STEM solar car activity at Madeley Academy – 19th May 2016

On Thursday 19th May 2016, Ashley Green and David Garlovsky [STEMNET Ambassadors] conducted a STEM solar car activity at Madeley Academy in Telford with 24 Yr 7 students. Many thanks for the support from Ian James (class teacher) and organizational tasks by Jonathan Boyle (deputy head teacher). It was a sunny afternoon when the students built single- and double-cell solar-powered cars using Solar-Active (http://solar-active.com/) solar car kits.

Each kit includes wheels, axles and a low-resistance solar motor with gearbox. When the gearbox is opened, the small nylon gears can be rearranged to give one of three different gear ratios: 3:1, 9:1 or 27:1. The challenge was to build the cars to travel straight and with speed. After building and racing the cars, we had a delicious lunch provided by the school kitchen. After lunch, the students constructed the cars again with pre-assembled body shells. The picture shows the cars racing on relatively smooth tarmac. The cars performed well and the students said they enjoyed the activity.

The students were asked what might prevent the cars from travelling straight and with speed. DG created a list of factors: alignment of front and rear wheel assemblies, condition of track, gear ratio, weight of car, wind direction, wheel tread, friction between wheels and PV cell, and the effects of solar irradiance and cell temperature. In discussion, the students added a few more: balance, wheels not being perfectly circular, tightness of wheels on axles, and whether an F1 spoiler could be added.

This was followed by a discussion of the importance of precision in the building of the car kits. Even professional engineers can make mistakes in construction, but learn from such mistakes. Ian James showed us amazing footage of the collapse of the world's third-largest (at the time) suspension bridge in Takoma Narrows, Washington in 1940.

The students were challenged to suggest changes to the design of the top template of the body shell, as changes are needed to make the top fit the chassis of the car. Their proposals included increasing the spacing between wheels and body shell by increasing the axle length, providing placement for wires so they do not drag on the ground, decreasing the depth of the body shell, and flattening the wings.

A discussion commenced about renewable energy technologies and Stanford Ovshinsky [DG's cousin], self-taught chemist and physicist, who invented the UNI-SOLAR PV technology used for the cars. He and his colleagues also invented battery technology that powers most of the world's smartphones and other mobile devices. He holds >1200 patents covering a range of technologies, including nickel-metal hydride batteries, rewritable CDs, DVD optical discs, flat-screen liquid crystal displays, hydrogen fuel cells, thin-film solar cells, etc. While Ovshinsky raised and lost hundreds of millions of dollars, his contributions to understanding energy management have had a lasting impact. Shortly before his death in 2013, he was working on a new approach to photovoltaic thin-film production that would allow factories to make enough solar panels in a year to produce at least one gigawatt of electricity annually - roughly the output of a nuclear power plant at the cost of a coal-fired plant.

Building the solar car covers GCSE Science aims. The students experienced our 'Let me do it, I'll understand' approach, which encourages problem-solving by applying STEM's innovative and integrated approaches to teaching and learning. These show that science is not one-dimensional but has a wider use in life, ensuring our young people are developing the employable skills, experience and motivation needed for the future.