Research Pays Off

Operational Improvements Cut Rail Transit Power Costs

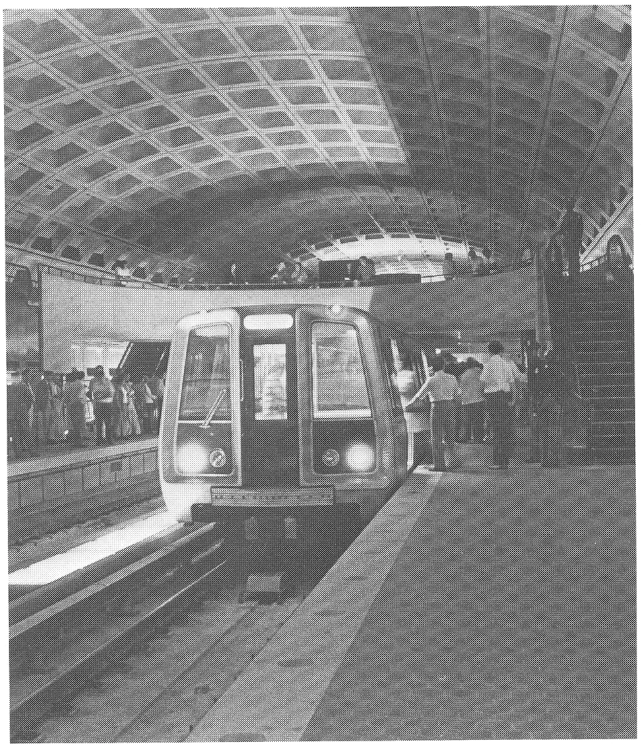
Public transit agencies, like homeowners, are reminded monthly at bill-paying time that the cost of energy is skyrocketing. While the average American pays about 6.7 percent of after-tax income for all utilities, the Washington Metropolitan Area Transit Authority (WMATA) figures that 15-17 percent of its costs for operating Metrorail is for electric bills alone—a staggering $21 million/year.

PROBLEM

Of the planned 101-mile WMATA network, 39 miles are now open to revenue service; within two years, 22 more miles will be added. With the system's expansion and the absolute increase in electric rates, WMATA's electric bills will rise dramatically—unless it can find ways to reduce power consumption.

SOLUTION

With funding support from the U.S. Department of Transportation, a research team under the leadership of Richard A. Uher of the Rail Systems Center (RSC), Carnegie-Mellon University, Pittsburgh, developed an Energy Management Model (EMM) for the transit industry. This sophisticated computer model was ready to go when WMATA turned to RSC for help in the spring of 1981. It was the first time that a comprehensive investigation of energy consumption was conducted of a North American rail transit system. The EMM application to Metrorail was verified by comparing simulated results with actual power consumption. They agreed within 3 percent.



Five energy-conserving strategies were investigated: performance modification, passenger load factor improvement, regeneration of braking energy, lighting load reduction, and escalator load reduction. Each resulted in recommendations with substantial cost savings.

APPLICATION

Coasting of trains offered the greatest saving potential. By spending $32,000 to change the speed regulators on the cars, savings of between $625,000 and $1,350,000 (4-9 percent) in energy costs are possible. The 2-3 percent increase in running time could be made up by shortening the turnaround time so that the overall schedule can be maintained. WMATA is conducting instrumented tests of the coasting strategy on a limited number of trains to verify the results of the EMM simulation, as well as to identify operational procedures to implement this strategy.

In other moves, the EMM has permitted quantification of benefits that are expected from use of chopper controllers in WMATA's recent order of new railcars. New operating procedures were recommended to improve the passenger load factor. By simulating alternate four-and six-car trains during the midday, off-peak weekday period and alternate two- and four-car trains during the evening, off-peak weekday period, and on Saturdays and Sundays, a reduction in annual car-miles by 3.82 million and an energy cost savings of $770,000 were estimated. Applying this strategy is estimated to cost Metrorail $68,000—the manpower costs of coupling and uncoupling operations associated with running the shorter trains. WMATA has implemented modified weekend schedules to reduce energy costs. Weekday schedule adjustments have also been made to improve load factors and for operational needs.

BENEFIT

The $250,000 invested in the research to develop a computer model that enables management of a rail transit system to quantify alternate operating strategies, to consider many options, and to evaluate benefits quickly can pay handsome dividends. Richard T. Labonski, WMATA Energy Management Officer, reports that using the EMM methodology can result in savings of $2-3 million/year—a whopping 10-14 percent of WMATA's electric bill. The EMM will shortly become one of the tools WMATA will routinely use in its planning.

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