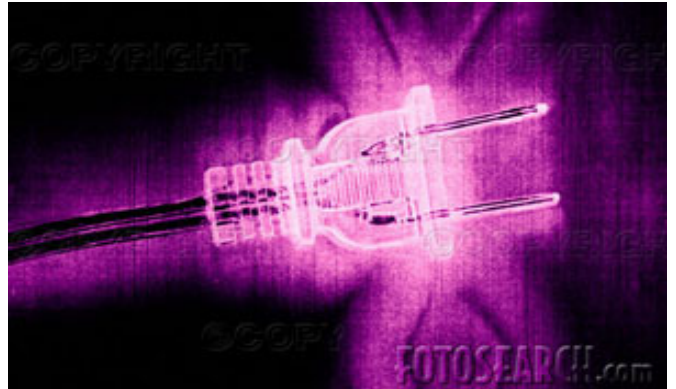


THE ENERGY SYSTEMS

By Chip Sigmon, CSCS*D

Instead of using the term “cardio”, strength & conditioning coach Mark Verstegan uses the term “Energy System Development” or ESD. We use that term a lot at the OrthoCarolina Sports Performance Facility. It means that you’re not just conditioning to get in shape, or you’re not burning calories just to burn calories, but you’re also training specifically for the sport that you’re competing in plus the individual that is training for general fitness is also training the heart, lungs, and building short and long term endurance at the same time.



I remember when I was in college at Appalachian State University (almost 30 years ago); I learned one of the most valuable principles in training and still use it in our programs today. The S.A.I.D. or Specific Adaptations to Imposed Demands that I am referring to simply means that however you train, your body will adapt physically to those specific demands that have been placed on it. In other words, have you ever seen a fat sprinter? Because sprinting burns a tremendous of calories and speeds up the metabolic process at a very high rate the body gets lean to help it meet the demands that are put on it by the type of training program that is prescribed.

The S.A.I.D. principle can also be applied as followed: whatever sport you are competing in, one should train predominantly in the energy system that is required for that particular sport. Football for example is a sport in which short sprints or short burst of energy is required. Yet, why do some coaches still have their players run long distances during their “conditioning” time?

At the OrthoCarolina Sports Performance Facility we want to develop the energy systems that the athlete plus the week-end warrior will need for both performance enhancement and for general fitness. But first look at a general overview of each energy system. The first energy system is your Alactate Power. This energy system helps the body’s ability to do high intensity work for short periods of time. This usually lasts for around 12 to 15 seconds. Sprint work, weight training or jumping drills are good examples. The second energy system that you want to improve and develop is your body’s lactate threshold. The lactate system helps you perform high intensity work for up to 3 minutes. The OrthoCarolina Sports Performance interval training is a great way to alternate periods of intense exercise with less strenuous bouts of training. The final energy system that the body uses is the aerobic system. This system has the ability to make the body work beyond 3 minutes and helps also with recovery between intense bouts of exercise. Lets say that you’re workout consist of 8 sprints that take around 20-25 seconds to run, such as 200 meters. When sprinting these eight 200 meters you are using the lactate system. However, when walking back to the starting point (between each sprint), the aerobic system kicks in. The aerobic system in this particular case helps quicken the recovery from repetitive bouts of high intense work.

For athletes it is very important to be aware of the energy systems that are required in the sport that he or she are competing in as well as the energy system that is being focused on when it comes to exercise prescription. The distance of the drill, the interval, the number of sets and reps are all very important elements to think about when designing workouts. The energy system utilized by the drill, volume, and the intensity of the workout will also have a great impact on the design of the training program.

One should realize that the dominate energy system utilized in almost all sports is the “Alactate power”. This energy system is generally accounted for over 80% of the energy used in almost all sports. The “Lactate” system accounts for around 20% of the energy for used in sports, and the “Aerobic system” only accounts for 10% with very few exceptions.

<u>BASIC ENERGY CHART</u>		
<u>ENERGY SYSTEM</u>	<u>TIME</u>	<u>DISTANCE/DRILL</u>
Alactate Power	1—15 sec.	Agilities Short Intervals Short Shuttles
Lactate System	1—3 mins.	Long Intervals Long Shuttles
Aerobic System	Beyond 3 mins.	Distance Runs Bike/Stepper Treadmill
Recovery	1—10 mins.	Dynamic Warm-up Tempo Runs

For developing the “aerobic system” and for “general fitness” the OrthoCarolina Sports Performance “Chase for Fitness” has three different types of workouts. However you must first figure out your “age predicted maximal heart rate” (APMHR). Many formulas have been proposed to estimate maximal heart rate (HRmax). The estimation of HRmax has been largely based on the formula; $HR_{max} = 220 - \text{age}$, however this formula was not developed from original research and has a large standard of error (7-11 beats per min.).

Current research indicates that HRmax formulas may need to be individualized to be more population (fitness level, health status, age, mode of exercise) specific. A review of the literature reveals that the formula with the lowest margin of error is: $205.8 - 0.685 \times \text{age}^1$. Thus a 40 year old has a max heart rate of 178.4 bpm.

The equation is as follows: The fat burning zone for a healthy adult at level one would be HRmax x 60% and 70%. To determine level two you would multiply it by 71% to 80%, and multiply 81% to 90% to determine level three.

So if you’re 40 years of age your training levels are as follows:

- Level 1 = 107 to 125 = your aerobic zone
- Level 2 = 126 to 143 = your aerobic threshold – anaerobic threshold zone
- Level 3 = 144 to 161 = your anaerobic zone

Our first program would be our Interval Workout. One would start out with a 3 to 5 minute warm up followed by a max effort to get your heart rate up to level 3 at 144 (using age 40 as an example) or above which should take 30 sec. to a minute; then recover for to 2-4 minutes at level 1 then repeat for 20-30 minutes. If you are not able to get up to level 3 each time, instead go to level 2 until you're able to stay at level 3 consistently.

When performing the Interval Workout you will of course need to use a heart rate monitor. We recommend using a heart rate monitor by "Polar". If calculating heart-rate zones and using a heart rate monitor seems like too much work, then you need to try our third workout using the "Rate of perceived Exertion scale (RPE). The second program, the RPE is designed to help clients monitor their exercise intensities through a rating system that accounts for all the body's responses to a particular exercise intensity.

RPE ON A SCALE OF 1-10	
Levels of the (RPE):	
1)	very light intensity
2)	light intensity
3 – 4)	moderate intensity
5 – 6)	strong intensity
7 –8)	very strong intensity
9 –10)	extremely strong intensity

On our second workout using the (RPE) you may choose the intensity you work at by starting with a 3 to 5 minute warm-up at level 1 or 2 then work up to and stay at certain levels for 30 seconds to 1 minute for a total of 20 to 30 minutes. The rate of intensity is totally up to you! The third and final workout in our "Chase for Fitness" program is simply staying in your aerobic zone or your prescribed heart rate (level 1) for 45 to 50 minutes. This is a great way to change the intensity so you won't burn out from your high intensity days. Choosing these 3 programs is also a great way to train all three of the energy systems to help you get in the best shape of your life for athletic performance and for overall general fitness!

(PLEASE CONSULT WITH A PHYSICIAN BEFORE BEGINNING ANY EXERCISE PROGRAM.)

- References: 1. Robergs, R.A. and Landwehr, R., The surprising history of the "HRmax=220-age" equation. *J Exercise Physiology* **online**; 2002, 5(2)
2. NSCA's Essentials of Personal Training
 3. Core Performance by Mark Verstegen



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