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Collective inspiration

With rising petrol prices and concerns about car pollution, school pupils across the UK are learning about optimising power consumption while having a great time racing in their home-made electric cars. **Siân Harris** visited Chipping Sodbury School in South Gloucestershire to find out what the young people get out of the Greenpower competition.

car challenge builds future engineers

WHAT MAKES students of Chipping Sodbury School in South Gloucestershire go back to their school on an icy Tuesday evening in February – and every other Tuesday evening in term-time? The answer is: they are designing and building race cars that they will race on some of the country's most well-known race tracks.

There is plenty to do too: the race season starts at the end of April and new cars are needed most years because their drivers grow too tall for the previous year's model.

Chipping Sodbury School is one of over 200 schools, clubs and companies in the UK that take part in the Greenpower competition. In this competition, school pupils build electric-powered cars and compete with them in endurance races to see which car can travel the furthest in the time given. Greenpower specifies the power of the motor and provides the batteries that must be used, so the success of each team's car comes down to its design and construction and the skills of its young drivers.

Chipping Sodbury School started its involvement with Greenpower six years ago when D&T teacher Brendan McMorrow joined the staff. The school has specialist technology school status and was keen to develop better links with its local community.

Greenpower, where pupils work together with older family

'We get £4,000-5,000 per year, which sounds a lot until you think that it's £400-500 for a set of wheels, and that you are competing with schools that have big budgets'
Brenden McMorrow, Chipping Sodbury School

members, teachers and local companies seemed to fit the bill. "We thought this was a great way to get parents involved," explains McMorrow.

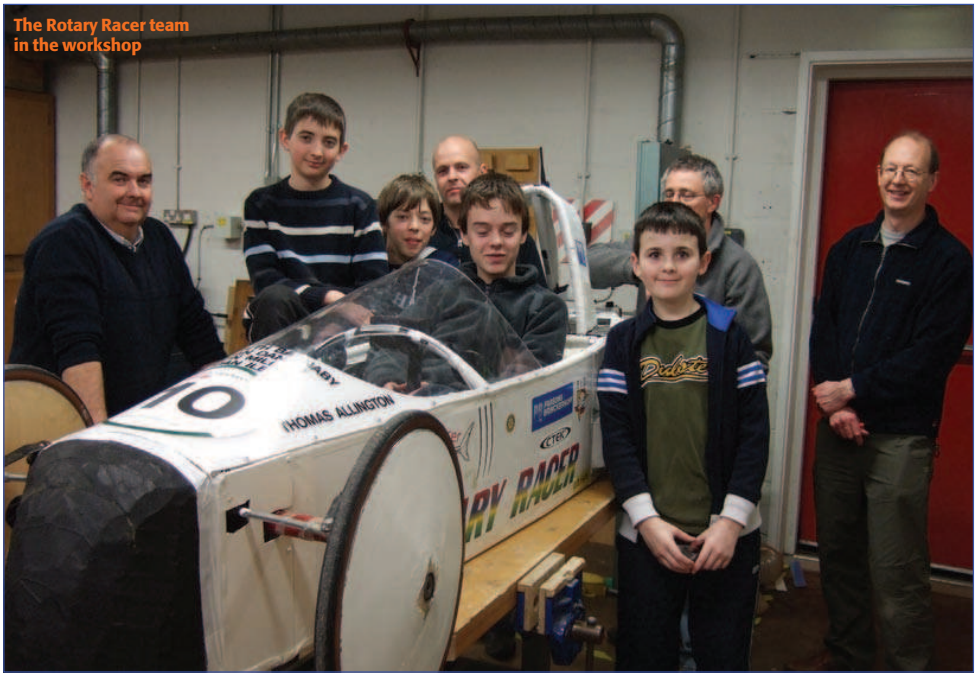
SPONSORSHIP AND FUNDING

The school's involvement in the competition began with two teams and donations to buy two kits. The school allows the club free use of its D&T facilities on a Tuesday evening, and pays for McMorrow's time. All other costs are met through sponsorship and other funding that the teams attract.

"We have been fairly fortunate. We probably get £4,000-5,000 per year, which sounds a lot until you think that it's £400-500 for a set of wheels, and that near the top you are competing with some schools that have big budgets," comments McMorrow.

Now the school has four Greenpower teams with six to eight pupils in each. The club members range in age from Year 7 to Year 13 and the club attracts both girls and boys. The only condition is that each pupil brings a parent with them too.

There is a waiting list to join the club and Chipping Sodbury School now advises other schools in the area about how to get their Greenpower clubs going.



The Rotary Racer team in the workshop

What's more, two of the Chipping Sodbury teams finished in the top five in last year's Formula 24 final, the competition for 11-16-year-olds. After regional heats, the final – a four-hour endurance race held at the Goodwood motor racing circuit near Chichester, included the top 75 teams from schools around the UK.

Chipping Sodbury's Rotary Racer team came second (after Zebedee, a car made by Sandbach High School, a girls' school in Cheshire that has also had a successful Greenpower club for several years).

At work with Team Fusion

The Rotary Racer car managed to cover nearly 113 miles in the four-hour race and averaged 28.25mph, including five pit stops.

According to the team, the car was very efficient in its power use which is one of the goals of the Greenpower competition. Running from the two 12V car batteries supplied by the organisers, it was calculated to have achieved an equivalent of around 1,760 miles per gallon of petrol during the race. "It's the car of the future," jokes one of the team members.

Not far behind, in fifth place, was Chipping Sodbury's RPodS car. The Pod Movement team, which built this car, had further success the same day when another of its cars, YPod?, came fourth in the final of Formula 24+, the championship for 16-21-year-olds.

GETTING ON THE TRACK

The races are highlights for all the work that the pupils and their parents put into the cars throughout the year. They often involve very early starts or camping nearby and races take place in a wide range of weather conditions. "There might be ▶

◀ fog or lightning and you can be thankful you've got round the circuit," observes Cheryl Watts, the mum of Jacob who is in another of Chipping Sodbury's teams, Team Fusion.

Cheryl has had plenty of experience of watching races in different conditions as her daughter, Kelly, was one of the first members of the Greenpower club at the school. Kelly has since left school and is now fulfilling part of the Greenpower goal by studying engineering at college.

So what is it like being in the driving seat on the track? "It's challenging but good fun," says Ben, one of the Year 9 boys that make up the Rotary Racer team with their dads.

Team mate Dan adds that the cars feel very fast to drive.

DESIGN CHALLENGES

The Rotary Racer team is currently working on a new car that will be tear-drop shaped.

Plenty of planning and debate, as well as some inevitable family arguments, go into each new design.

Balancing the competition's safety specifications with keeping the overall size down is a big challenge and requires some creative solutions. For example, early Rotary Racer cars included a steering wheel but this has since been replaced with a lever for steering to save space.

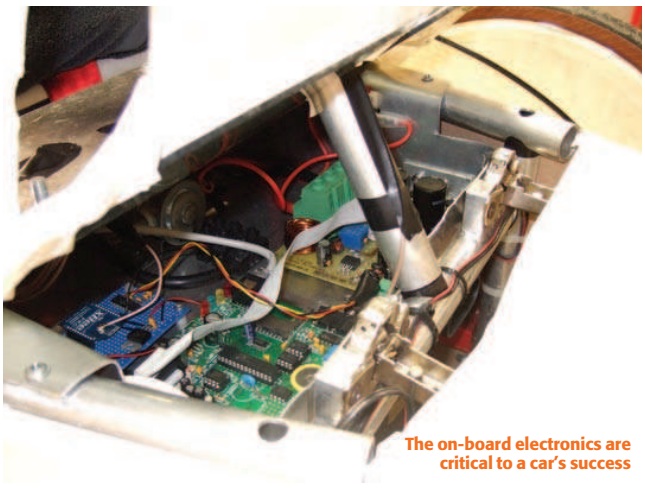
The teams use various pieces of software to help with their design, such as trying out different ideas in virtual wind tunnel software to see which is the most aerodynamic. They have also had the chance to test scale models of their design ideas in a real wind tunnel at the nearby University of the West of England.

Beyond the size and shape of the car, the electronics design, which is all done by the team, is vital for getting the best performance. The Rotary Racer car has a fixed gear but has electronic speed control, which gives many of the power optimisation features that gears provide. It also includes on-board telemetry.

During races or in practices on the school's tennis courts or at a local airfield, data can be collected on the car, the battery's performance and how the car was driven.

All this work into designing and building cars is not just about doing well in races. As McMorrow points out, it helps the pupils with both social skills and their school work. Pupils are able to use what they've learned in science and D&T lessons – the Qualifications and Curriculum Authority (QCA) recommends Greenpower as a project for D&T at Key Stage 4, and in some schools Greenpower cars have even been submitted as GCSE and A Level course work.

There are other areas of



The on-board electronics are critical to a car's success

competition choices

GREENPOWER AND GOBLIN

A lever is used to steer Rotary Racer

The Greenpower competition was set up in 1999 to promote engineering and technology through electric car design. Greenpower is a non-profit-making company supported by a number of sponsors and partnered with the Institution of Mechanical Engineers (IMechE).

When the competition first started there were just 22 cars, but by 2008 had grown to around 400 teams. It has also expanded from being a competition for secondary school pupils to include primary schools, sixth form and college students, and businesses. Last year's Greenpower Corporate Challenge included teams from Bentley Motors, Renishaw and the BBC's 'Blue Peter'. These teams were required to build and race cars to the same regulations as the schools and then compete against the top 15 school teams. The IMechE also has its own electric car challenge for students, known as Formula Student.

Most of the Chipping Sodbury School cars compete in Formula 24, the competition for 11-16-year-olds. This consists of four-hour endurance races, with the winning team being the one whose car travels the furthest. The races are held at famous circuits throughout the country, such as Dunsford, Castle Combe and Goodwood. Regional heats are held across the country and the first, second and third-placed teams, as well as those who meet a qualification distance, go through to the final.

Each team must have at least six drivers. Five must drive in the race for between 20 minutes and two hours each. Driver changes happen at the pit stops, where tyres are also checked and batteries are changed. Greenpower supplies each team with four 12V lead/acid batteries and a 24V electric motor. The cars start with two of their batteries and then exchange them but the batteries cannot be recharged during the race. Parents and teachers are not involved in the driving or pit stops.

Chipping Sodbury School also has a car in Formula 24+, the formula for 16-21-year-olds. The design specifications for these cars are more flexible than the Formula 24 specifications and the endurance races are 90 minutes long.

For some of the young people joining Chipping Sodbury School, the idea of building and racing cars is not a new one. Cara and Jacob, for example, participated in Greenpower's junior competition when they were in primary school. Wellesley Primary School in nearby Yate is involved in Goblin racing, which is for primary school children in school Years 5 and 6.

The specifications for Goblin cars are simpler and tighter than those for the older races, based on reusable kits that Greenpower sells. Wellesley Primary School has two Goblin kits that were provided by Airbus. The children and their parents make these kits into cars each year and then race them in Greenpower races and against other local schools.

'There might be fog or lightning and you can be thankful you've got round the circuit'

Cheryl Watts, Team Fusion parent

learning that benefit too, such as numeracy and IT skills. Literacy skills are also developed when the pupils write letters to potential sponsors and other sources of funding.

Designing and building race cars also gives pupils a chance to experiment with different materials and their properties, such as steel, bamboo, glass, plastic and composite materials. The club's use of different materials took some of the pupils to a meeting at Loughborough University, where they won an award for their work.

Rotary Racer & crew

SUSTAINABLE BUILDING

Sustainable materials are another area of interest for the club. For example, Team Fusion, which is composed of pupils in Years 7, 8 and 9, is building its latest car almost entirely out of reclaimed wood. Parts of the new car started life as packing cases or pieces of furniture and the plan is to make the seat out of wicker. When it comes to how it works though, simple is best, according to one of the dads in the team. The wooden car will have accelerator and brake pedals and two pulleys for the steering.

The teams have also had a chance to do some great visits, such as watching BBC television programme 'Top Gear' being filmed and appearing on the ITV programme 'Richard Hammond's 5 o'clock Show'. They have also been on the local television and radio news.

Apart from the obvious fun that the pupils and their parents have, there is also plenty to be proud of. As Rotary Racer's Gareth says: "I am most proud of the success and of building something that works." Team mate Ben agrees: "You make something and it turns out to be fantastic."

For Terry Barnaby, one of the dads, one of the best things is seeing how the team members work together in the races. "The parents can't be there in the races and they really work together as a team." ■

Teams at the races

SECRET OF SUCCESS: PARENT POWER

Chipping Sodbury School's cars and their teams have built up an impressive record over the past few years but, with only a small budget at their disposal, what is the secret of their success?

For DT teacher Brendan McMorrow the answer is simple: the involvement of parents. "I think that the main thing is the link between the parents and the kids," he explains. "Parents and kids do not usually spend much together at this age."

Greenpower helps them to do this. Many of the young people and their parents admit to discussing their cars and the races when they are at home. The cars sometimes go home for a bit of additional work at the weekend, especially close to the race season.

The club helps the parents to get to know each other better and to meet new people when they go to races.

As well as the social aspect of this parental involvement, the parents bring a wealth of different skills and experience to the teams. Most of the dads in Rotary Racer have some sort of engineering background, for example, while Cheryl Watts, a Team Fusion mum, has been able to use her experience in the printing industry to produce posters and publicity material to help attract sponsorship for her team.

The involvement of parents also makes the administration of the club easier. McMorrow is always on hand on a Tuesday evening to advise the teams but often he finds that the teams run themselves.

As well as helping the club members to develop organisational and project management skills, this has also enabled the club to be able to support four different teams.