

Actions taken in response to the editor comment on "Effect of tidal stream power generation on the region-wide circulation in a shallow sea" by G. I. Shapiro

A revised paper with responses to the referees as indicated in the discussion should generally be acceptable. I would like to make a few additional points.

Linear (Rayleigh) friction. All the referees commented but the new text (5) to (11) generally deals with this well. In my opinion this new text **could be reduced / "streamlined"** a bit. However, there is an important statement after (10) "The generated electric power PE is equal to the reduction of mechanical power of the flow P less small energy losses . . .". **"Small" relates to the comment of Referee 2** about other losses of power. I don't think that Figure 1(b) proves that the losses are small, although they might have the right dependence on flow speed. Any evidence about "small" energy losses would be useful here.

RESPONSE: *In order to streamline the text I removed references to the amounts of 'electrical' power produced and concentrated the story on the main focus of the paper- the amounts of 'extracted' mechanical energy from the tides. This relates in particular to the text between new L229-239. I also removed (i) the equation for electrical efficiency, C_p , and the last few terms in eq (10); (ii) Fig1(b) which relates to the electric power, retaining Fig1(a) related to the mechanical forces and hence loss of mechanical energy.*

Referees 1 and 3 comment about alternative shapes of farm. Definitely include the alternative linear farm as well, but I think this response is OK / sufficient.

RESPONSE: *Fig.8. added to the manuscript and presented in the responses to the referees.*

Referee 2 comment "Even with the assumption of depth-uniform drag coefficient, the value of this needs to be related to the type and spacing of turbines . . .". The response relates the range of power generation to La Rance. However, it is not obvious that the area of turbines is capable of generating as much as La Rance. It is very unlikely that the effect of the turbines will be to attract more energy flux to the turbine farm; hence there is an inherent limit related to the tidal energy flux intercepted by the farm; this implies a limit on the drag coefficient.

RESPONSE: *This is correct. In the ideal conditions the standard turbines (with horizontal axes) could intercept no more than about 59% of incoming energy flux (the Betz limit), the helical turbines have maximum efficiency of about 35%. The limits of the energy intercepted by the farm are discussed in the text (new L129-145).*

Referee 2 comment "Unless these problems are addressed . . ." This calls for an explicit emphatic statement in the paper that existing estimates related to tidal farms should not be taken too seriously.

RESPONSE: *The following phrase was added to the abstract and discussion 'This study shows that both energy extraction estimates and effects on region wide circulation depend on a complex combination of factors, and the specific figures given in the paper should be generally considered as first estimates'.*

Referee 2 comment re L41. I think this calls for a qualification in the text, next to "almost inexhaustible", that extractable energy is limited.

RESPONSE: *The phrase is added: (new L45-46): 'However, similar to other energy resources, the amount of practically extractable energy is limited.'*

Referee 2 comment re L54. Some change in the text is called for but I think this is all a minor quibble.

RESPONSE:

The formulations are amended in new L53-58 .

Referee 2 comment re L55. Perhaps the wording should be more cautious. "E.g. may be a potential stable source" rather than "deemed to become a stable source". [Although the Severn is unlikely for a while, the project for the Mersey seems to have some momentum - public consultations are taking place].

RESPONSE:

*As advised , this sentence now reads (new L60-62): 'Despite its relatively high cost, generation of electricity from tidal energy **may be a potential stable source** of renewable energy for the future'.*