Joint optimization of regional water-power systems - DTU Orbit (08/11/2017)

Joint optimization of regional water-power systems

Energy and water resources systems are tightly coupled; energy is needed to deliver water and water is needed to extract or produce energy. Growing pressure on these resources has raised concerns about their long-term management and highlights the need to develop integrated solutions. A method for joint optimization of water and electric power systems was developed in order to identify methodologies to assess the broader interactions between water and energy systems. The proposed method is to include water users and power producers into an economic optimization problem that minimizes the cost of power production and maximizes the benefits of water allocation, subject to constraints from the power and hydrological systems. The method was tested on the Iberian Peninsula using simplified models of the seven major river basins and the power market. The optimization problem was successfully solved using stochastic dual dynamic programming. The results showed that current water allocation to hydropower producers in basins with high irrigation productivity, and to irrigation users in basins with high hydropower productivity was sub-optimal. Optimal allocation was achieved by managing reservoirs in very distinct ways, according to the local inflow, storage capacity, hydropower productivity, and irrigation demand and productivity. This highlights the importance of appropriately representing the water users' spatial distribution and marginal benefits and costs when allocating water resources optimally. The method can handle further spatial disaggregation and can be extended to include other aspects of the water-energy nexus.

General information

State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems, Water Resources Engineering, SINTEF , DHI Hørsholm
Authors: Cardenal, S. J. P. (Intern), Mo, B. (Ekstern), Gjelsvik, A. (Ekstern), Riegels, N. D. (Ekstern), Arnbjerg-Nielsen, K. (Intern), Bauer-Gottwein, P. (Intern)
Pages: 200-207
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information

Journal: Advances in Water Resources
Volume: 92
ISSN (Print): 0309-1708
Ratings:
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 4.53 SJR 2.156 SNIP 2.056
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 2.303 SNIP 2.093 CiteScore 4.31
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.948 SNIP 1.964 CiteScore 3.66
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.448 SNIP 1.786 CiteScore 3.03
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.574 SNIP 1.769 CiteScore 2.81
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.611 SNIP 1.734 CiteScore 2.84
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.707 SNIP 1.479
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.862 SNIP 1.652
BFI (2008): BFI-level 1

Scopus rating (2008): SJR 1.54 SNIP 1.599
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.509 SNIP 1.509
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.305 SNIP 1.564
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.632 SNIP 1.905
Scopus rating (2004): SJR 1.372 SNIP 1.602
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.321 SNIP 1.563
Scopus rating (2002): SJR 1.229 SNIP 1.401
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 1.205 SNIP 0.922
Scopus rating (2000): SJR 1.261 SNIP 1.417
Scopus rating (1999): SJR 1.416 SNIP 0.909
Original language: English
Hydropower, Irrigation, Water-energy models, Stochastic dual dynamic programming, Water-energy nexus, Water Science and Technology, Dynamic programming, Electric power systems, Hydroelectric power, Optimization, Productivity, Reservoirs (water), Stochastic models, Stochastic systems, Economic optimization, Long-term management, Optimization problems, Spatial disaggregation, Water energy, Water resources systems, Water resources
DOIs:
10.1016/j.advwatres.2016.04.004
Source: FindIt
Source-ID: 2303431076
Publication: Research - peer-review › Journal article – Annual report year: 2016