On the Energy Efficiency of Sorting Algorithms

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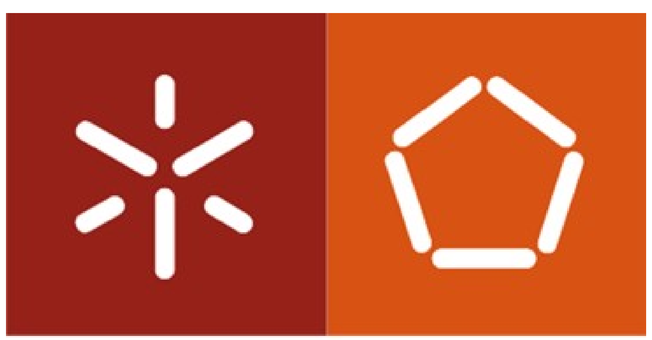
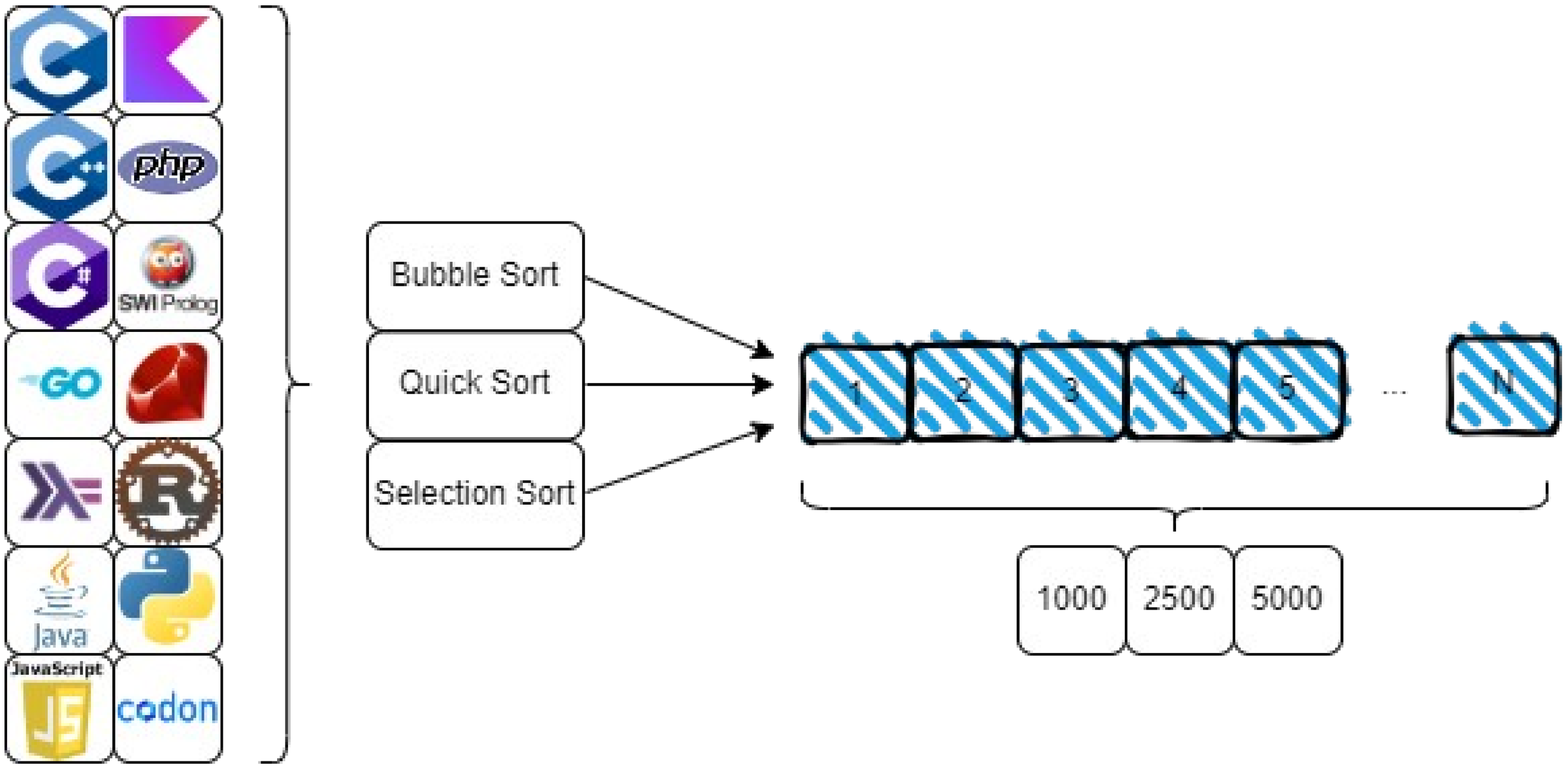
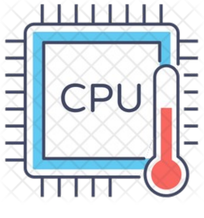


Analysis of programming languages' performance when running various sorting algorithms.



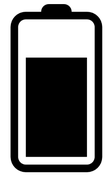
Temperature sensors & PowerCap



Reads CPU temperature

Guarantee that all programs execute at the same (CPU) temperature

Limits CPU power



Consumes less energy

Longer execution time

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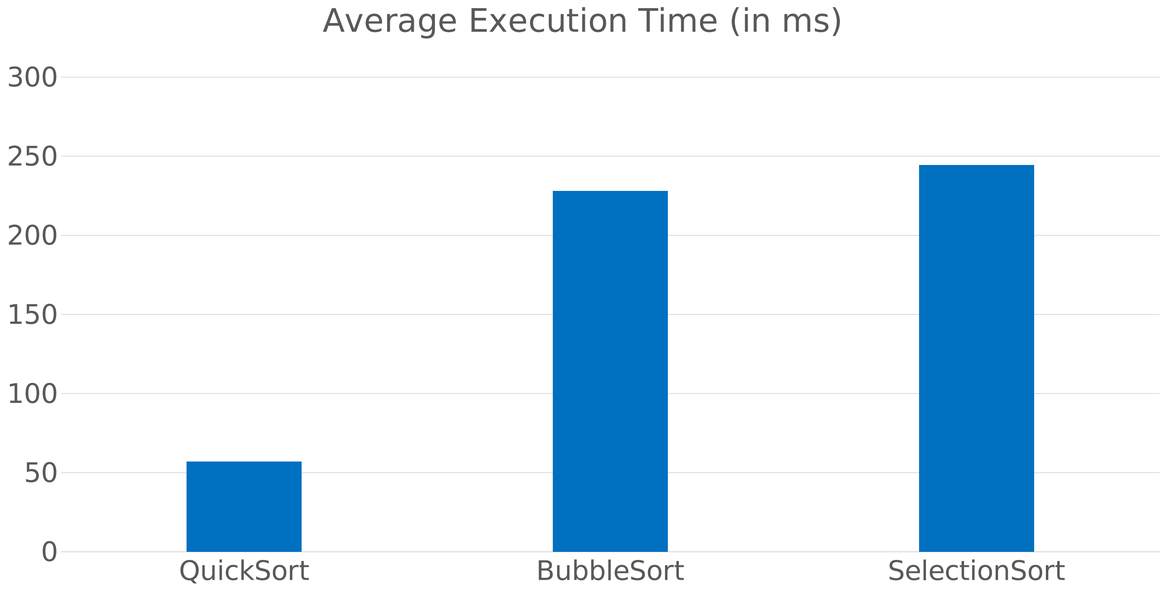
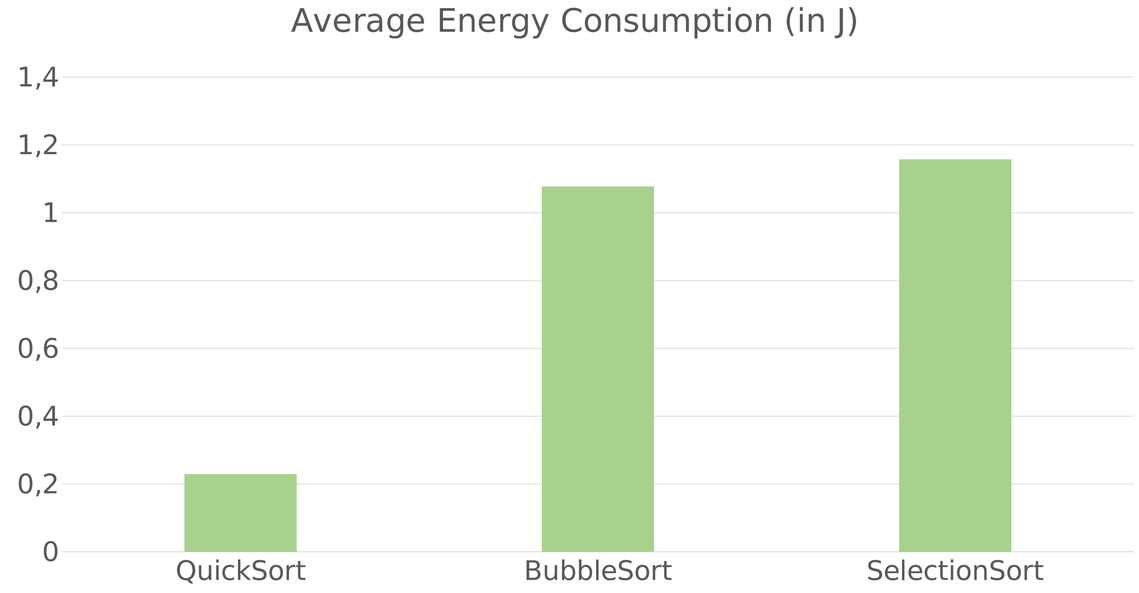
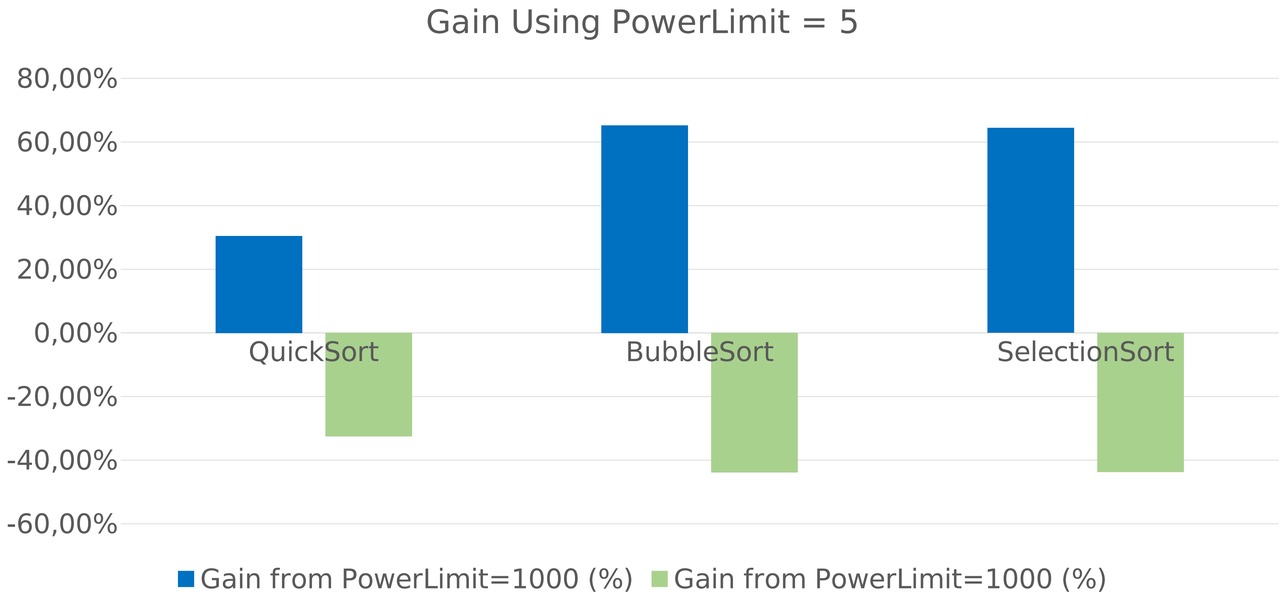
Results – Quick Sort performance and energy consumption







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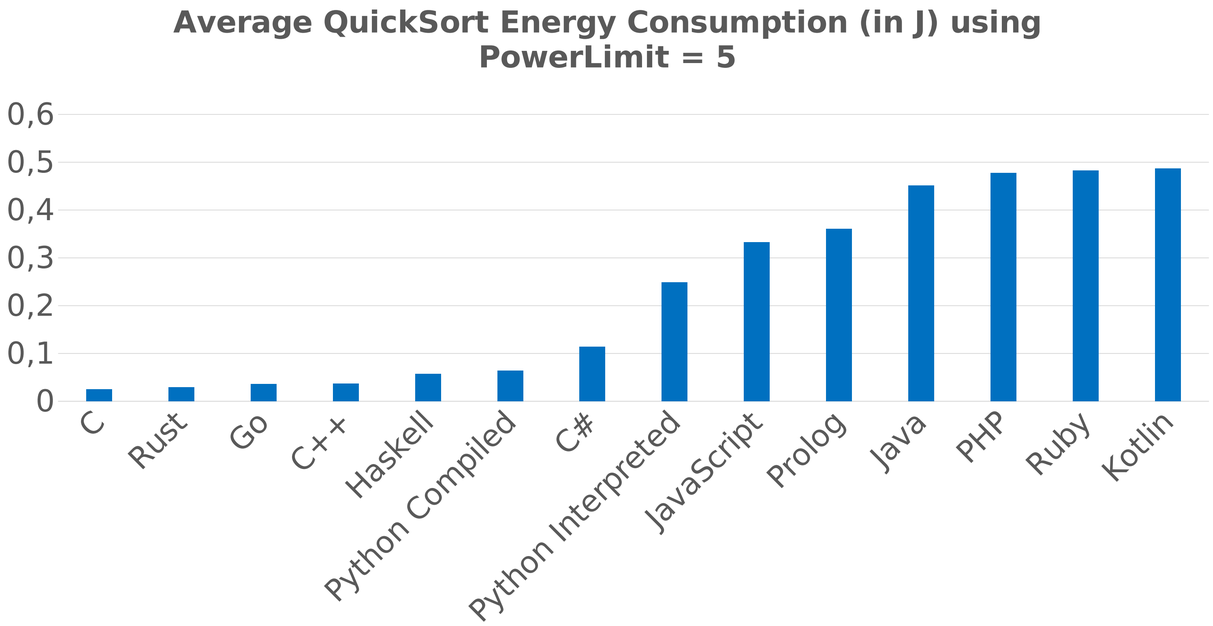
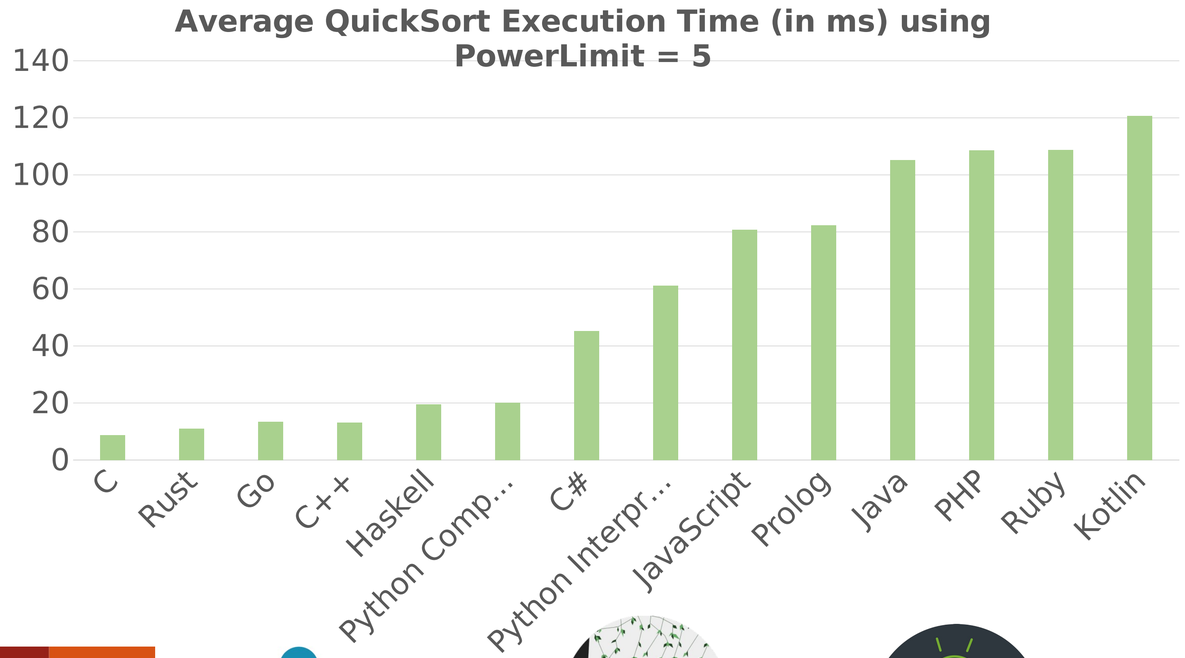
Results – Programming languages performance and energy consumption





QuickSort		
	Energy (J)	Time (ms)
(c) Pascal	0.02	3
(c) C	0.02	4
(c) Rust	0.03	6
(c) Go	0.05	9
(c) OCaml	0.09	9
(i) PHP	0.23	20
(v) Lisp	0.25	18
(i) Lua	0.26	23
(c) Haskell	0.29	20
(i) Perl	0.32	28
(i) Ruby	0.61	45
(i) Python	0.73	61
(i) JavaScript	0.78	60
(v) Java	1.49	87
(v) Erlang	1.50	101
(i) Dart	1.70	114
(v) Racket	2.24	169

Pereira, R. et al. (2020). "Ranking Programming Languages by Energy Efficiency" in Science of Computer Programming, volume 205. Elsevier, 2021, page 48.

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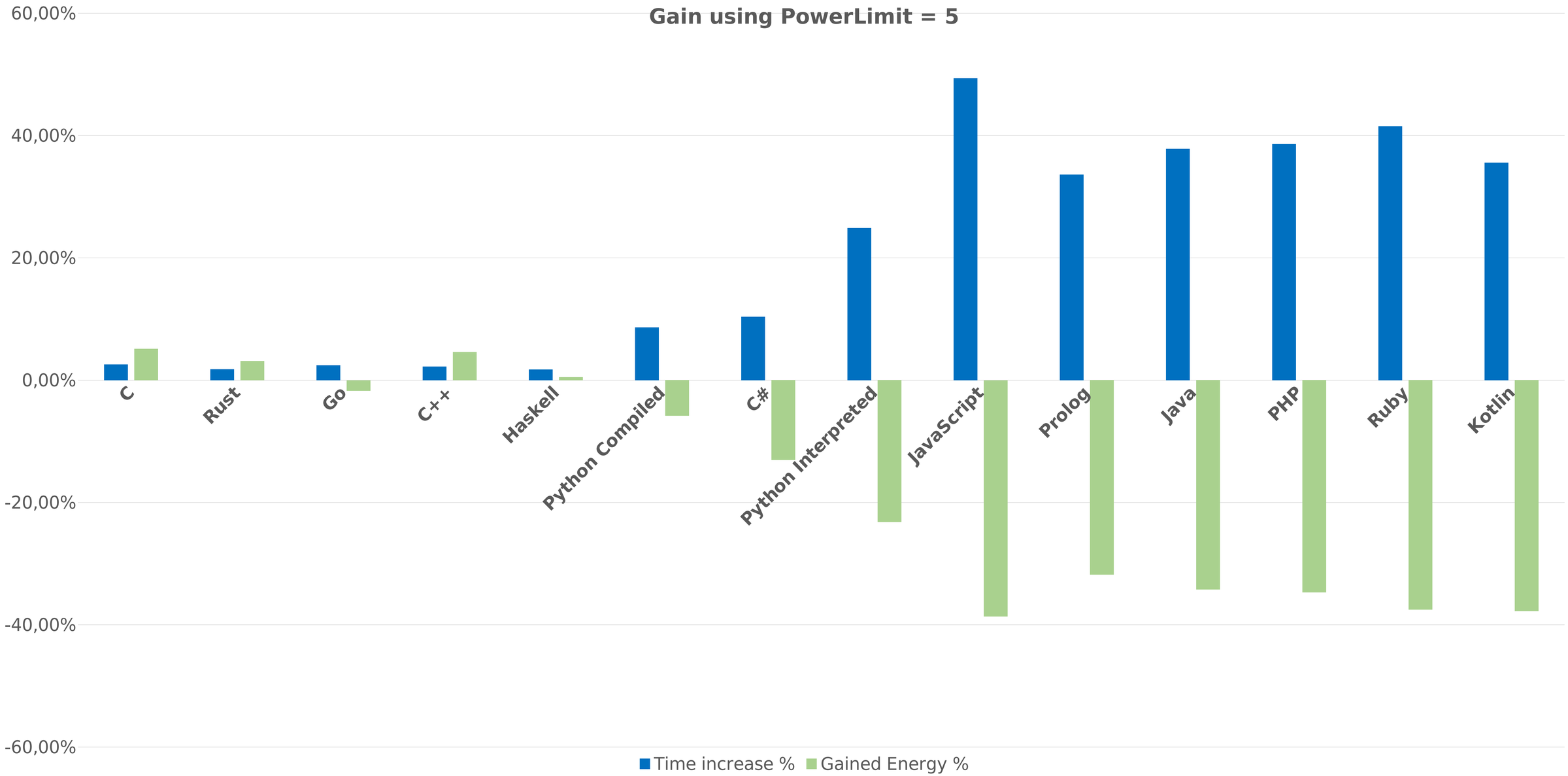
Results – Powercap influence (Languages)



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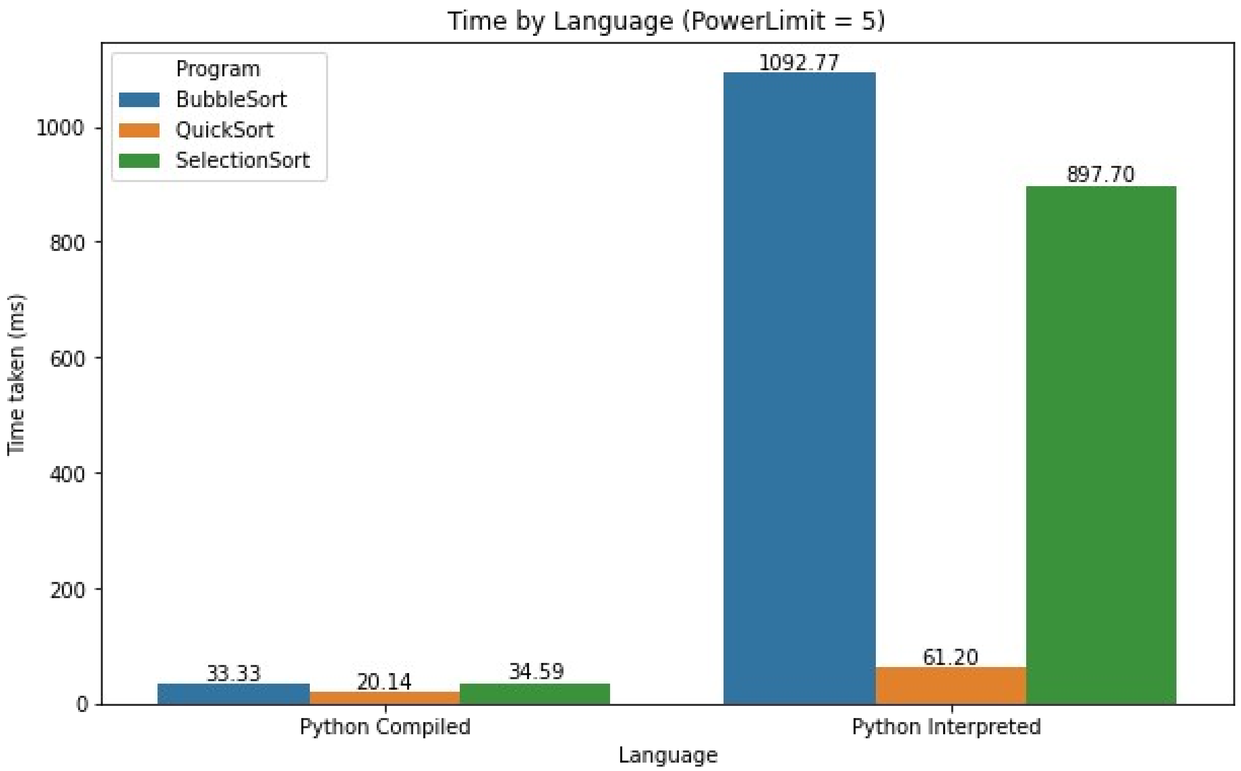
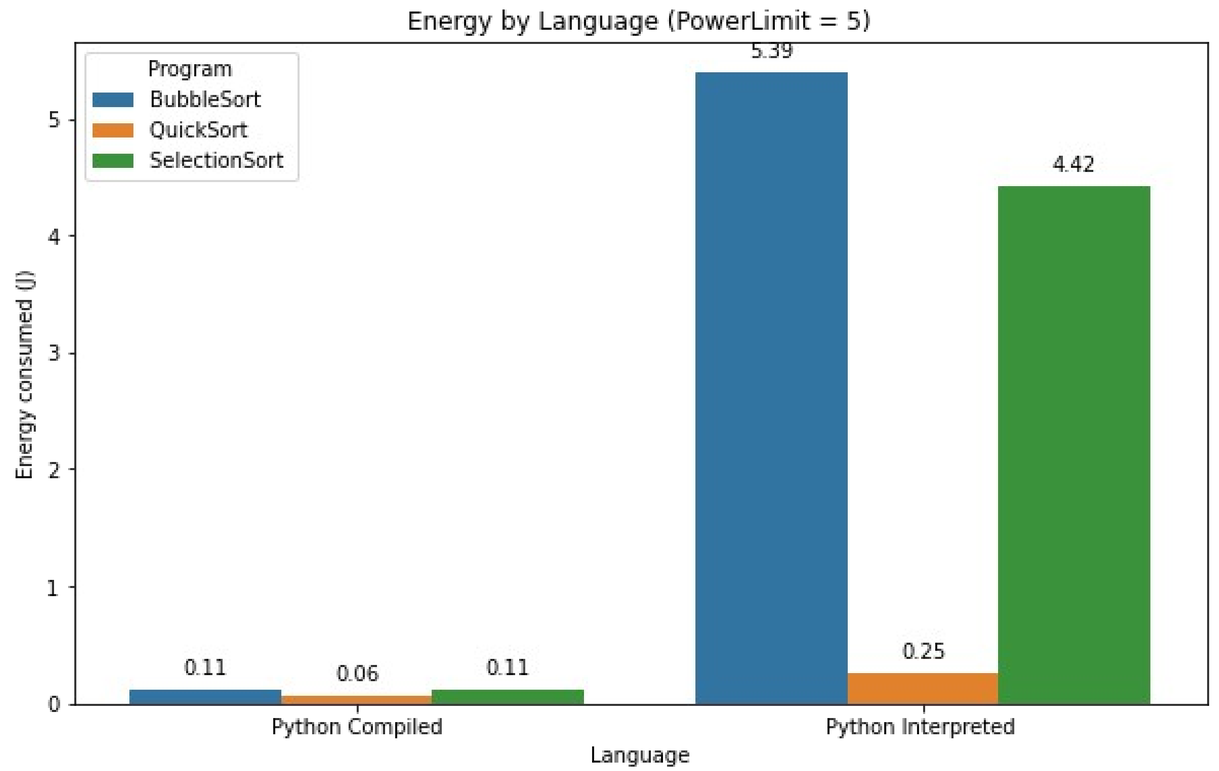
Results – Python compiled vs Python Interpreted





Conclusions

- **C and QuickSort** → faster and greener
- **Powercap** → - energy consumption + runtime
- **JavaScript** → **- 38.63%** energy consumption using Powercap
- Python compiled > Python interpreted