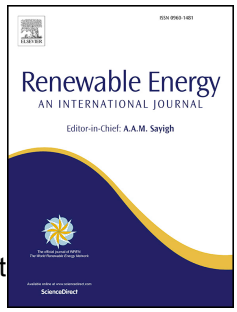
Accepted Manuscript



The trade-off between tidal-turbine array yield and impact on flow: A multi-objective optimisation problem

R.J. du Feu, S.W. Funke, S.C. Kramer, D.M. Culley, J. Hill, B.S. Halpern, M.D. Piggott

PII: S0960-1481(17)30709-7

DOI: 10.1016/j.renene.2017.07.081

Reference: RENE 9056

To appear in: *Renewable Energy*

Received Date: 22 March 2016

Revised Date: 5 July 2017

Accepted Date: 18 July 2017

Please cite this article as: du Feu RJ, Funke SW, Kramer SC, Culley DM, Hill J, Halpern BS, Piggott MD, The trade-off between tidal-turbine array yield and impact on flow: A multi-objective optimisation problem, *Renewable Energy* (2017), doi: 10.1016/j.renene.2017.07.081.

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

ACCEPTED MANUSCRIPT

The trade-off between tidal-turbine array yield and impact on flow: a multi-objective optimisation problem.

R.J. du Feu [a,b*], S.W. Funke [c], S.C. Kramer [a], D.M. Culley [a], J. Hill [d], B.S. Halpern [e,f,g] & M.D. Piggott [a,b]

[a] *Applied Modelling and Computation Group, Department of Earth Science and Engineering, Imperial College London, London, UK*

[b] *Gantham Institute, Imperial College London, London, UK*

[c] *Center for Biomedical Computing, Simula Research Laboratory, Oslo, Norway*

[d] *Environment Department, University of York, UK*

[e] *Bren School of Environmental Science and Management, University of California, Santa Barbara, California 93106, USA*

[f] *National Center for Ecological Analysis & Synthesis, University of California, Santa Barbara, California 93106, USA*

[g] *Silwood Park Campus Imperial College London, London, UK*

[*] *Corresponding author, r.du-feu14@imperial.ac.uk*

Abstract

This paper introduces a new approach for investigating trade-offs between different societal objectives in the design of tidal-turbine arrays. This method is demonstrated through the trade-off between the yield of an array, and the extent to which that array alters the flow. This is posed as a multi-objective optimisation problem, and the problem is investigated using the array layout optimisation tool OpenTidalFarm. Motivated by environmental concerns, OpenTidalFarm is adapted to not only maximise array yield but also to minimise the effect of the array upon the hydrodynamics of the region, specifically the flow velocity. A linear scalarisation of the multi-objective optimisation problem is solved for a series of different weightings of the two conflicting objectives. Two idealised test scenarios are evaluated and in each case a set of Pareto solutions is found. These arrays are assessed for the power they generate and the severity of change they cause in the flow velocity. These analyses allow for the identification of trade-offs between these two objectives, while the methods proposed can similarly be applied to the two key societal objectives of energy production and conservation, thus providing information that could be valuable to stakeholders and policymakers when making decisions on array design.

Keywords:
marine renewable energy, tidal turbines, gradient-based optimization, multi-objective optimization, Pareto front, environmental impact

دریافت فوری ← متن کامل مقاله

ISIArticles
مرجع مقالات تخصصی ایران

✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
✓ امکان دانلود نسخه ترجمه شده مقالات
✓ پذیرش سفارش ترجمه تخصصی
✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
✓ دانلود فوری مقاله پس از پرداخت آنلاین
✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات