

CYCLING FUSION

EVERYTHING YOU NEED INDOORS TO IMPROVE YOUR RIDING OUTDOORS

POWER INTERPRETATION

cyclingsport.com



© Copyright 2011, Cycling Fusion

DATA INTERPRETATION

Or

WHAT'S IT ALL MEAN?

cyclingsport.com



© Copyright 2011, Cycling Fusion

LET'S LISTEN IN ON THE WATTAGE FORUM

> On 3 May 2011 07:52, Aaron Fillion aaf@ici.com wrote:

Hi, so now on ICI's forum there are three different FTPs:

1. Your FTP for riding the trainer
2. Your FTP for Steady-State riding on Road Bike
3. Your FTP for Group Rides and Races

Actually, I find there's 6:

1. Your FTP for riding the trainer on Road Bike
2. Your FTP for Steady-State riding on Road Bike
3. Your FTP for Group Rides and Races on Road Bike
4. Your FTP for riding the trainer in TT Position
5. Your FTP for Steady-State riding in TT Position
6. Your FTP for Races in TT Position

I'm still trying to figure out my VO2 zone in the zero position on the turbo.....

Note, I use the average of my TT and road bike FTP for 80% to approximate overall FTP.

cyclingsport.com



© Copyright 2011, Cycling Fusion

THERE'S A POWER "LANGUAGE"??

• Yes there is! Let's do a little instructional primer:

- Power: The rate of doing work, where work is equal to force times distance.
- Acute Training Load (ATL): The overall quantity (i.e., combination of frequency, duration, and intensity) of training that you have performed recently (during the past week or two). See also Chronic Training Load (CTL).
- Chronic Training Load (CTL): The overall quantity (i.e., combination of frequency, duration, and intensity) of training that you have been performing over a substantial period of time—for example, several months or more. See also Acute Training Load (ATL).
- Functional threshold power (FTP): The highest power that a rider can maintain in a quasi-steady state without fatiguing for approximately one hour. When power exceeds FTP, fatigue will occur much sooner, whereas power just below FTP can be maintained considerably longer.

COVAULT



© Copyright 2011, Cycling Fusion

THERE'S A POWER "LANGUAGE"??

- Intensity Factor (IF): For any workout or part of a workout, the ratio of the Normalized Power to the rider's functional threshold power.
- Normalized Power (NP): An estimate of the power that you could have maintained for the same physiological "cost" if your power had been perfectly constant, such as on an ergometer, instead of variable.
- Lactate Threshold (LT): The exercise intensity at which the release of lactate into the blood first begins to exceed its rate of removal, such that blood lactate levels begin to rise. There are 2 distinct increases (LT1 and LT2) that track closely with changes in ventilation and hence LT is typically equivalent to VT or Ventilatory Threshold for both VT1 and VT2.
- Metabolic fitness: The ability of your muscles to balance aerobic energy production with energy demand, which in turn determines the rate of muscle glycogen utilization, blood lactate levels, and so on.

COVAULT



© Copyright 2011, Cycling Fusion

THERE'S A POWER "LANGUAGE"??

- Threshold heart rate: The heart rate corresponding to functional threshold power. See Functional Threshold power. NOTE: this same term is not defined this way outside of power punks.
- Training Stress Score (TSS): A composite number that takes into account the **duration** and **intensity** of a workout to arrive at a single estimate of the **overall training load** and physiological stress created by that session. It is conceptually modeled after the heart rate-based training impulse (TRIMP).
- $\dot{V}O_{2max}$: The maximal rate of whole-body oxygen uptake that can be achieved during exercise. $\dot{V}O_{2max}$ is primarily limited by the ability of the cardiovascular system to deliver O_2 -carrying blood to exercising muscle; hence, $\dot{V}O_{2max}$ is considered the best measure of a person's cardiovascular fitness and sets the upper limit to aerobic power production.

COVAULT



© Copyright 2011, Cycling Fusion

HOW MUCH IS SCIENCE & HOW MUCH IS PHILOSOPHY

Again, eyes dropping on the Wattage Forum...

- > Long story short: We have moved to Golden Cheetah rather than pay the additional fee to upgrade from MKO 2.2 to 2.0 forced by the change to a Garmin 500 headed system.
- >
- > The Xpower of rides "seems" to be significantly lower than Normalized power did for similar rides. Since Relative Intensity is based on the ratio of Xpower to average power this decreases RI. As I understand things, Bikescore is calculated the same way TSS is, i.e. $RI^2 \times \text{Time} \times 100$. This would seem to create a much lower Bikescore than TSS leading to lower STS (ATL) and LTS (CTL). Our problem is that we have some specific training targets based on the WKO metrics and wonder how far out of line they are compared to the Golden Cheetah metrics.

WHAT'S THE POINT???

- * Knowing "your power" is cool.
- * Bragging rights!
- * You want to figure out if Indoor Cycling is really the best hope we have of ever becoming truly free from fossil fuels

KNOWING "**WHAT IT ALL
MEANS**", TURNS THE
INTERESTING INTO THE
USEFUL

Maybe you have some
specific use for cycling power

START WITH PURPOSE

- Why do you want to develop your power
 - Cycling Event, Racing, Fitness Improvements
- What type of power is required to meet your goal
 - Sustainable / long range power
 - Climbing / for er... climbing
 - Explosive / for a variety of applications - some of which might not even be cycling related

BEFORE WE CAN GET TO THE
GOOD STUFF OF
INTERPRETATION, COMES
A PROPER FOUNDATION

We have terminology & philosophy too...

IN THE CONTEXT OF
INDOOR CYCLING & THE
NON-RACING OUTDOOR
CYCLIST...

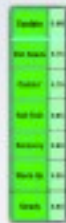
Simpler is Better

ASSUMPTIONS

- 99% of our indoor students do not own outdoor power meters
- The tools we have at our disposal are as follows:
 - Indoor calculated power
 - Heart rate monitors indoors and out
 - Cadence sensors in both environments
 - We can use software to track our results

SUSTAINABLE POWER ZONE

Indoor Chart



Used For:

Flat roads and small climbs, sometimes recovery between intervals or after climbs

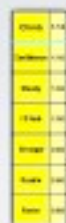
Training:

7 to 20 minute efforts of sustained riding in almost any heart zone

- Sustained power training begins at .5 Watts/Lb, or a very comfortable warm up power level.
- As it moves through to the middle of the zone, it becomes sufficient for a little quicker pace, but still on flat ground.
- The top two or three levels represent the beginning power levels required to climb slight grades, albeit at a pretty slow pace.
- Nevertheless, this is a critical juncture that must be mastered for at least the 7 minute interval in order to enter the real Climbing Zone.

CLIMBING POWER ZONE

Indoor Chart



Used For:

Roads with slight grades, or small climbs with speed, mild climbs with intermittent steep sections

Training:

3-6 minutes of sustained climbing in Heart Zones 3 through 5, depending on where your 20 minute MSP is.

- The rider has arrived at the most critical juncture for all new cyclists - the ability to sustain 1 Watt/Lb
- With this power, there are few road rides that couldn't be tackled, and no hills except for those with grades in the high teens should force a dismount.
- Here we begin to develop the ability to climb the hills with pace, and take our cycling (indoors and out) to the next level
- This also marks where we can begin to experiment with speed in bigger gears

EXPLOSIVE POWER ZONE

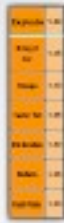
Indoor Chart

Used For:

Roads with slight grades, or small climbs with speed, mild climbs with intermittent steeps

Training:

1-2 minutes of sustained climbing in Heart Zones 4 and above. If no level can be sustained for 2 minutes, the rider should start with 60 seconds.



- At this level, most hills can be climbed slowly, and climbs with grades under 5% can be climbed with real speed (10 mph or more).
- The combination of climbing steeper hills slowly and overcoming the slighter grades with pace, will provide real confidence and motivation to work harder and venture into the Explosive Power zone more often.
- Explosive Power training will essentially mimic anaerobic interval training where both high Threshold and VO2 should be trainable to increase.

© Cycling Fusion



© Copyright 2011, Cycling Fusion

MAXIMUM SUSTAINABLE POWER (MSP)

We have chosen to use the term **Maximum Sustainable Power** or **MSP** to refer to the most power a rider can generate in each of the Cycling Fusion Power Zones. We feel that the term "Threshold" should be reserved for discussions about the metabolic process that takes place with respect to the production of energy. Therefore, to avoid the confusing terms, we do not refer to threshold with respect to power, but instead reserve its use solely to reference ones heart rate anchor, which is used to determine Heart Zones® for specific cardiovascular training.

© Cycling Fusion



© Copyright 2011, Cycling Fusion

THRESHOLD POWER VS POWER **AT** THRESHOLD

- **Threshold Power** = the highest amount of power you can sustain for a specific type of power; as reflected by the time frame required to test that type of power. Every rider has at least 3 Power Thresholds for Endurance (Sustainable Power Zone - roughly equivalent to FTP or Functional Threshold Power), Short & Hard Efforts (Climbing Power Zone), and Power Bursts (Explosive Power Zone).
- **Power at HR Threshold** = the highest amount of power you can sustain while you sustain your heart rate at high Threshold or L2 (LT2), or the number of watts you generate as your heart rate reaches threshold, and passes it by on the way to an intense effort.

© Copyright 2011, Cycling Fusion

POWER TRAINING WITHOUT A HEART MONITOR

- Leaves too much information on the table
- Prevents you from improving body awareness, relaxation and efficiency
- Requires you to assume your cardiovascular fitness is constant and unchangeable, yet we know that is not the case
- Robs you of the ability to improve your rate or extent of Decoupling as well as your Efficiency.

cytech



© Copyright 2011, Cycling Fusion

POWER TRAINING **WITH** A HEART MONITOR

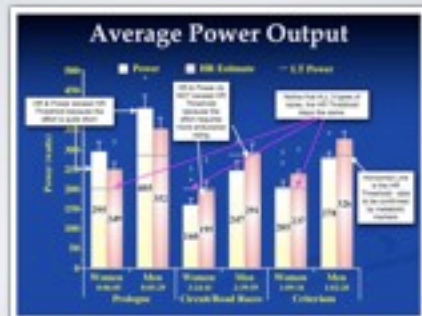
- Helps you get an initial read on where you are at the start of each training season
- Provides key "tip-offs" for the over-training syndrome
- Will help you see efficiency gains often before you see the power improvements - staged motivation
- Gives you a window into the impact of emotion, stress and other non-training related factors affecting your performance

cytech



© Copyright 2011, Cycling Fusion

HR & POWER TOGETHER



© Copyright 2011, Cycling Fusion

PURPOSE CAN'T BE ACCOMPLISHED BY POWER TRAINING IN A VACUUM

Table 1. Overview of energy systems

SYSTEM	PROPERTIES	LOADS	SUBSTRATE
Phosphagen	1. Highest contractile force 2. Fastest contraction 3. Quickest to fatigue 4. Recruited first	Fast-twitch (Type II) muscle fibers	ATP, ADP
Non-aerobic glycolysis	1. Higher contractile force 2. Fastest contraction 3. Quick to fatigue 4. Recruited second	Fast-twitch (Type II) muscle fibers	1. Glycogen (muscle, hepatic) 2. Plasma glucose
Oxidation	1. Lowest contractile force 2. Slowest contraction 3. Slow to fatigue 4. Recruited last	Mitochondria of slow-twitch (Type I & I ₂) muscle fibers	1. Intramuscular triglycerides 2. Plasma free fatty acids 3. Oxygen (muscle, hepatic) 4. Plasma glucose

Source: Training By Power - F. Howes

© Copyright 2011, Cycling Fusion

cyclus.com

ICI PRO

ENERGY CONTRIBUTIONS

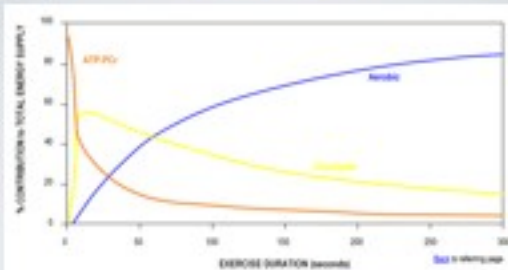


Fig. 4. Relative contribution of three energy systems to exercise (Dr. Quain, P.R. Energy system interaction and relative contribution during maximal exercise. *Sports Medicine* 13:333-335, 1992.)

© Copyright 2011, Cycling Fusion

cyclus.com

ICI PRO

GOOD GENETICS HELPS

Table 3. Effect of muscle fiber composition on efficiency for groups with high (H) and normal (N) % type I fibers

SUBJECT PAIR (A, B)	MUSCLE FIBER COMPOSITION (% type I)		WALKING (km/h)		POWER (W/kg)	
	H	N	H	N	H	N
1, 8	80	46	4.92	4.67	207	205
2, 3	77	46	5.28	4.28	228	202
3, 16	76	46	4.98	4.34	203	201
4, 11	75	35	4.12	4.05	225	207
5, 12	70	38	4.67	4.66	204	204
6, 13	69	46	4.58	4.21	213	207
7, 14	62	38	5.28	4.21	228	202
MEAN ± SD	71.67	46.42	4.68 ± 0.10	4.48 ± 0.13	212.67	203.87

Significantly greater than normal % Type I Group (p<0.05), by design. For groups affected in % Type I muscle fibers.
Group H (subjects 1-7) contained 60% Type I fibers, whereas Group N had 38-45% Type I. Subjects were paired according to criteria described in the methods section.
© Howes, J.F., et al. High efficiency of type I muscle fibers improves performance. *International Journal of Sports Medicine* 13:1-10, April 1992.

Source: Training By Power - F. Howes

© Copyright 2011, Cycling Fusion

cyclus.com

ICI PRO

GOOD TIME TO TAKE A SHORT BREAK

Simpler is Better

WE CAN'T TALK ABOUT POWER WITHOUT TALKING ABOUT CLIMBING

POWER & CLIMBING

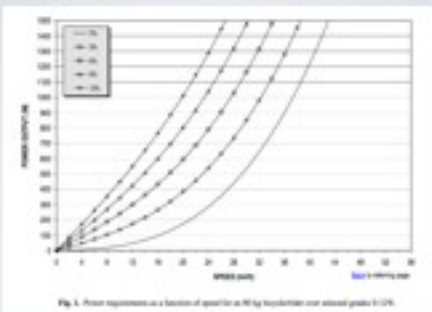
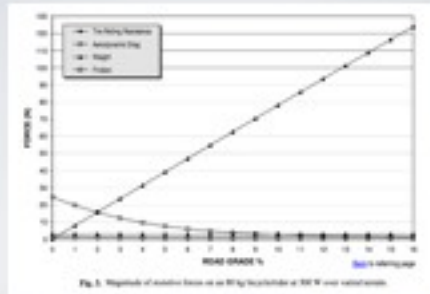


Fig. 1. Power requirement as a function of speed for a 70 kg rider on a road bike at 10% grade.

DRAMATICALLY LINKED



Source: Training By Power - I Flow

© Copyright 2011, Cycling Fusion

cytaps.com



WATTS PER POUND

- Watts per pound reflects your "power to weight ratio"
- Watts per pound is calculated by dividing power output by body weight. *Example: if you average 150 Watts and your weight is 150 pounds = $150/150 = 1$ Watt per pound*
- Watts per pound is easier for Americans to understand than Watts per kilograms
- Watts per pound can be used by coaches and cycling instructors to keep the entire class at the same effort level regardless of the rider's size or weight.

cytaps.com



© Copyright 2011, Cycling Fusion

WATTS PER POUND

- Climbing ability is very dependent on the power to weight ratio of the rider (plus bike & whatever is being carried)
- The great equalizer - Watts / Kg or Lb
- Why not KG? In class Watts/Lb can be done in your head
- Watts per pound is an equalizer which allows riders an accurate comparison of their power
- There is little difference between women and men in power generation except at the elite level

cytaps.com



© Copyright 2011, Cycling Fusion

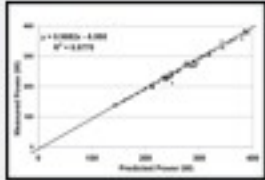
POWER & SPEED FOR CLIMBING



Power (W)	2%	4%	6%	8%	7%	8%	9%	10%	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%
4.0	0.3	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.7	1.7
5.0	0.3	0.4	0.5	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1
6.0	0.4	0.5	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2
7.0	0.5	0.6	0.8	0.9	1.1	1.2	1.4	1.5	1.7	1.8	2.0	2.1	2.3	2.4	2.6	2.8	2.9	3.1
8.0	0.5	0.7	0.9	1.0	1.2	1.4	1.6	1.7	1.9	2.1	2.3	2.4	2.6	2.8	3.0	3.1	3.3	3.5
9.0	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.1	3.3	3.5	3.7	3.9
10.0	0.7	0.9	1.1	1.3	1.5	1.7	2.0	2.2	2.4	2.6	2.8	3.1	3.3	3.5	3.7	3.9	4.2	4.4
11.0	0.7	1.0	1.2	1.4	1.7	1.9	2.2	2.4	2.6	2.9	3.1	3.4	3.6	3.8	4.1	4.3	4.6	4.8
12.0	0.8	1.0	1.3	1.6	1.8	2.1	2.4	2.6	2.9	3.1	3.4	3.7	3.9	4.2	4.5	4.7	5.0	5.2
13.0	0.9	1.1	1.4	1.7	2.0	2.3	2.6	2.9	3.1	3.4	3.7	4.0	4.3	4.5	4.8	5.1	5.4	5.7
14.0	0.9	1.2	1.5	1.8	2.1	2.4	2.8	3.1	3.4	3.7	4.0	4.3	4.6	4.9	5.2	5.5	5.8	6.1
15.0	1.0	1.3	1.6	2.0	2.3	2.6	3.0	3.3	3.6	3.9	4.2	4.6	4.9	5.2	5.6	5.9	6.2	6.6
16.0	1.0	1.4	1.7	2.1	2.4	2.8	3.1	3.5	3.8	4.2	4.5	4.9	5.2	5.6	5.9	6.3	6.6	7.0
17.0	1.1	1.5	1.9	2.2	2.6	3.0	3.3	3.7	4.1	4.5	4.8	5.2	5.6	5.9	6.3	6.7	7.1	7.4
18.0	1.2	1.6	2.0	2.4	2.8	3.1	3.5	3.9	4.3	4.7	5.1	5.5	5.9	6.3	6.7	7.1	7.5	7.9
19.0	1.2	1.7	2.1	2.5	2.9	3.3	3.7	4.2	4.6	5.0	5.4	5.8	6.2	6.6	7.1	7.5	7.9	8.3
20.0	1.3	1.7	2.2	2.6	3.1	3.5	3.9	4.4	4.8	5.2	5.7	6.1	6.6	7.0	7.4	7.9	8.3	8.7




RESEARCH PUBLISHED

- **Comparison of Predicted and Measured Power Output During Uphill Cycling**
- Carl Foster, Ph.D., FACSM; Jacob Cohen, Gene Nacey - University of Wisconsin-La Crosse and Cycling Fusions.



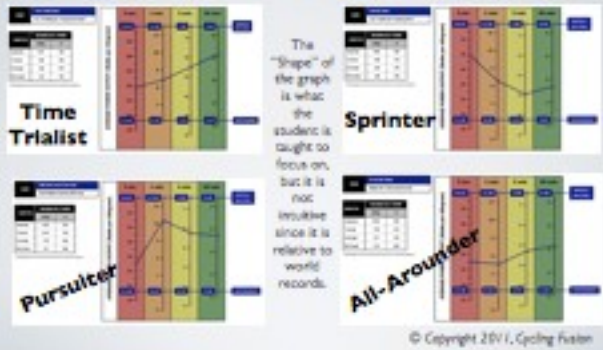


 © Copyright 2011, Cycling Fusion

POWER PROFILES

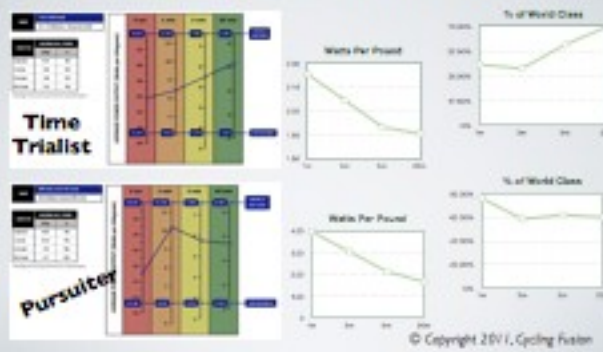
- In Power Training, the amount of power each individual can generate is quite variable, and these three separate time intervals reflect this variability and the different muscle development that comes into play.
- **Endurance Riders** - will look for their numbers in the Sustainable Power zone to be the strongest
- **Climbers** - will want their 3 and 5 minute power to be the strongest
- **Sprinters** - will need their 1 minute power to be on fire
- **Generalists** - will look for respectable numbers all around

© Copyright 2011, Cycling Fusion

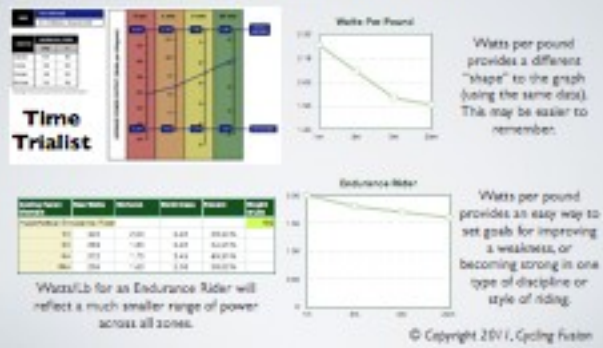
WORK / THEORY ON PROFILES BY TRAINING PEAKS



SHAPE OF GRAPHS ADJUSTED TO CYCLING FUSION ZONES



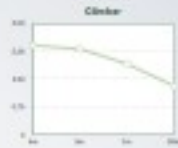
CYCLING FUSION POWER ZONE PROFILES



POWER PROFILES CONT.

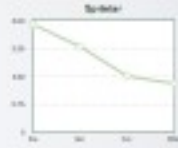
Category	Sub-Category	Power (W)	Power (W)	Power (W)	Power (W)
Explosive Power	1st	450	3.00	3.00	20.0%
	2nd	400	2.80	2.80	18.0%
	3rd	350	2.60	2.60	16.0%
	4th	300	2.40	2.40	14.0%

Watts/lb is strong in the two sub divisions of the Climbing zone, but not as strong for the other zones.



Category	Sub-Category	Power (W)	Power (W)	Power (W)	Power (W)
Explosive Power	1st	450	3.00	3.00	20.0%
	2nd	400	2.80	2.80	18.0%
	3rd	350	2.60	2.60	16.0%
	4th	300	2.40	2.40	14.0%

Watts/lb is near the top of the zone for Explosive Power but takes significant dip after the 1 minute climbing zone.



© Copyright 2011, Cycling Fusion

POWER PROFILES CONT.

Category	Sub-Category	Power (W)	Power (W)	Power (W)	Power (W)
Explosive Power	1st	450	3.00	3.00	20.0%
	2nd	400	2.80	2.80	18.0%
	3rd	350	2.60	2.60	16.0%
	4th	300	2.40	2.40	14.0%

Generalists are likely to be "all over the place". They will defy categories. Overall though, we would expect them to ride longer distances, with good to excellent sustainable power, respectable climbing, but probably very little prowess when it comes to sprinting.



© Copyright 2011, Cycling Fusion

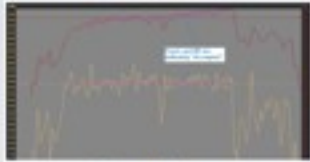
DECOUPLING & EFFICIENCY

**Key principles for
Interpreting Power Data**

DECOUPLING

• Cardiac Creep

- When we refer to Cardiac Creep, we are speaking of the effect on Heart Rate when Power is held constant.



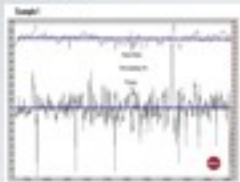
Trained Athlete



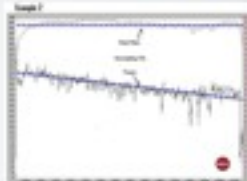
De-Conditioned Individual

DECOUPLING

Trained Athlete



Un-Trained Athlete



• Power Slide

- Heart Rate is held steady, and Power slides downward.

EFFICIENCY

- Efficiency allow the body to work longer, harder or both
- Enables an entirely new range of race or ride strategies
- Significance is far reaching
 - Provides an ongoing measurement of our health, perhaps even prolonging our lives

CARDIAC CURRENCY

What are you paying for
generating that power

WATTS PER BPM

- HR reflects the stress or strain the body is under; one is paying a price for Watts produced
- The heart monitor is giving you a window into just what that "cardiac costs" is.
- Divide HR into Watts generated during a given test or workout to get your Efficiency score
- Reproduce the same test, under the same conditions...

WATTS PER BPM

- ...Watts/bpm is less, our bodies are becoming more efficient
 - It took less cardiac effort to raise or maintain power
- ...Watts/bpm is more, our bodies are becoming more inefficient, or one might suspect some cumulative fatigue or overtraining
 - a higher heart rate for the same or lower effort is one of the tell tale signs that the body needs a rest (Recovery)

EXAMPLE - DIRTY DOZEN

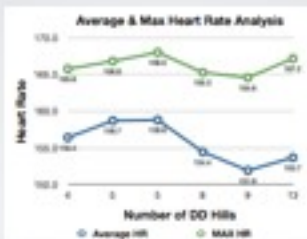
Dist. (mi)	Dist. (mi)	Dist. (mi)	Dist. (mi)	Dist. (mi)	Dist. (mi)	Dist. (mi)	Dist. (mi)	Dist. (mi)	Dist. (mi)	Dist. (mi)	Dist. (mi)	Dist. (mi)	Dist. (mi)	Dist. (mi)	Dist. (mi)	Dist. (mi)	Dist. (mi)	Dist. (mi)	Dist. (mi)	Dist. (mi)
10.00	10.00	1			10.00	1.00			1.00	10.00%	1.00									
10.10	10.10	1	1.00		10.10	1.00			1.00	9.90%	1.00									
10.20	10.20	1	2.00	5.00%	10.20	1.14	10.4%	1.00	1.00	9.79%	1.14	10.4%	1.00							
10.30	10.30	1	3.00	10.00%	10.30	1.47	14.6%	1.00	1.00	9.70%	1.47	14.6%	1.00							
10.40	10.40	1	4.00	15.00%	10.40	1.90	19.2%	1.00	1.00	9.61%	1.90	19.2%	1.00							
10.50	10.50	1	5.00	20.00%	10.50	2.33	23.7%	1.00	1.00	9.52%	2.33	23.7%	1.00							
10.60	10.60	1	6.00	25.00%	10.60	2.76	27.2%	1.00	1.00	9.43%	2.76	27.2%	1.00							
10.70	10.70	1	7.00	30.00%	10.70	3.19	31.7%	1.00	1.00	9.34%	3.19	31.7%	1.00							
10.80	10.80	1	8.00	35.00%	10.80	3.62	35.2%	1.00	1.00	9.25%	3.62	35.2%	1.00							
10.90	10.90	1	9.00	40.00%	10.90	4.05	39.7%	1.00	1.00	9.16%	4.05	39.7%	1.00							
11.00	11.00	1	10.00	45.00%	11.00	4.48	44.2%	1.00	1.00	9.07%	4.48	44.2%	1.00							
11.10	11.10	1	11.00	50.00%	11.10	4.91	48.7%	1.00	1.00	8.98%	4.91	48.7%	1.00							
11.20	11.20	1	12.00	55.00%	11.20	5.34	53.2%	1.00	1.00	8.89%	5.34	53.2%	1.00							
11.30	11.30	1	13.00	60.00%	11.30	5.77	57.7%	1.00	1.00	8.80%	5.77	57.7%	1.00							
11.40	11.40	1	14.00	65.00%	11.40	6.20	62.2%	1.00	1.00	8.71%	6.20	62.2%	1.00							
11.50	11.50	1	15.00	70.00%	11.50	6.63	66.7%	1.00	1.00	8.62%	6.63	66.7%	1.00							
11.60	11.60	1	16.00	75.00%	11.60	7.06	71.2%	1.00	1.00	8.53%	7.06	71.2%	1.00							
11.70	11.70	1	17.00	80.00%	11.70	7.49	75.7%	1.00	1.00	8.44%	7.49	75.7%	1.00							
11.80	11.80	1	18.00	85.00%	11.80	7.92	80.2%	1.00	1.00	8.35%	7.92	80.2%	1.00							
11.90	11.90	1	19.00	90.00%	11.90	8.35	84.7%	1.00	1.00	8.26%	8.35	84.7%	1.00							
12.00	12.00	1	20.00	95.00%	12.00	8.78	89.2%	1.00	1.00	8.17%	8.78	89.2%	1.00							

EXAMPLE: RIDE OR RACE

The Pittsburgh Dirty Dozen Climbs

CYCLING FUSION	This hill's Grade Ranges	Avg. Grade	Range of Watts/Lb Range	Average Watts/Lb	Miles	Time in Min.	Vertical Feet
Center Ave	8% to 19%	8.7%	3 to 3.3	1.1	0.84	10.1	306
Garnin	3% to 16%	as done on 9/9/10 during training			0.73	8.11	5.5 mph
Ravine St.	6% to 18%	11.7%	2 to 2.0	1.5	0.65	7.8	297
Garnin	10% to 18%	as done on 9/9/10 during training			0.67	8.3	4.7 mph
Berry Hill Rd.	15% to 27%	17.9%	1.6 to 3.0	2.0	0.19	2.5	183
Garnin	11.5% to 26%	as done on 9/9/10 during training			0.33	3.5	3.8 mph
High St.	6% to 20%	13.0%	2 to 2.2	1.5	0.24	2.9	173
Garnin	3% to 16%	as done on 9/9/10 during training			0.37	4.7	4.7 mph

EXAMPLE: DIRTY DOZEN



EXAMPLE - DIRTY DOZEN

Old Power	New Power	Rating	Old Power	Change in Power	Distance	Distance Change	Max HR	HR	Percent of HR	Max Power	New Power
Watts	Watts		Watts	Watts	km	km	beats/min	beats/min	%	Watts	Watts
100.00	100	1			100.00	1.00		1.00	10.00%	1.00	
100.10	100	1	1.00		100.00	1.00		1.75	10.25%	1.00	
101.20	101	1	1.20	1.20%	101.20	1.12	10.4%	1.50	10.35%	1.12	10.4%
100.00	100	1			100.00	1.00		1.00	10.00%	1.00	
100.10	100	1	1.00		100.00	1.00		1.50	10.50%	1.00	
100.20	100	1	2.00		100.20	1.00		1.50	10.50%	1.00	
100.00	100	1	0.00	0.00%	100.00	1.00	10.0%	1.00	10.00%	1.00	10.00%
100.10	100	1			100.10	1.00		1.00	10.00%	1.00	
100.10	100	1	1.00		100.10	1.01		1.00	10.01%	1.00	
100.10	100	1	0.10	0.10%	100.10	1.01	10.0%	1.00	10.00%	1.01	10.01%
100.00	100	1			100.00	1.00		1.75	10.75%	1.00	
100.10	100	1	0.10		100.10	1.00		1.50	10.50%	1.00	
100.20	100	1	0.20		100.20	1.00		1.50	10.50%	1.00	
100.00	100	1	0.00	0.00%	100.00	1.00	10.0%	1.00	10.00%	1.00	10.00%
100.10	100	1	0.10	0.10%	100.10	1.01	10.0%	1.00	10.00%	1.01	10.01%
100.20	100	1	0.20	0.20%	100.20	1.02	10.0%	1.00	10.00%	1.02	10.02%
100.00	100	1			100.00	1.00		1.75	10.75%	1.00	
100.10	100	1	0.10		100.10	1.00		1.50	10.50%	1.00	
100.20	100	1	0.20		100.20	1.00		1.50	10.50%	1.00	
100.00	100	1	0.00	0.00%	100.00	1.00	10.0%	1.00	10.00%	1.00	10.00%
100.10	100	1	0.10	0.10%	100.10	1.01	10.0%	1.00	10.00%	1.01	10.01%
100.20	100	1	0.20	0.20%	100.20	1.02	10.0%	1.00	10.00%	1.02	10.02%
100.00	100	1			100.00	1.00		1.75	10.75%	1.00	
100.10	100	1	0.10		100.10	1.00		1.50	10.50%	1.00	
100.20	100	1	0.20		100.20	1.00		1.50	10.50%	1.00	
100.00	100	1	0.00	0.00%	100.00	1.00	10.0%	1.00	10.00%	1.00	10.00%
100.10	100	1	0.10	0.10%	100.10	1.01	10.0%	1.00	10.00%	1.01	10.01%
100.20	100	1	0.20	0.20%	100.20	1.02	10.0%	1.00	10.00%	1.02	10.02%

cyclist.com

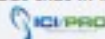


© Copyright 2011, Cycling Fusion

CONDUCTING POWER TESTS

- Riders should not have had a "hard" workout the previous day. Ideally this would be done after a day off the bike.
- Riders should already have played some Power games in order to have some idea of where they might start with a given test.
- The rider should have a Structured Warm up for at least 20 minutes prior to this test. Written guidelines are in the appendix of the manual.
- While it is always recommended to work out with a Heart Monitor, it is not required. If it is used though, data should be recorded (more about that in later sections).

cyclist.com



© Copyright 2011, Cycling Fusion

STRUCTURED WARMUP

- Increases muscle temperature - increased speed of contraction & relaxation
- Greater mechanical efficiency because of lowered resistance in the muscle
- Increased nerve transmission and muscle metabolism
- Reduces the risk of muscle damage
- Increased blood flow as the muscles 'vascular bed' dilates

cyclist.com



© Copyright 2011, Cycling Fusion

STRUCTURED WARMUP

- Increases FFA mobilization (*sparing glycogen*)
- Prepares you psychologically for the intense efforts to come
- Once you're warmed up, you're ready to race or train properly

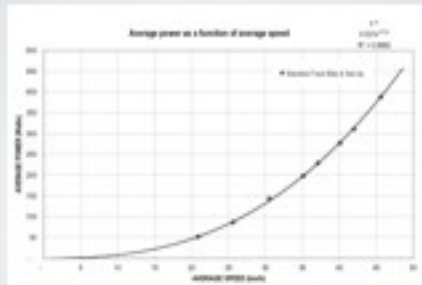
ONE WAY TO STRUCTURE

- 5 minutes very easy
- 5 minutes at a slightly higher level, but still quite easy
- 5 minutes at 50 bpm (beats per minute) below Heart Rate Threshold (HRT)
- 4 minutes at 40 bpm from HRT
- 1 minute at 20 bpm from HRT
- 4 minutes at 30 bpm from HRT
- 1 minute at 10 bpm from HRT
- 4 minutes at 20 bpm from HRT
- 1 minute at 5 bpm from HRT

POWER NOTES FOR INDOOR CYCLING INSTRUCTORS

- Power Zones are specific to each individual. Unlike Heart Zones though, the variation ability to generate power is so wide, it was absolutely necessary to create two Charts.
- Consider the fact that the USA Cycling Federation had to create 5 different levels of racing categories to help cyclists compete within a reasonable level of ability
- Even if an individual is a dedicated outdoor rider, the indoor chart may push them to attain higher power levels.

THE FASTER YOU GO, THE HARDER IT GETS!



POWER TEST

DATA COLLECTION

EFFICIENCY TESTS

10 Seconds Before Threshold		40 Minute Zone 4 Steady State				
Reference & Identifying	Average Power	Power (W)	Time of Session	Power (W)	Power (W)	Power (W)
	100					0.00
	200					0.00
	300					0.00
	400					0.00
	500					0.00
	600					0.00
	700					0.00
	800					0.00
	900					0.00
	1000					0.00
	1100					0.00
	1200					0.00
	1300					0.00
	1400					0.00
	1500					0.00
	1600					0.00
	1700					0.00
	1800					0.00
	1900					0.00
	2000					0.00
	2100					0.00
	2200					0.00
	2300					0.00
	2400					0.00
	2500					0.00
	2600					0.00
	2700					0.00
	2800					0.00
	2900					0.00
	3000					0.00

POWER TEST

SUSTAINABLE

SIMILAR TO THRESHOLD OR FTP

The Threshold Power Test (Single effort)

01 20-minute Warm-up in Zone 1-2

02 5 Minutes All Out

Punch it and hold it! Make sure that you start at a high power, but not so high that you die at the end. You should have a time in mind that you'll hit the finish line in the last minute. The goal of this first part is to make sure, as typical, up the legs for the rest of the effort and second, to capture your ability to produce watts in what is called *initial* power. Doing this initial 5-minute effort also helps to ingrain with the mind "this zone" that always starts at the beginning of a ride. Then, when you do your main effort, you will be able to produce power that someone likely to be truly representative of your FTP (Functional Threshold Power).

03 18 Minutes Easy at an Endurance Pace (Zone 2)

04 20 Minute Time Trial

Try to do this on a road that is fairly flat and allows you to put out a strong, steady effort for the entire 20 minutes. Do not start out too hard! That's a common mistake, so make sure that you get up to speed and then try to hold that speed as best you can. You want a maximum effort for 20 minutes.

05 18-25 Minutes at an Endurance Pace (Zone 2)

06 18-25 Minutes Cool-down

POWER TEST

SUSTAINABLE

SIMILAR TO THRESHOLD OR FTP

The 2 X 20 Sustainable Power Test (Conducive to Indoor Cycling)

- (1) 30-minute Warm-up in Zone 1-2
- (2) 20 Minutes - as many watts as you can sustain
You should have an idea of where to start from at least 2 power classes - Tour de Power, and Power Games. Guidelines for interpreting the first test should guide the second test.
- (3) 5 Minutes Recovery in the Active Recovery Zone (1)
- (4) 20 Minute Round 2
Adjust from your first test if need be. Otherwise, try to repeat the same or better results.
- (5) 5 Minute Cool-down (Zone 2 then 1)
- (6) Average the 2 for your MSP
Constitutes a 60 minute class

icyPRO



© Copyright 2011, Cycling Fusion

POWER TEST

DATA COLLECTION

EFFICIENCY TESTS

10 Beats Below Threshold	40 Minute Zone 4 Steady State				
Reference & Identifying Data	Average Power	Power Output	Time at Power	Avg Power	Avg Heart Rate
1	200			200	150
2	200			200	150
3	200			200	150
4	200			200	150
5	200			200	150
6	200			200	150
7	200			200	150
8	200			200	150
9	200			200	150
10	200			200	150
11	200			200	150
12	200			200	150
13	200			200	150
14	200			200	150
15	200			200	150
16	200			200	150
17	200			200	150
18	200			200	150
19	200			200	150
20	200			200	150
21	200			200	150
22	200			200	150
23	200			200	150
24	200			200	150
25	200			200	150
26	200			200	150
27	200			200	150
28	200			200	150
29	200			200	150
30	200			200	150

icyPRO



© Copyright 2011, Cycling Fusion

POWER TESTS - 2 X 20 MSP

MSP 2 x 20 Tests	Sustainability Test 1		Sustainability Test 2		
Reference	Target Power	Time you hit the Target all or all	Target Power	Time you hit the Target all or all	Best Power

icyPRO



© Copyright 2011, Cycling Fusion

INTERPRETATION GUIDELINES

• First 5 minutes:

- Hit Threshold - Abort

• HalfWay (10 min mark):

- Hit Threshold - Borderline... if you race - try to hang in, otherwise it's probably best to abort

• 15 minutes in:

- Hit Threshold - Try to push it through, and note your HR and Time

cyclus



© Copyright 2011, Cycling Fusion

INTERPRETATION GUIDELINES

• First Test Complete

- Hit Threshold inside of the 5 min mark - try to repeat on 2nd effort
- NEVER Hit Threshold - stop being a weenie - increase your target
- Make sure your form is filled out completely - a history of your efforts in a controlled environment is key to understanding your capabilities.

cyclus



© Copyright 2011, Cycling Fusion

CYCLING FUSION

EVERYTHING YOU NEED INDOORS TO
IMPROVE YOUR RIDING OUTDOORS

© Copyright 2011, Cycling Fusion