Journal of policy science

Abstrak

A mathematical model was developed for evaluating CO2-reduction technologies in power generation, residential, commercial and road transport sector in Japan. The existing and new power generation technologies evaluated included 34 centralized and 8 dispersed power generation technologies in the resedential and commercial energy demand sectors. To take into account the varieties of useful energy and of its demand duration patterns among entities in the demand sectors, the hourly mean power and heating and cooling demand-supply balances in one residential and four commercial representative entities were considered for each month. The road transport sector addressed five types of automotive use. The useful-energy demands are exogenously given; the model calculates the technology installations that satisfy the demands to minimize the total systems cost for each year up to 2030. The availability of the new technologies, i.e., the first years they are installable, is derived from research and development (R&D) process analyses on the basis of surveys to experts. As a result of the model calculation, dispersed molten carbonate and solid oxid fuel cells and onboard gasoliene reforming-type fuel cell vehicle (FCV) technologies are expected to have the largest economic values, approximately 60-120 billion constant 1998 yen (460-920 million U.S dollars (USD)) among the evaluated new CO2-reduction technologies. One of the implications from our calculations is that extending electric power corporations' commercial coverage to dispersed power generation, in addition to centralized power generation, is desirable to help lower overall costs in society, as well as to secure industry profits.