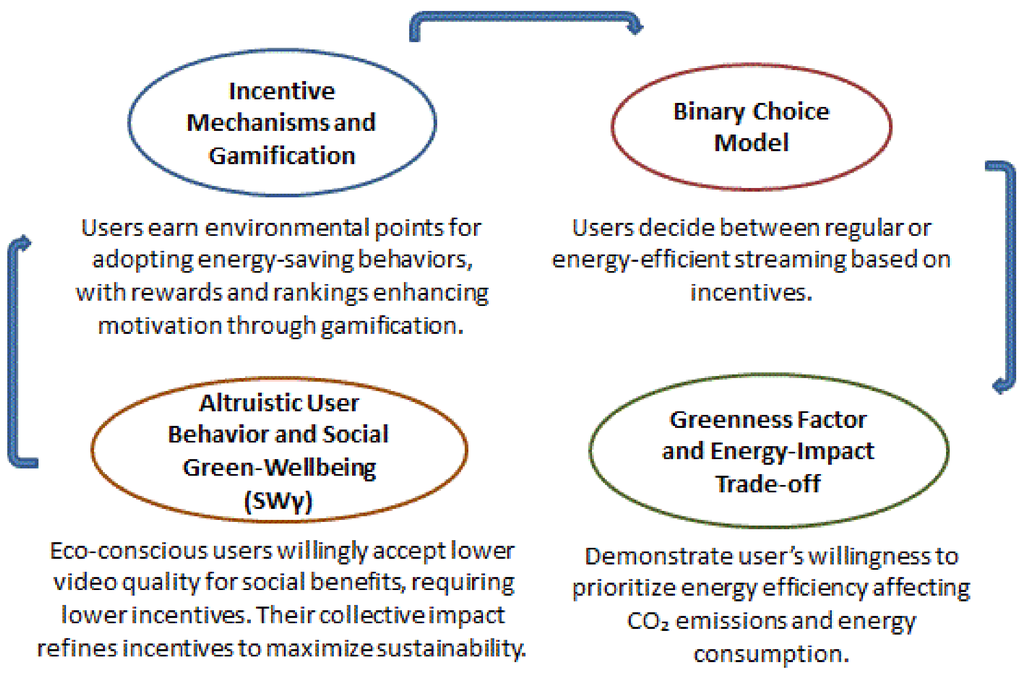

Fig. 1 Effective user acceptance model for energy-efficient video streaming

Additionally, we build a **serious-game** based on top-K and bottom-M rankings, to foster peer comparison and competition, transforming passive acceptance into active engagement. Moreover, within a **Stackelberg game** formulation, the video streaming service provider—acting as the strategic leader—optimizes both incentive levels and game parameters to achieve network-wide energy reductions while adhering to budgetary constraints.

RESULTS

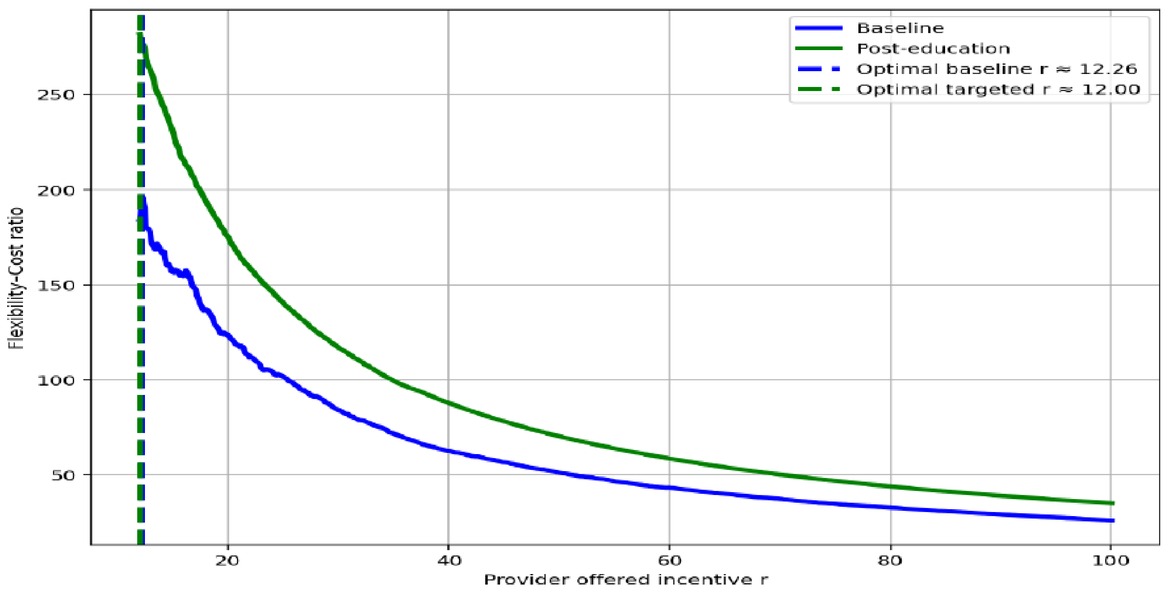

Fig. 2 Flexibility-Cost ratio for the baseline offered incentives (blue) vs the educated offered incentives (green). Personalized incentives enable **cost-effective network flexibility**. Service Provider improves the optimal offered incentives via education of users.

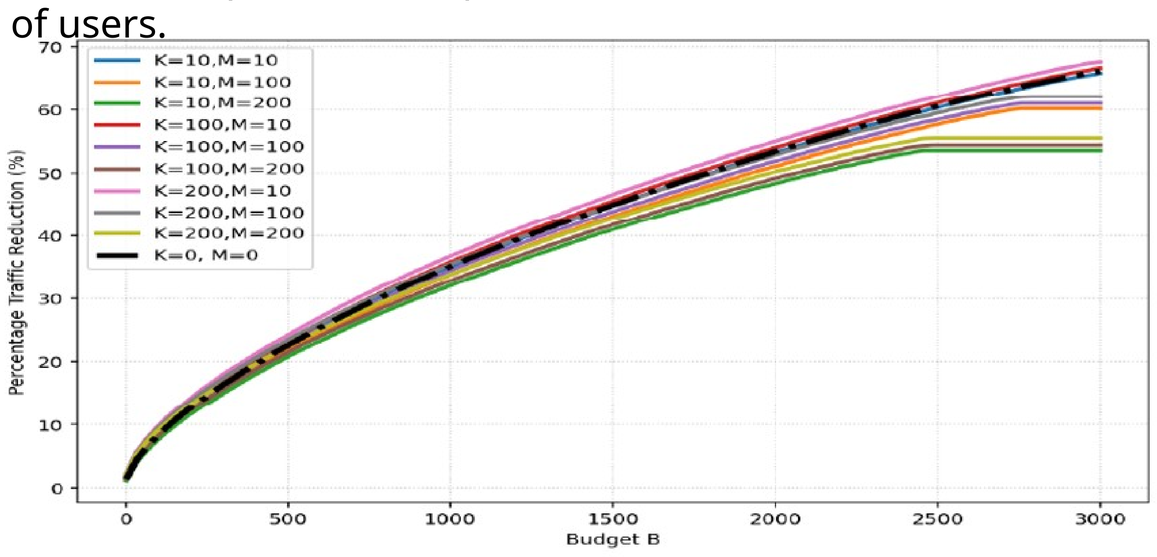

Fig. 3 Traffic Reduction from Ultra-HD (20 Mbps) to Full-HD (5Mbps): Gamified incentives achieve **67,2%** traffic reduction, **reducing traffic by factor > 3.**

This structured approach empowers providers with proactive, application-level control over energy consumption, offering measurable benefits such as **reduced high-bitrate traffic** and **increased participation in energy-saving behaviors**, while also considering **user satisfaction**.

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