Supplementary Information

Sustainable Hybrid Energy Harvester based on Air Stable Quantum Dot Solar Cells and Triboelectric Nanogenerator

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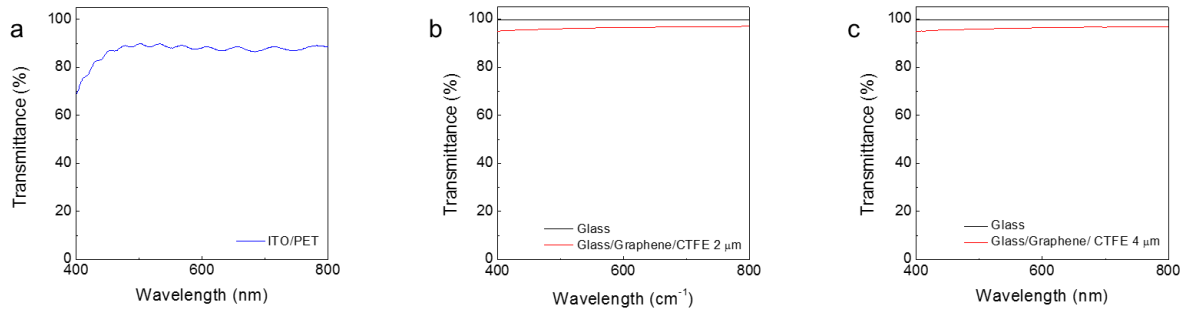


Supplementary Figure S1. Transmittance of the TENG; (a) the top ITO/PET electrode and (b) the P(VDF-TrFE-CTFE) layer on the bottom graphene electrode. (c) Transmittance of 4 μm-thick CTFE layer on graphene.

Supplementary Table S1. Individual performance of QDSCs.

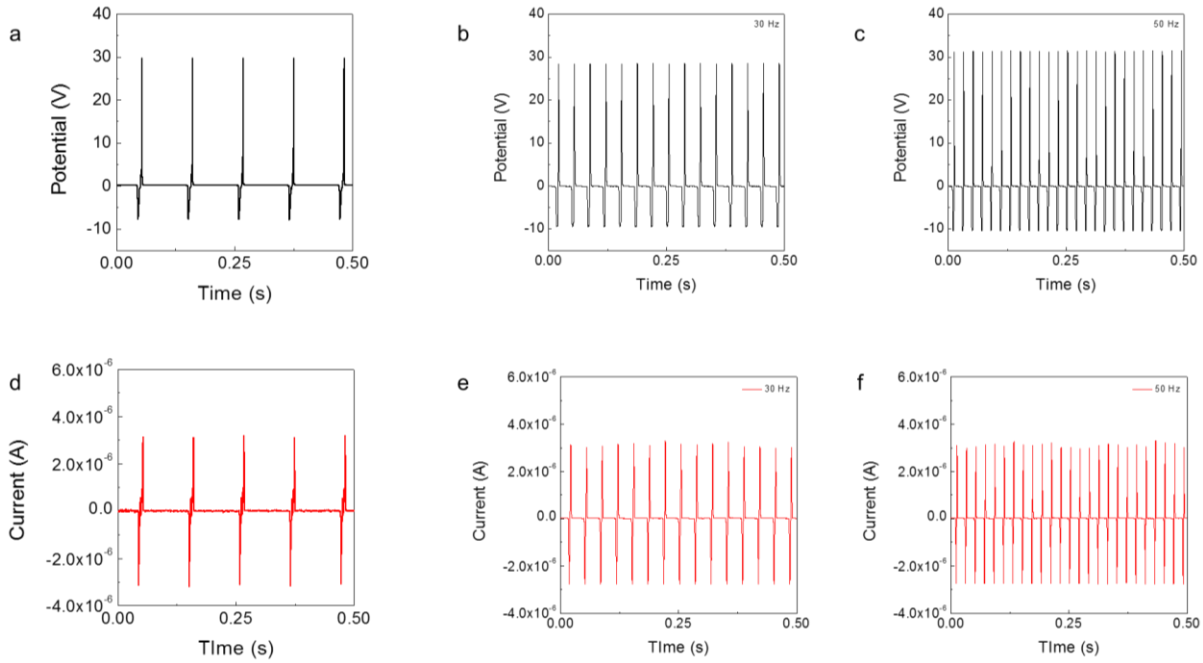
Samples	V_{oc} (V)	J_{sc} (mA/cm^2)	FF	PCE (%)
1	0.52	26.44	0.59	8.11
2	0.50	25.75	0.68	8.76
3	0.52	25.75	0.62	8.30
4	0.50	25.92	0.58	7.50
5	0.52	26.44	0.57	7.83
6	0.50	26.02	0.61	7.94
Average	0.51 ± 0.01	26.05 ± 0.32	0.61 ± 0.04	8.07 ± 0.43

Supplementary Table S2. Changes in power conversion efficiency of the 6-QDSCs before and after assembly of the TENG.

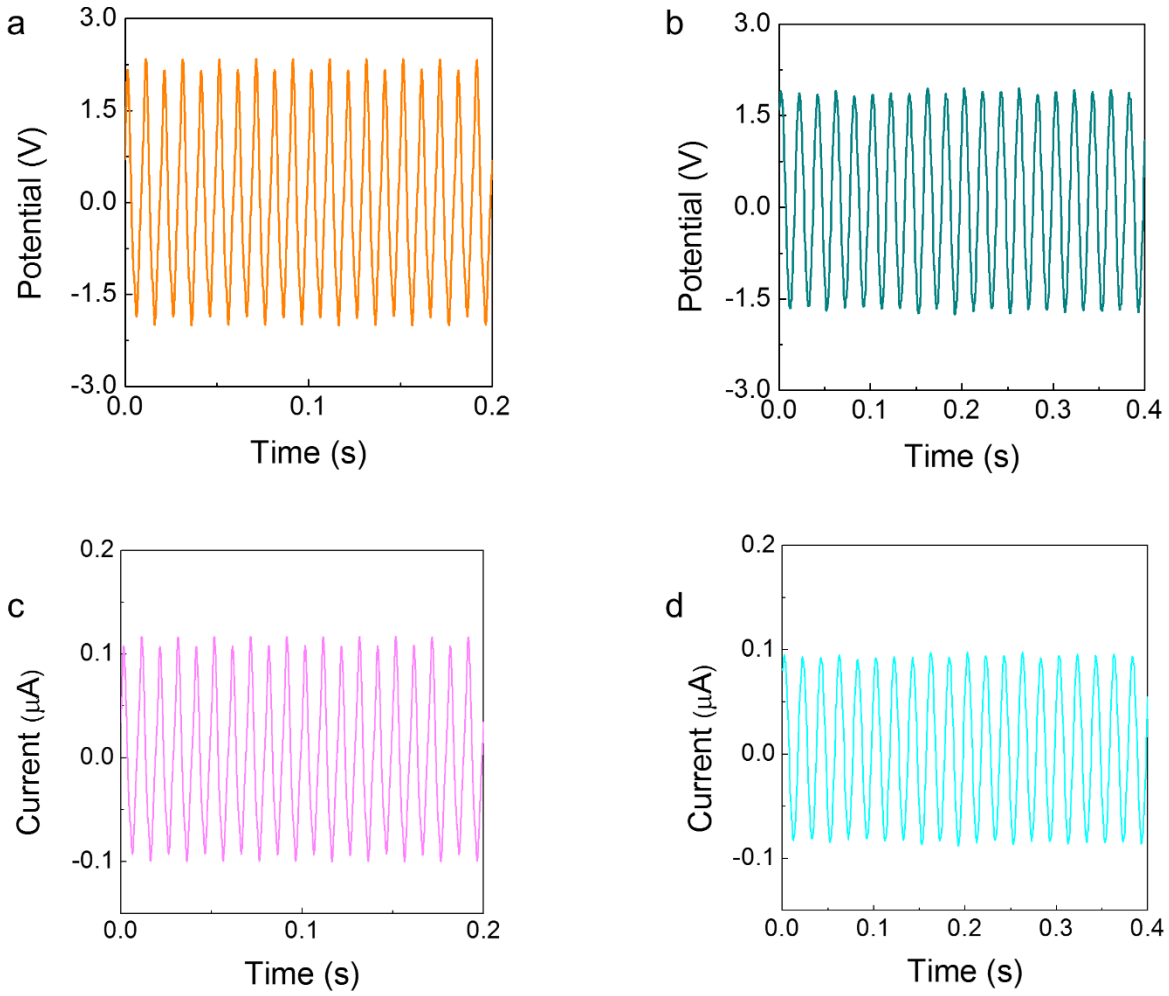
Parameter	Before	After	Δ (After - Before)
V_{oc} (V)	3.12	3.12	0
J_{sc} (mA/cm^2)	23.96	22.10	-1.86
FF	0.61	0.65	0.04
PCE	7.60	7.47	-0.13

Due to series connection, an active area of 6-QDSCs is 6 times larger than that of a single cell and thus PCE of the 6-QDSCs is calculated by using an equation below:

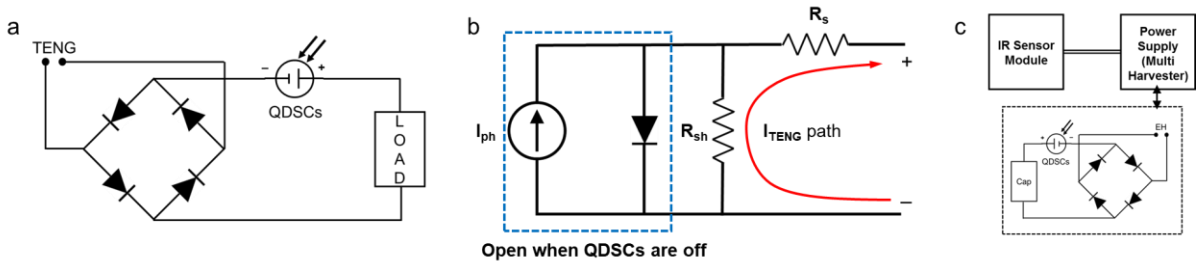
$$V_{oc} \times J_{sc} \times \mathrm{FF} \,/_{6\ (\text{number of cells})}$$



Supplementary Figure S2. Potential and current output of the TENG without rectification at the frequency of (a) and (d) 10 Hz, (b) and (e) 30 Hz, and (c) and (f) 50 Hz, respectively.



Supplementary Figure S3. Potential and current output of the TENG which was driven by environmental energy sources; (a) and (c) sound, and (b) and (b) wind, respectively.



Supplementary Figure S4. (a) Schematics of a power management circuit for the HEH to obtain a hybrid signal. (b) An equivalent circuit of a solar cell and current path (Red curve) of the TENG (I_{TENG}). (c) The schematics of a sensor module connected with the power management circuit.

Supplementary Video S1. Operating LEDs at the conditions of charging capacitors and opening the relay switch for 0.2 seconds.

Supplementary Video S2. Operating LEDs at the continuous mode.

Supplementary Video S3. Operating the IR sensor without aid of any external power supply.