IPENZ ENGINEERING UPDATE September 2011

Welcome to the 50th issue of the IPENZ Update. The inaugural issue was launched at the 2007 IPENZ Conference. The purpose of the update is to highlight items of interest to the engineering profession, including management, as well as technical articles.

Energy Library would like to thank IPENZ for their financial support which has helped with the sustainability of this service to the engineering industry in general. Many professional engineers no longer have access to an in-house library and this service has grown in popularity over the last few years. Currently the update is made available to all who ask to go on the mailing list.

While IPENZ will no longer be supporting the Engineering Update, Energy Library has decided to continue with this service. To this end, we are now looking for some industry sponsorship so please contact us if you would like to discuss options open to you.

Special Topic: Marine Energy

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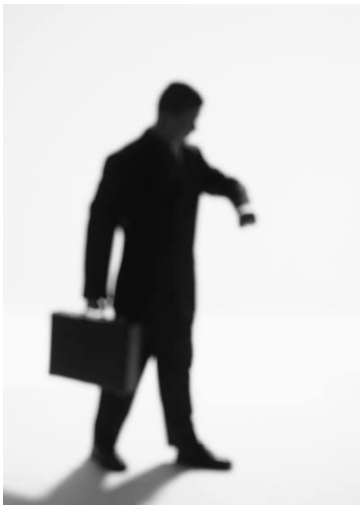
Management/Leadership/Strategic Planning/Recruitment/Training and Development/Project Management/Corporate Responsibility

√IPENZ 50/01 Are you a good problem solver?
Gano, D. L. Quality Progress, Volume 44, Issue 5 (May 2011) Pages 30-36.

√IPENZ 50/02 Smart rules: Six ways to get people to solve problems without you.
Morieux, Y. Harvard Business Review, Volume 89, Issue 9/10 (September/October 2011) Pages 78-86.
The article discusses six rules managers can implement to help those under them make smart decisions and solve problems. A first step is to gain a better understanding of the goals and challenges of subordinates by interacting with them and observing how they do their jobs. Individuals who interface with multiple stakeholders should be empowered to mediate conflicts between different parts of the organization. Accountability among employees can be enhanced by taking steps to ensure they are affected by the consequences of their actions.



√IPENZ 50/03 Change through executive coaching.
Training Journal (July 2011) Pages 66-70.

√IPENZ 50/04 Mapping sustainability assessment with the project life cycle.
Thomson, C. S., El-Haram, M. A. and Emmanuel, R. Proceedings of the ICE - Engineering Sustainability, Volume 164, Issue 2 (June 2011) Pages 143-157.
Traditionally viewed as a technically based exercise focused on assessing the sustainability performance of buildings, sustainability assessment is increasingly called upon to play a proactive role that supports the management of sustainability across the project life cycle. Calls are emerging for assessment to evolve as a tool that contributes to the predominantly subjective nature of decisions taken across the project life cycle and to achieve better integration between assessment and project activities. This paper aims to contribute towards this emerging understanding by considering an empirically based case study which follows a progressive approach to apply and integrate sustainability assessment with the life cycle stages of a university campus building project. The paper presents the findings of a mapping exercise that identifies the emerging phases and activities of the assessment in relation to the stakeholders involved and life cycle stages. By exploring an empirical context that is by nature forward thinking, some recommendations are drawn to facilitate the evolution of sustainability assessment towards the advocated approach.
Abstract reprinted with the permission of Thomas Telford Limited: http://www.ice.org.uk/services/services_journals.asp

√IPENZ 50/05 Case law and variations in cumulative impact productivity claims.
Nguyen, L. D. and Ibbs, W. Journal of Construction Engineering & Management, Volume 136, Issue 8 (August 2010) Pages 826-833.

√IPENZ 50/06 Sustainable development and professional practice.
Laws, D. and Loeber, A. Proceedings of the ICE - Engineering Sustainability, Volume 164, Issue 1 (March 2011) Pages 25–33.
This paper explores the implications of treating sustainable development as a feature of the design and implementation of concrete technical projects, rather than as an abstract line of thinking about possible futures. In such ventures, human dimensions of sustainability, like managing conflicting interpretations and coping with divergent plans and perspectives, become core questions for the professionals involved. The paper describes four common dilemmas that shape this process and discusses their persistent influence on professional practice. The paper argues that confronting these problems will lead engineers to approach technical projects as arenas for learning and problem-oriented negotiation. The conclusion reviews practical strategies that engineers and other professionals may employ to cope with the complexities of integrating sustainability into their practice.
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http://www.ice.org.uk/services/services_journals.asp

√IPENZ 50/07 The CEO of Bayer Corp. on creating a lean growth machine.
Babe, G. S. Harvard Business Review, Volume 89, Issue 7/8 (July/August 2011) Pages 41-45.
At a meeting in September 2007 of the executive committee of Bayer Material Science, Babe knew he was expected to present a detailed plan for reducing overhead costs at the company's North American headquarters. Earlier that year the committee had suggested shutting down the headquarters altogether; to preserve the region's credibility- and his own position-Babe would have to find some impressive savings. He did. The plan he presented would cut 25% from the $400 million in overhead costs. But Babe didn't stop there: He asked for $70 million in additional resources, which he would use to completely transform and grow the business. That bold proposal paid off . The committee endorsed his plan and granted the $70 million, giving Babe 18 months in which to deliver. Now he would have to lay off hundreds of employees; retrain 1,000 others; outsource many operations; roll out new IT systems; and modify the company's product offerings. Following the mantra "Simplify, standardize, automate," his transformation team redesigned virtually every one of the company's business processes. Perhaps most important, it developed change management skills within the organisation,

√IPENZ 50/08 What really happened to Toyota?
Cole, R. E. MIT Sloan Management Review, Volume 52, Issue 4 (Summer 2011) Pages 29-35.

√IPENZ 50/09 Elucidating the positive side of the work-family interface on international assignments: A model of expatriate work and family performance.
Lazarova, M., Westman, M. and Shaffer, M. A. Academy of Management Review, Volume 35, Issue 1 (January 2010) Pages 93-117.

√IPENZ 50/10 Expert system software: Use only as directed.
Greco, T. J. Leadership & Management in Engineering, Volume 10, Issue 2 (April 2010) Pages 73-77.
This article examines the possibility that expert system software may be used incorrectly within the engineering profession. This could lead to inaccurate answers to problems by novice users who may be unaware that the results don't make sense.

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√IPENZ 50/11 Are you a collaborative leader?
Ibarra, H. and Hansen, M. T. Harvard Business Review, Volume 89, Issue 7/8 (July/August 2011) Pages 68-74.
Social media and technologies have put connectivity on steroids and made collaboration more integral to business than ever. But without the right leadership, collaboration can go astray. Employees who try to collaborate on everything may wind up stuck in endless meetings, struggling to reach agreement. On the other side of the coin, executives who came of age during the heyday of "command and control" management can have trouble adjusting their style to fit the new realities. In their research on top-performing CEOs, Insead professors Ibarra and Hansen have examined what it takes to be a collaborative leader. They've found that it requires connecting people and ideas outside an organization to those inside it, leveraging diverse talent, modeling collaborative behavior at the top, and showing a strong hand to keep teams from getting mired in debate. In this article, they describe tactics that executives from Akamai, GE, Reckitt Benckiser, and other firms use in those four areas and how they foster high-performance collaborative cultures in their organizations.

√IPENZ 50/12 The 5 hidden roles of the managerial coach.
Barner, R. T+D, Volume 65, Issue 6 (June 2011) Pages 38-45.

√IPENZ 50/13 Release stress and build resilience.
Ferri-Reed, J. Chief Learning Officer, Volume 10, Issue 7 (July 2011) Pages 42-47.

√IPENZ 50/14 First public-private-partnership application in Taiwan's wastewater treatment sector: Case study of the Nanzih Bot wastewater treatment project.
Sha Zheng and Tiong, R. L. K. Journal of Construction Engineering & Management, Volume 136, Issue 8 (August 2010) Pages 913-922.

√IPENZ 50/15 Building a benchmarking program.
Boyle, S. Chief Learning Officer, Volume 10, Issue 6 (June 2011) Pages 20-35.

√IPENZ 50/16 MBTI personality and hemisphericity of a U.S. Air Force Group.
Devlin, M. S. and Singh, A. Leadership & Management in Engineering, Volume 10, Issue 3 (July 2010) Pages 108-120.

√IPENZ 50/17 Piloting evaluation metrics for sustainable high-performance building project delivery.
Korkmaz, S., Riley, D. and Horman, M. Journal of Construction Engineering & Management, Volume 136, Issue 8 (August 2010) Pages 877-885.

√IPENZ 50/18 Project contracting strategies: Evaluating costs, risks and staffing requirements.
Gloria, J. T., Siegfriedt, W. E. and Carstens, A. Power Engineering, Volume 115, Issue 3 (March 2011) Pages 50-57.

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Technical Aspects of Engineering

√IPENZ 50/19 Speed and grace.
Chober, H. Civil Engineering, Volume 81, Issue 2 (February 2011) Pages 54-79.
The article discusses the process for the development of steel and glass shell grid covering of the New Yas Hotel at the Formula 1 racetrack in Abu Dhabi, United Arab Emirates.

√IPENZ 50/20 Experimental investigation of tsunami impact on free standing structures.
Nouri, Y. et al. Coastal Engineering Journal, Volume 52, Issue 1 (March 2010) Pages 43-70.

√IPENZ 50/21 Holistic approach for assessing the vulnerability of buried pipelines to earthquake loads.
Allouche, E. and Bowman, A. L. Natural Hazards Review, Volume 7, Issue 1 (February 2006) Pages 12-18.

√IPENZ 50/22 Seismic fragility analysis of frame structures.
Lin, J. H. International Journal of Structural Stability & Dynamics, Volume 8, Issue 3 (September 2008) Pages 451-463.

√IPENZ 50/23 Learning from nature.
Sarkisian, M. et al. Civil Engineering, Volume 81, Issue 6 (June 2011) Pages 60-65.
The article discusses how structural forms and processes from nature can be adopted successfully in the creation of superior structural systems.

√IPENZ 50/24 Pedestrian bridge project in San Francisco region was no easy walk.
Reid, R. L. Civil Engineering, Volume 81, Issue 2 (February 2011) Pages 32-35.
The article focuses on the 6.8 million dollars Robert I. Schroder Overcrossing pedestrian and bicycle bridge by international engineering firm Arup in Contra Costa County, California.

√IPENZ 50/25 Deterioration rates of typical bridge elements in New York.
Agrawal, A. K., Kawaguchi, A. and Chen, Z. Journal of Bridge Engineering, Volume 15, Issue 4 (July 2010) Pages 419-429.

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√IPENZ 50/26 The i-bridge – a novel bridge concept
Proceedings of the ICE - Bridge Engineering, Volume 164, Issue 2 (June 2011) Pages 63–74.
Feasibility studies on a novel bridge concept embracing industrial bridge engineering, conceptual design and finite-element analyses have been carried out at Chalmers University of Technology. The i-bridge concept consists of V-shaped glass-fibre-reinforced polymer beams reinforced by carbon-fibre-reinforced polymer profiles. The deck consists of glass-fibre-reinforced polymer plates in composite action with ultra-high-performance steel-fibre-reinforced concrete. A general description of the bridge concept as well as the conducted initial investigations and numerical analyses are presented. The investigations performed indicate that the bridge concept could be realised from a technical structural point of view. In addition, the industrial characteristics proposed aim at ensuring efficient production and operation of the bridge.
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√√IPENZ 50/27 Dynamic performance simulation of long-span bridge under combined loads of stochastic traffic and wind.
Chen, S. R. and Wu, J. Journal of Bridge Engineering, Volume 15, Issue 3 (May 2010) Pages 219-230.

√IPENZ 50/28 Geosynthetic versatility.
Goldberg, S. Erosion Control, Volume 18, Issue 1 (January/February 2011) Pages 28-36.
The article provides information on the relevance of using geosynthetic materials in the effort of stabilizing streambanks and protecting slopes

√IPENZ 50/29 Geotechnical design for the Port Botany expansion project, Sydney.
Davies, P. R. E. and McIlquham, J. D. Proceedings of the ICE - Geotechnical Engineering, Volume 164, Issue 3 (June 2011) Pages 149–167.

√IPENZ 50/30 The design and construction of filled building platforms.
McNicholl, D. P. Proceedings of the ICE - Geotechnical Engineering, Volume 164, Issue 2 (April 2011) Pages 89–99.

√IPENZ 50/31 Algal capture of carbon dioxide; biomass generation as a tool for greenhouse gas mitigation with reference to New Zealand energy strategy and policy.
Packer, M. Energy Policy, Volume 37, Number 9 (September 2009) Pages 3428-3437.

√IPENZ 50/32 Climate policies for road transport revisited (I): Evaluation of the current framework.
Creutzig, F. et al. Energy Policy, Volume 39, Issue 5, May 2011, Pages 2396-2406.

√IPENZ 50/33 Assessing the potential for the uptake of on-farm anaerobic digestion for energy production in England.
Tranter, R. B. et al. Energy Policy, Volume 39, Issue 5 (May 2011) Pages 2424-2430.
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√IPENZ 50/34 Impacts of 'metals' on human health: a comparison between nine different methodologies for Life Cycle Impact Assessment (LCIA).
Pizzol, M. et al. Journal of Cleaner Production, Volume 19, Issues 6/7 (April/May 2011) Pages 646-656.

√IPENZ 50/35 Covering it all.
Civil Engineering, Volume 81, Issue 1 (January 2011) Pages 64-71.
The article focuses on the landfill covers designed to permanently contain the residuals of pesticides and chemical warfare agents at the Rocky Mountain Arsenal (RMA) Superfund site in Denver, Colorado.

√IPENZ 50/36 Benefiting Bakersfield.
Civil Engineering, Volume 81, Issue 1 (January 2011) Pages 56-63.
The article offers information on the Bakersfield Wastewater Treatment Plant 3 in Bakersfield, California that was expanded to offer various advantages to the city.

√IPENZ 50/37 History of the changing concepts in ventilation requirements.
Klauss, A. K. and Tull, R. H. ASHRAE Journal, Volume 53, Issue 2 (February 2011) Pages 34-43.

√IPENZ 50/38 Behaviour of compacted silt used to construct flood embankment.
Mountassir, G. E. et al. Proceedings of the ICE - Geotechnical Engineering, Volume 164, Issue 3 (June 2011) Pages 195–210.

√IPENZ 50/39 Urban runoff mitigation by a permeable pavement system over impermeable soils.
Fassman, E. A. and Blackbourn, S. Journal of Hydrologic Engineering, Volume 15, Issue 6 (June 2010) Pages 475-485.

√IPENZ 50/40 Designing storm-water controls to promote sustainable ecosystems: Science and application.
Palhegyi, G. E. Journal of Hydrologic Engineering, Volume 15, Issue 6 (June 2010) Pages 504-511.

√IPENZ 50/41 Numerical modeling of thermally enhanced pipe performances in vertical ground heat exchangers.
Raymond, J. et al. ASHRAE Transactions, Volume 117, Part 1 (2011) Pages 899-907.

√IPENZ 50/42 Numerical Investigation of Horizontal Ground Coupled Heat Exchanger.
Benazza, A. et al. Energy Procedia, Volume 6, Impact of Integrated Clean Energy on the Future of the Mediterranean Environment?, (2011) Pages 29-35.

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√IPENZ 50/43 **Design and realization of LED Driver for solar street lighting applications.**
Fathi, M., Chikouche, A. and Abderrazak, M. Energy Procedia, Volume 6, Impact of Integrated Clean Energy on the Future of the Mediterranean Environment?, (2011) Pages 161-166.

√IPENZ 50/44 **Development of street lighting system-based novel high-brightness LED modules.**
Long, X., Liao, R. and Zhou, J. IET Optoelectronics, Volume 3, Issue 1 (February 2009) Pages 40-46.

√IPENZ 50/45 **Estimating the value of improved street lighting: A factor analytical discrete choice approach.**
Willis, K. G., Powe, N. A. and Garrod, G. D. Urban Studies, Volume 42, Issue 12 (01/11/2005)Pages 2289-2303.

√IPENZ 50/46 **Tangible intervention: Improving the effectiveness of lighting control systems.**
Dugar, A. M. and Donn, M. R. Lighting Research & Technology, Volume 43, Issue 3 (September 2011) Pages 381-393.

√IPENZ 50/47 **A fresh approach to control room management and related best practices.**
Treat, R. Pipeline & Gas Journal, Volume 238, Issue 6 (June 2011) Pages 32-40.

√IPENZ 50/48 **Response of various vibration parameters to the condition monitoring of ball bearing used in centrifugal pumps.**
Utpat, A., Ingle, R. B. and Nandgaonkar, M. R. Noise & Vibration Worldwide, Volume 42, Issue 6 (June 2011) Pages 34-40.

√IPENZ 50/49 **Water quality with storage in permeable pavement basecourse.**
Myers, B., Beecham, S. and van Leeuwen, J. A. Proceedings of the ICE - Water Management, Volume 164, Issue 7 (July 2011) Pages 361–372.

Special focus on Marine Energy,

√IPENZ 50/50 Assessment of marine renewable energy industry stakeholder requirements in North Scotland.
Alastor, C. Journal of Environmental Assessment Policy & Management, Volume 12, Issue 1 (March 2010) Pages 29-49.

√IPENZ 50/51 Direct electric energy conversion system for energy conversion from marine currents.
Leijon, M. and Nilsson, K. Proceedings of the Institution of Mechanical Engineers -- Part A -- Power & Energy (Professional Engineering Publishing), Volume 221, Issue 2 (March 2007) Pages 201-205.

√IPENZ 50/52 Energy production from marine biomass: Fuel cell power generation driven by methane produced from seaweed.
Yokoyama, S., Jonouchi, K. and Imou, K. International Journal of Applied Science, Engineering & Technology, Volume 4, Issue 3 (2008) Pages 168-171.

√IPENZ 50/53 Enhancing local distinctiveness fosters public acceptance of tidal energy: A UK case study.
Devine-Wright, P. Energy Policy, Volume 39, Issue 1 (January 2011) Pages 83-93.
Tidal energy has the technical potential to form part of a low carbon electricity sector, however, its 'social potential' is less clear, as few empirical studies of public beliefs and responses have been conducted to date. This research addressed this gap by investigating a tidal energy convertor in Northern Ireland, said to be the first grid-connected device of its kind in the world. Data was collected from 313 residents of two nearby villages using mixed methods, guided by a conceptual framework that avoided 'NIMBY' assumptions and instead drew on place theory. Findings indicated strong support for the project, arising from beliefs that the project enhanced local distinctiveness by 'putting the area on the map worldwide'; appeared visually familiar and helped tackle climate change. These positive beliefs outweighed concerns about outcome and process aspects, which were preponderant in one of the two villages. The project was interpreted to have few positive local economic outcomes, to potentially threaten local livelihoods and local ecology. Moreover, residents expressed cynicism about consultation procedures, and reported low levels of behavioural engagement. Implications of the findings for the literature on public acceptance of renewable energy, and for the emerging marine energy sector specifically, are discussed.

√IPENZ 50/54 **Estimating power output from a tidal current turbine farm with first-order approximation of hydrodynamic interaction between turbines**.
Ye Li and Calisal, S. M. International Journal of Green Energy, Volume 7, Issue 2 (March/April 2010) Pages 153-163.

√IPENZ 50/55 **The exploitation of marine currents energy on the Strait of Gibraltar.**
Nuñez-Rivas, L. R. and Novoa, R. E. M. Journal of Marine Technology & Environment, Volume 2 (2010) Pages 125-130.

√IPENZ 50/56 **Generating electricity from the oceans.**
Bahaj, A. S. Renewable & Sustainable Energy Reviews, Volume 15, Issue 7 (September 2011) Pages 3399-3416.
Ocean energy has many forms, encompassing tides, surface waves, ocean circulation, salinity and thermal gradients. This paper will considers two of these, namely those found in the kinetic energy resource in tidal streams or marine currents, driven by gravitational effects, and the resources in wind-driven waves, derived ultimately from solar energy. There is growing interest around the world in the utilisation of wave energy and marine currents (tidal stream) for the generation of electrical power. Marine currents are predictable and could be utilised without the need for barrages and the impounding of water, whilst wave energy is inherently less predictable, being a consequence of wind energy. The conversion of these resources into sustainable electrical power offers immense opportunities to nations endowed with such resources and this work is partially aimed at addressing such prospects. The research presented conveys the current status of wave and marine current energy conversion technologies addressing issues related to their infancy (only a handful being at the commercial prototype stage) as compared to others such offshore wind.

√IPENZ 50/57 **Levelised costs of wave and tidal energy in the UK: Cost competitiveness and the importance of "banded" Renewables Obligation Certificates**.
Allan, G. et al. Energy Policy, Volume 39, Issue 1 (January 2011) Pages 23-39.
In this paper, publicly available cost data are used to calculate the private levelised costs of two marine energy technologies for UK electricity generation: Wave and Tidal Stream power. These estimates are compared to those for ten other electricity generation technologies whose costs were identified by the UK Government (). Under plausible assumptions for costs and performance, point estimates of the levelised costs of Wave and Tidal Stream generation are £190 and £81/MWh, respectively. Sensitivity analysis shows how these relative private levelised costs calculations are affected by variation in key parameters, specifically the assumed capital costs, fuel costs and the discount rate. We also consider the impact of the introduction of technology-differentiated financial support for renewable energy on the cost competitiveness of Wave and Tidal Stream power. Further, we compare the impact of the current UK government support level to the more generous degree of assistance for marine technologies that is proposed by the Scottish.

√IPENZ 50/58 **Marine current turbines: pioneering the development of marine kinetic energy converters.**
Fraenkel, P. L. Proceedings of the Institution of Mechanical Engineers -- Part A -- Power & Energy (Professional Engineering Publishing), Volume 221, Issue 2 (March 2007) Pages 159-169.

√IPENZ 50/59 Internationalization as a strategy to overcome industry barriers—An assessment of the marine energy industry.
Løvdal, N. and Neumann, F. Energy Policy, Volume 39, Issue 3 (March 2011) Pages 1093-1100.
Research on conditions to develop new innovations within emerging renewable energy industries is often done with a national focus. However, recent research on international entrepreneurship has revealed that firms operate on international levels very early in their life time. Thus, based on former research on international entrepreneurship and case examples, we build the propositions that firms in the marine energy industry use internationalization as a strategy to overcome industry barriers. Our primary source of data is a unique dataset from a global survey of all the companies in the marine energy industry who are aiming to commercialize a wave or tidal energy device.

√IPENZ 50/60 Marine current energy devices: Current status and possible future applications in Ireland.
Rourke, F. O., Boyle, F. and Reynolds, A. Renewable & Sustainable Energy Reviews, Volume 14, Issue 3 (April 2010) Pages 1026-1036.
There is a growing demand for the use of renewable energy technologies to generate electricity due to concerns over climate change. The oceans provide a huge potential resource of energy. Energy extraction using marine current energy devices (MCEDs) offers a sustainable alternative to conventional sources and a predictable alternative to other renewable energy technologies. A MCED utilises the kinetic energy of the tides as opposed to the potential energy which is utilised by a tidal barrage. Over the past decade MCEDs have become an increasingly popular method of energy extraction. However, marine current energy technology is still not economically viable on a large scale due to its current stage of development. Ireland has an excellent marine current energy resource as it is an island nation and experiences excellent marine current flows. This paper reviews marine current energy devices, including a detailed up-to-date description of the current status of development. Issues such as network integration, economics, and environmental implications are addressed as well as the application and costs of MCEDs in Ireland.

√IPENZ 50/61 Marine renewable energy: potential benefits to biodiversity? An urgent call for research.
Inger, R. et al. Journal of Applied Ecology, Volume 46, Issue 6 (December 2009) Pages 1145-1153.

√IPENZ 50/62 Numerical model assessment of tidal stream energy resources in the Severn Estuary, UK.
Xia, J., Falconer, R. A. and Lin, B. Proceedings of the Institution of Mechanical Engineers -- Part A -- Power & Energy (Professional Engineering Publishing), Volume 224, Issue 7 (2010) Pages 969-983.

√IPENZ 50/63 Recent patents on tidal power extraction devices.
Ilzarbe, J. M. B. and Teixeira, J. A. Recent Patents on Engineering, Volume 3, Issue 3 (November 2009) Pages 178-193.

√IPENZ 50/64 Regulatory, design and methodological impacts in determining tidal-in-stream power resource potential.
Atwater, J. F. and Lawrence, G. A. Energy Policy, Volume 39, Issue 3 (March 2011) Pages 1694-1698.

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√IPENZ 50/65 Mobilising for marine wind energy in the United Kingdom.
Jay, S. Energy Policy, Volume 39, Issue 7 (July 2011) Pages 4125-4133.

√IPENZ 50/66 A review on the development of tidal current energy in China.
Liu, H. et al. Renewable & Sustainable Energy Reviews, Volume 15, Issue 2 (February 2011) Pages 1141-1146.

√IPENZ 50/67 Review of marine renewable energies: Case study of Iran.
Zabihian, F. and Fung, A. S. Renewable & Sustainable Energy Reviews, Volume 15, Issue 5 (June 2011) Pages 2461-2474.

√IPENZ 50/68 Tidal current energy resource assessment in Ireland: Current status and future update.
O'Rourke, F., Boyle, F. and Reynolds, A. Renewable & Sustainable Energy Reviews, Volume 14, Issue 9 (December 2010) Pages 3206-3212.

√IPENZ 50/69 Tide energy.
Wood, K. Composites Technology, Volume 16, Issue 5 (October 2010) Pages 28-36.