CONCEPT2 STEP TEST 2 SEPTEMBER 2026 · HEART-RATE MODEL FITTED ON 7.6 H OF TRAINING

Rowing physiology, measured and modelled

One athlete, two instruments. A six-step lactate test fixes where the thresholds sit. A heart-rate model then predicts the cardiac cost of a session — and shows which conditions move that cost most.

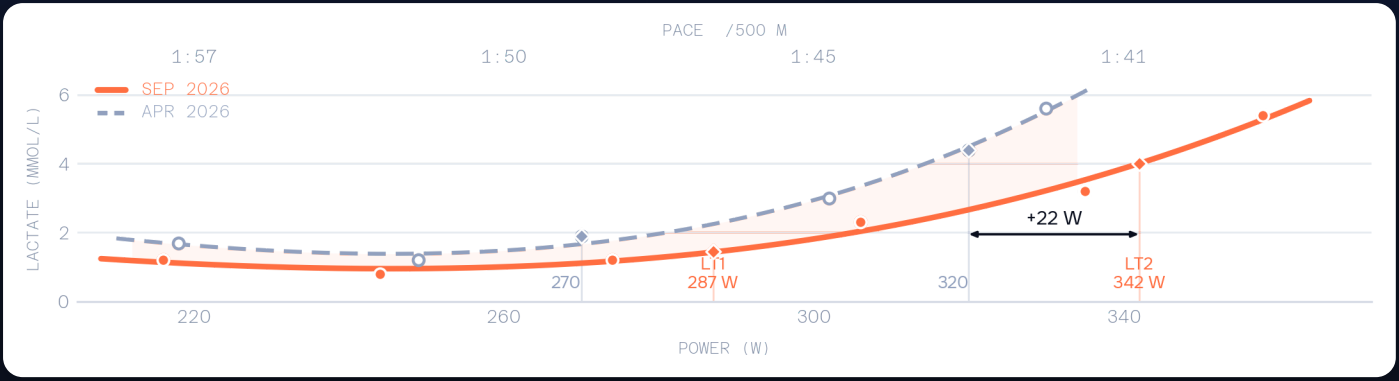
LT2 · 4 MMOL/L
342 W
1:41 /500 m
+22 W vs April (320 W)

LT1 · AEROBIC
287 W
1:47 /500 m
+17 W vs April (270 W)

HEART RATE PREDICTED
6.7
bpm RMSE · r = 0.98
on an 85-minute session

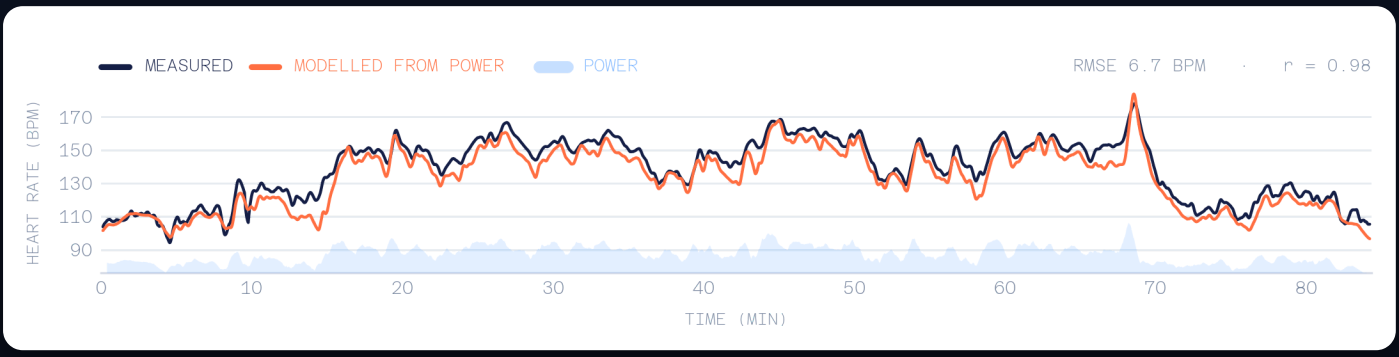
COST OF HEAT
+5
bpm at 250 W
above 28 °C vs below 12 °C

FIG. 1 Where the thresholds sit



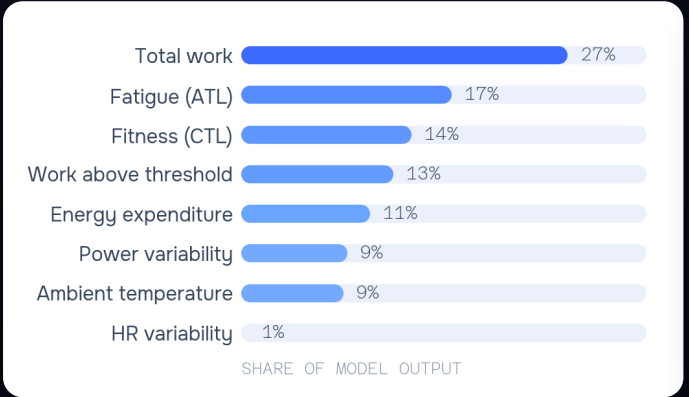
Capillary lactate after each 5-minute step, April versus September. The whole curve has shifted right and flattened: **the same 330 W now costs 3.2 mmol/L instead of 5.6**. LT1 is taken at the curve minimum + 0.5 mmol/L, LT2 at 4 mmol/L.

FIG. 2 Heart rate predicted from power alone



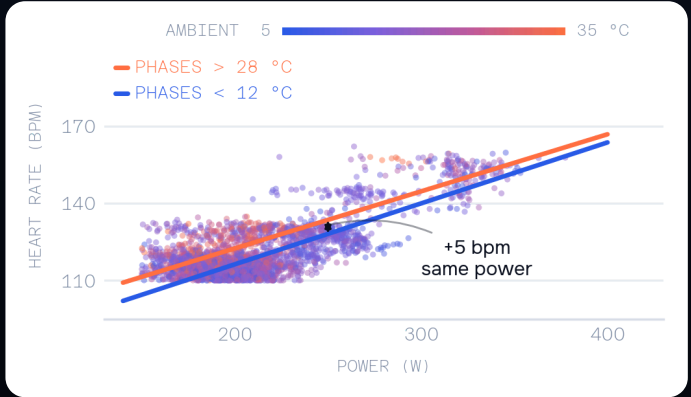
A first-order cardiac response — separate rise and recovery time constants plus a drift term driven by accumulated work — fitted on 7.6 h of the athlete's sessions. **It tracks an 85-minute session to 6.7 bpm.** Every parameter is physiological, so the fit stays readable.

FIG. 3 What moves aerobic efficiency



A second model predicts power per heartbeat from context. Bars are out-of-fold mean |SHAP|, **R^2 = 0.76 on 15 076 stable phases**. Work done leads; heat is smaller but plannable.

FIG. 4 The heat term, opened up



Each point a stable phase, coloured by its recorded temperature. **At 250 W, phases above 28 °C run 5 bpm higher** than those below 12 °C (95% CI 4–6).