Work less to pollute less?

What contribution can or must working time reduction play in reducing carbon emissions?

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Andrew Watt

Working Paper 2012.08

etui.

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european trade union institute

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1. Introduction[1]

At the start of his Presidency Nicolas Sarkozy told French voters he would give them the opportunity to work more so as to earn more. This article asks, rather, whether we can, and whether we must, work less to pollute less.

The planet is warming and anthropogenic (human-caused) emissions of greenhouse gases (GHG) are now generally accepted as being a major cause (Stern 2006). In response, international agreement is being sought on ways to reduce carbon emissions. As part of this the European Union has committed to reducing its GHG emissions by 20% (below 1990 levels) under its Europe 2020 Strategy and has a longer-term commitment to reduce emissions by 80-95% by 2050, again from the 1990 base.[2]

GHG are emitted as part of productive and consumption activities that are counted as part of economic output, as measured by the Gross Domestic Product (GDP). One way to reduce emissions, then, is to reduce the carbon intensity of output, i.e. the amount of CO2 equivalent gases emitted for each unit of GDP. This is sometimes called decoupling emissions from growth. Another is to reduce the level of output, to de-grow as it is sometimes called (see e.g. Jackson 2009; Coutrot/Gadrey 2012). The latter approach, though, raises questions about material living standards, distribution, debt repayment and, not least, employment. The impact of a policy of zero growth or de-growth on employment can, however, be mitigated by reducing average working hours, and thus decoupling employment from output.

This contribution examines these interrelationships more formally. It starts by decomposing GHG emissions into their components. Based on an extrapolation of recent trends, various combinations of increases in carbon efficiency, economic growth and changes in average working time can be calculated that deliver a given rate of reduction in emissions. The focus is on the contribution that working time reduction can, and possibly must, make if Europe's climate protection goals are to be achieved. It is to be emphasised

1. This article originated in a presentation made to the Friedrich Ebert Stiftung's *Fortschrittsforum* (Progress Forum). I am very grateful for helpful comments made by members of Working Group III, particularly Michael Dauderstädt and Rudolf Zwiener. I would also like to thank Béla Galgóczi and Maria Jepsen for extremely helpful comments on an earlier draft and Till van Treeck for useful literature hints. The usual disclaimer applies.

2. In February 2010 the Commission established a new Directorate General – analogous to a ministry – for Climate Action. Information on EU policies in this area is at: http://ec.europa.eu/dgs/clima/mission/index_en.htm/

from the outset that the results are mechanical simulations and not predictions; they are intended to indicate orders of magnitude and policy options and trade-offs.

The key findings from these scenarios are that, on the basis of recent trends, unless there is a qualitative leap in the resource efficiency of our economies, reaching Europe's climate change targets will require a very substantial reduction in economic output and living standards. If employment rates are to be maintained, this, in turn, presupposes a massive reduction in average working hours. The acceleration of decoupling required to permit living standards to continue to rise and working time reduction to be limited is substantial. This is particularly the case if allowance is made for the fact that Europe's carbon emissions are higher and its rate of decoupling lower on a consumption rather than production basis. The only strategy that appears commensurate with the normative views set out in the paper, i.e. meeting emissions targets while maintaining employment – would seem to be a combination of radical efforts to accelerate the decoupling of emissions from economic growth and considerably more substantial reductions in average working hours than have been the norm in recent decades.

2. Contributing factors to GHG emissions – a decomposition

The basis for the analysis is a simple decomposition with three elements.

First the volume of emissions (GHG) is equal to economic output (Y) multiplied by the emissions per unit of output (GHG/Y, or the carbon efficiency of the economy):

$$GHG = Y * GHG/Y$$

Second, output (Y) can be decomposed into the total number of working hours (H) multiplied by the output produced by each working hour (Y/H, or hourly labour productivity):

$$Y = H * Y/H$$

Third, total working hours (H) is simply the product of the number of people in employment (E) and their average working hours (H/E):

$$H = E * H/E$$

If we substitute into equation (1) the expressions for Y and for H in equations (2) and (3) respectively we obtain:

$$GHG = GHG/Y * Y/H * E * H/E$$

And we can express this in rates of change (Δ) as:

$$\Delta GHG = \Delta GHG/Y + \Delta Y/H + \Delta E + \Delta H/E$$

In words: the volume of GHG emissions is equal to the product of the carbon efficiency of the economy, hourly labour productivity, employment and average working hours. And the rate of change of emissions is equal to the sum of the rates of change of these four factors.

These two decompositions – we will make use here only of the second one, expressed in rates of change – are based on simple mathematical identities. They contain, of themselves, no normative implications. They are both true by definition and trivial.

3. Normative settings and empirical orders of magnitude

In order to do anything useful with these identities in terms of forward-looking policy relevance we need to plug in some known or forecast numbers and to take some normative views about how some of the variables *ought* to develop. We can thus identify trade-offs and implications for the other variables that conform to the need for these five simple variables to obey the laws of mathematics and logic. Taking the variables in turn, the following normative settings are proposed as a baseline:

— **Emissions** are a 'bad'. The now overwhelming consensus is that CO_2 levels are already excessive and have longer-run effects that we poorly understand, but which may be catastrophic[3]. Therefore emissions should be drastically reduced, ideally to zero.

— The **decoupling factor** should be as high as possible, as this enables emissions to be reduced without sacrificing material living standards. However, the technical ability to do this is uncertain[4] and decoupling costs money: the investments needed to achieve it use resources that cannot be put to other ends.

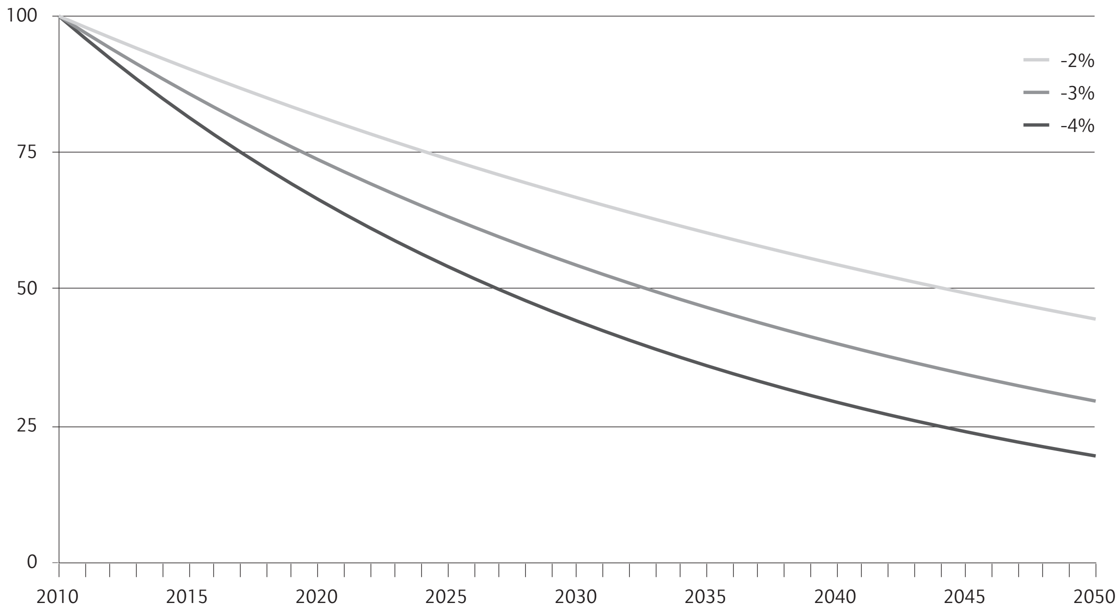
— Increasing **labour productivity** is a good thing in the sense that it enables humans to enjoy higher material living standards for a given amount of labour, or to reduce their labour input while maintaining their material living standards. It is the mainspring for economic growth which, at least in the current economic model, is important amongst other things for financing welfare systems and, as we currently see in the euro area, a precondition for debt repayment.

— Access to paid **employment** is the precondition – again, at least in our current way of organising society – for the material reproduction and the social integration of the vast majority the adult population. The normative implication is that 'in equilibrium' (i.e. given an initial employment rate considered satisfactory) employment should increase or decrease in line with labour supply, as approximated by the growth or decline of the working-age population.

3. A wealth of reports and evidence from the UN's Intergovernmental Panel on Climate Change can be found at: http://www.ipcc.ch/
4. For a sceptical view see Jackson 2009; for a more optimistic one see von Weizsäcker *et al.* (2009).

— While work can be inherently satisfying it is normatively assumed here that the 'disutility of labour' (roughly the cost of persuading a worker to do an extra hour of overtime) increases in proportion to the length of average working hours. This is a standard assumption broadly shared by economists of all persuasions. The implication is that, other things being equal, reductions in **average working time** are normatively a 'good thing'.[5]

Figure 1 **Annual rates of GHG reduction needed for an 80% reduction by 2050**



Source: Own calculations.

Let us now put some empirical flesh on the normative bones. We consider two geographical entities: the European Union (EU27) and its largest member state, Germany (DE).

— As a baseline target for the reduction of **GHG emissions**, we operationalise the EU's commitment to reduce emissions by 80-95% from their 1990s levels by 2050 as an 80% reduction from 2010 levels (for simplicity's sake all the scenarios will run from 2010 to 2050). A simple calculation shows that this translates into a reduction in emissions of 4% every year (Figure 1). If we look back at the ten-year period before the economic crisis (and thus bracketing out the one-off effects of that event), we see that emissions were cut in the EU27 by 4.3% and in Germany by

5. This is the normative starting point for the scenarios. We will return to discuss this in more detail later, where we will also consider the distribution of working hours around the average.

8.1% *over the entire period* 1998 to 2008.[6] Thus the annual rate of reduction was only about one tenth of that considered necessary in the EU as a whole and one fifth in Germany.[7]

— Between 1998 and 2008 output (real GDP) increased in the EU27 by 25.7% and in Germany by 17.1%. We can calculate the improvement in the **carbon intensity**, the decoupling factor, over this period by dividing emissions by GDP in each year. Carbon intensity improves from its starting level of 1 (100/100) to 0.761 (95.7/125.7) for the EU27 and to 0.779 (91.1/117.1) for Germany. These translate into annual rates of change of -2.69% and -2.47% for the EU and Germany respectively.[8]

— Unfortunately data involving hours worked are available for the EU only for the period since 2000. Because **labour productivity** is highly cyclical, it is important to leave out the crisis years to estimate what could serve as a trend. Taking, then, the period 2000-2008 as a not entirely satisfactory basis for estimation, we arrive at a rounded figure for labour productivity growth of 1.5% per annum for both Germany and the EU27.

— For the **working-age population**, if we take the ten-year period from 1998-2008 the German working age population has already begun to decline, the average rate being -0.3% a year. At the level of the EU27, by contrast, the working-age population has been expanding at a rate of about 0.37%. As a very rough approximation, in view of the onset of ageing a figure of 0.3% will be used for the EU and -0.3% in Germany, the latter reflecting the fact that this was a period of economic stagnation in Germany and net emigration may be expected to give way to net immigration, at least in the coming years.

— With the same caveats as apply to the data on hourly labour productivity, the annual *decline* in **average working hours** per person employed is around 0.3% in the EU27 and 0.4% in Germany.

6. All the figures cited are taken from the Eurostat online database or represent the author's calculations thereon.

7. There are two reasons not to look at the trend going back to 1990, which most of the climate protection processes take as a starting point. Data are often not available for the EU27 in the early 1990s. And while they are for Germany, the one-off winding up of East German industry in the early 1990s distorts the figures: between 1990 and 2008 German emissions fell by 21%. Of course the broader 'transition' of Eastern Europe, involving its widespread deindustrialization, is precisely why 1990 is usually chosen as a benchmark year. It makes the emissions reduction targets seem easier to achieve.

8. Note that this figure relates to the output *produced* in the EU/Germany. This obscures the fact that some of the goods consumed in Europe are produced abroad and imported, while some produced domestically are consumed abroad. To the extent that the carbon content of imports is higher than those of exports, the effective reduction in Europe/Germany's contribution to global GHG emissions is less substantial. This point is ignored in this section, but we return to it in section 6 below.

4. Scenario calculations

We can now examine different scenarios based on either assuming that these rates-of-change values will be extrapolated in the future or that they will change in various ways. The basis for these calculations is equation (5) above. As mentioned above, these are *not* forecasts. All the variables here will be subject to pressures for change of various sorts. The purpose of this article is not to speculate about this – some reflections are given in the conclusion – but to show the implications of certain assumed paths for different variables, and thus the need for policy interventions and the different choices policymakers will face *in terms of orders of magnitude*.

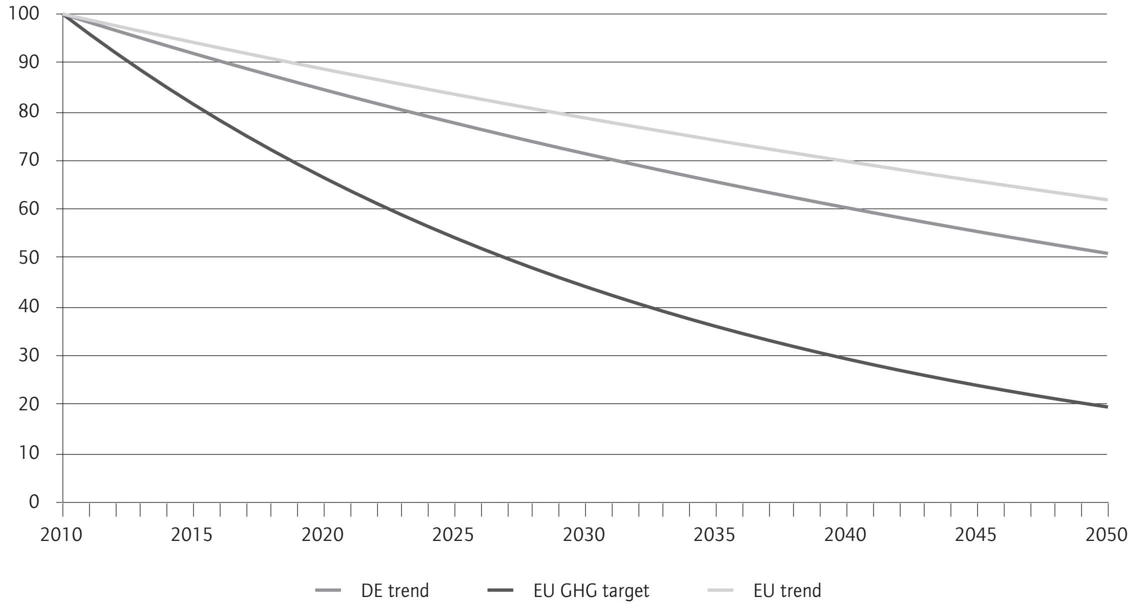
The first task is to calculate the path of emissions between 2010 and 2050 based on a continuation of the empirical trends observed in the eight or ten years prior to the crisis. The sum of the four rates of change (decoupling, labour productivity, employment and average hours) is for the EU27 around -1.2% a year (-2.7 + 1.5 + 0.3 -0.3). The corresponding figure for Germany is around -1.7% a year (-2.5 + 1.5 - 0.3 - 0.4). Thus on past trends EU emissions are set to decline slowly, because the decline in average hours and the rise in the labour force cancel out, while the carbon efficiency of output has been increasing somewhat faster than productivity growth. Germany's emissions are set to fall slightly faster; although the pace of decoupling is slightly slower, the shrinking (rather than growing) workforce and marginally faster reduction in average working hours more than compensate.

This trend extrapolation of emissions clearly shows that the rate of reduction is far below what would be necessary to meet the EU's climate-protection target (Figure 2).

If recent trends continue over the forty-year forecasting horizon, GHG emissions, rather than dropping by 80%, would decline by less than 40% in the EU27 as a whole and in Germany by less than half. The first finding is therefore the obvious one: very substantial changes are needed in some combination of the four determining variables in order to generate the reductions in emissions widely seen as necessary to avoid hugely damaging, even catastrophic, climate change. The question is how radical must these changes be and what are the possible combinations.

To see this we deploy a simulation strategy as follows. Recall that the annual reduction of GHG required to reach the target of an 80% reduction over 40 years is 4%. This implies that the annual changes in the four terms on the right hand of the equation must sum to -4.

Figure 2 **GHG emissions on current trends**



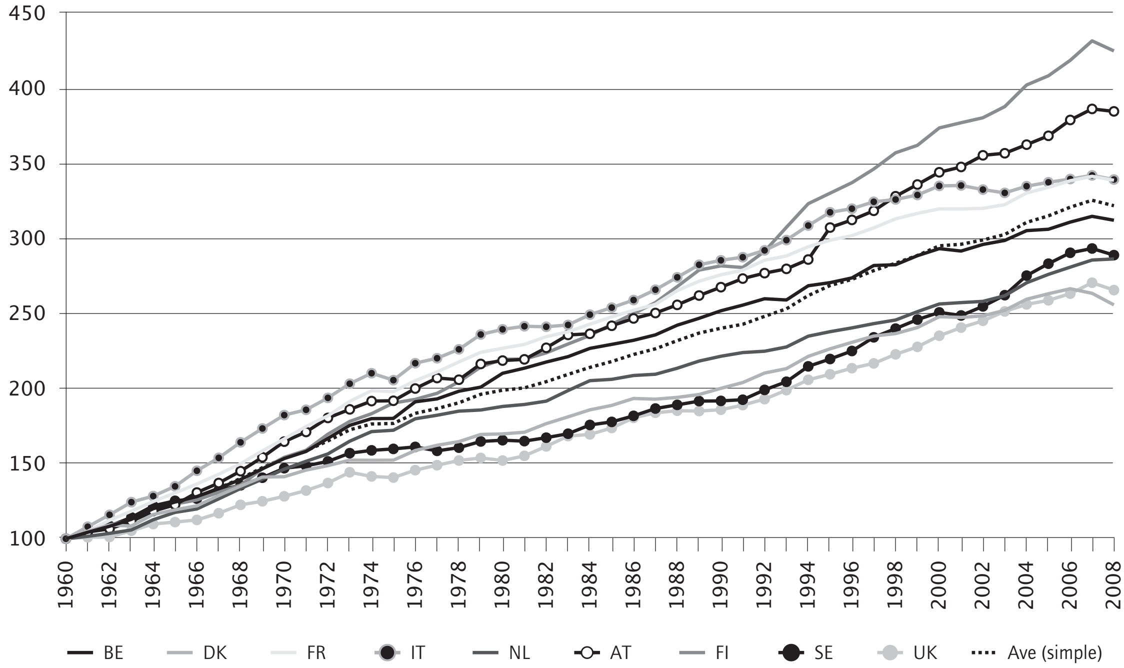
Source: Own calculations based on Eurostat data.

The second step is to bring in the normative considerations of the previous section. Two variables will be assumed – a justification follows – to keep the same values as in the baseline scenario, and thus continue their recent (pre-crisis) trend. The two variables are labour productivity and employment.

There remain two parameters which can then be varied so as to meet the GHG reduction goal: carbon efficiency of output and average working hours. The remaining simulations *assume* various degrees of improvement in progress in decoupling emissions from output. It is then a simple matter to calculate the pace of working time reduction needed each year in order to reduce emissions according to plan, i.e. by 4%.

What could justify assuming that the recent labour productivity and employment trends will continue in the future? In the former case both an empirical and a normative argument can be made. We do not have long time series for productivity per working hour, but we do for productivity per worker (Figure 3). This chart would warrant detailed discussion, but what is important for the argument here is that, in most cases, the lines for each country approximate to a straight line (and thus a constant rate of annual growth). This is particularly true of the (simple) average, which evens out country-specific shifts. So, over the approximately 50-year period covered, despite wars, crises and booms, changes of government and massive structural changes, advanced economies appear to have what might be called an innate tendency for labour productivity to rise steadily, as knowledge is created, the capital stock developed and workers move from lower to higher productivity activities.[9]

Figure 3 **Long-term labour productivity (per employee) trend, selected countries, 1960=100**



Source: Eurostat; own calculations.

Of course, it is conceivable that this trend will *not* continue for the next forty years. Still the relative stability of this trend is a strong argument for extrapolating the *recent* productivity trend – not that of the entire post-war period, in other words considering the period 2000-08 as one in which the catch-up process mentioned in a footnote was more or less complete. The second argument is normative: it may well be possible deliberately to slow the productivity trend growth of labour productivity: blocking structural change, cutting investment in research and development, levying a tax on corporate investment, would do the trick. But, as indicated above, there are strong welfare arguments for choosing other ways to reduce emissions than crushing labour productivity growth.

The justification for maintaining employment growth at the same pace as the growth of the working-age population (and thus holding the employment rate constant) over the longer term is normative; employment is seen as key for

9. A number of countries do exhibit a flattening of the productivity growth trend. To some extent this is a catch-up phenomenon: Italy is a case in point, being a country that only really began to industrialise in the post-second world war period. As countries approach the technological frontier, the rate of productivity growth slows somewhat. Note, moreover, that this flattening partly reflects a process of shortening average working hours, as some of the benefits of higher output are taken in the form of greater leisure. In other words, if we did have such long-run figures for productivity per working hour, the lines would tend to be straighter still than is the case for productivity per worker.

material reproduction and social integration. In the past there has been a tendency for the employment rate to rise (i.e. for employment to grow faster than the working-age population) notably due to the increased integration of women into the labour market. This more than offset trends to stay longer in education and to retire earlier. The ‘reserve army’ of female labour has, in many EU economies, by now been largely absorbed into the work force, at least in per capita terms[10]. At the same time the pressure on pension systems is leading to postponement of retirement and rising employment rates among elderly workers. Moreover, in the wake of the economic crisis, the rate of job growth should almost certainly be considerably higher for a number of years in order to absorb the unacceptably high number of persons involuntarily unemployed. As vital as this is in the short run, over a fifty-year period this factor does not make a major difference, however. Finally, an increase in the employment rate is an explicit goal of EU policy. All in all, these reflections suggest that the rate of change of the working-age population understates the desirable growth rate of employment.

What is (empirically) unclear, indeed unknowable, is whether the growth of the 15-64-year-old population will continue in the future. Even if natural demographic trends can be predicted to some extent, the scope for counter-acting immigration is, in principle, large; whether this materialises is primarily a policy choice, is subject to unpredictable political developments and, ultimately, is unknowable. Probably recent population trends constitute a ceiling for future developments. In sum, if we consider that employment should rise somewhat faster than the working-age population, but that the latter can be expected to increase more slowly than in recent years, a pragmatic case can therefore be made for taking the recent working-age population trend as the baseline trend for desired employment growth.

For both the EU27 and Germany we then model three simple scenarios. In the first (no change) scenario the current rate of decoupling stays as it is, in the second it is raised by half and in the third it is doubled. The annual percentage rates of decline in emissions per unit of GDP are thus as follows.

Table 1 **Three scenarios for decoupling rates**

Decoupling rate (% p.a.)	S1 (No change)	S2 (50% faster decoupling)	S3 (100% faster decoupling)
EU27	-2.69	-4.04	-5.38
DE	-2.47	-3.71	-4.94

Source: Own calculations and assumptions.

10. Arguably not in terms of working hours, but that enters into the variable average working hours, not employment growth.

This implies, given the above assumptions about productivity and employment, the following annual rates of percentage change in average working hours in order to achieve the desired GHG emissions cut of 4 % p.a.

Table 2 **Three scenarios – implications for working time reduction**

Average working hours (% change p.a.)	S1 (No change)	S2 (50% faster decoupling)	S3 (100% faster decoupling)
EU27	-3.11	-1.77	-0.42
DE	-2.73	-1.50	-0.26

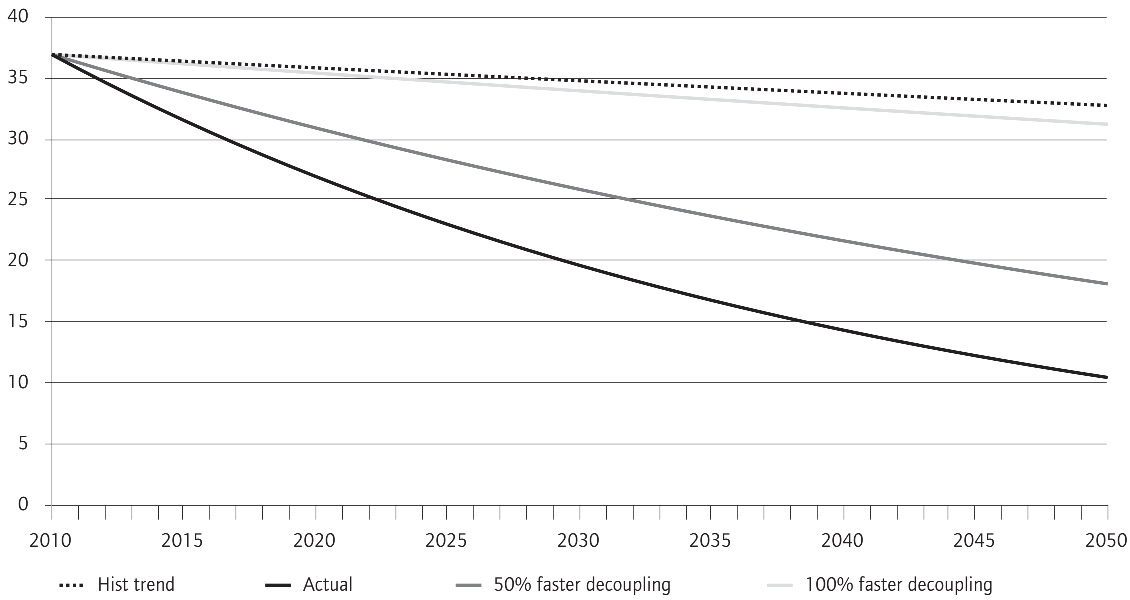
Source: Own calculations based on above assumptions.

5. Implications for working time and living standards

These different rates of change in working time lead to widely varying results, if maintained over the entire forty-year period, both for working hours and for living standards.

Figures 4 and 5 show the implied trajectory of working time for the EU27 and Germany respectively. In each case the starting point is the actual average number of working hours per week according to Eurostat.[11] As a baseline the dotted line indicates the decline in working time that would be realised if the recent trend continues. On that basis in 2050 weekly average hours would be just under 33 and just over 30 hours in the EU27 and Germany respectively.

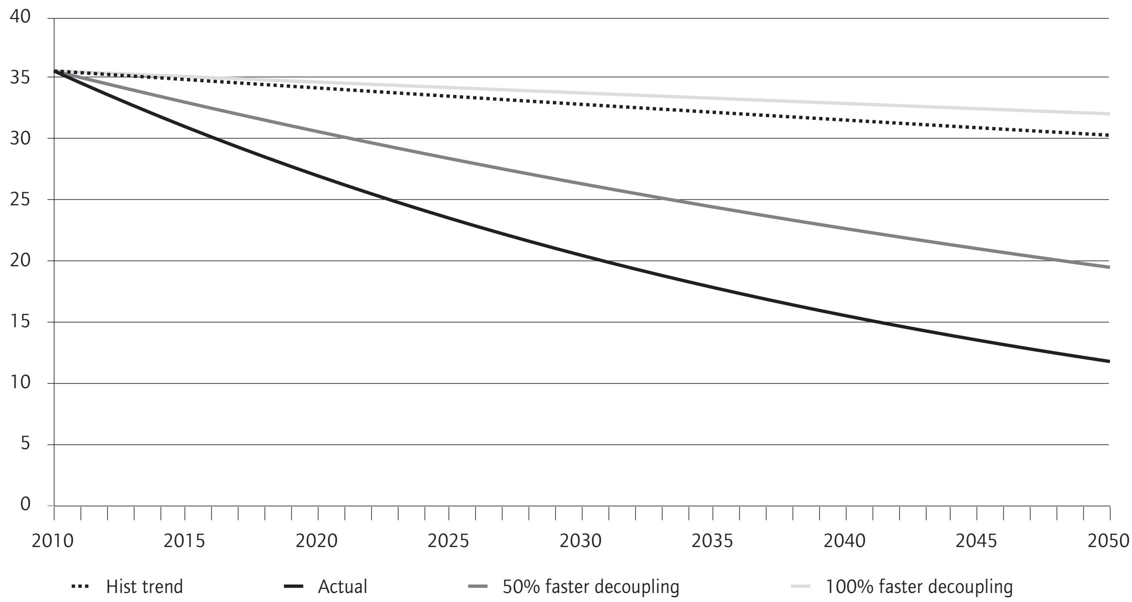
Figure 4 **Scenario projections of weekly working hours, EU27**



Source: Own calculations

11. Note that the rates of change in working time are based on annual hours data; these are more reliable given possible variations in holidays, etc. The rates of change over time are then applied to the current average weekly hours figures as they are more intuitive for the orders of magnitude involved than taking a base of 100 or annual hours.

Figure 5 **Scenario projections of weekly working hours, Germany**



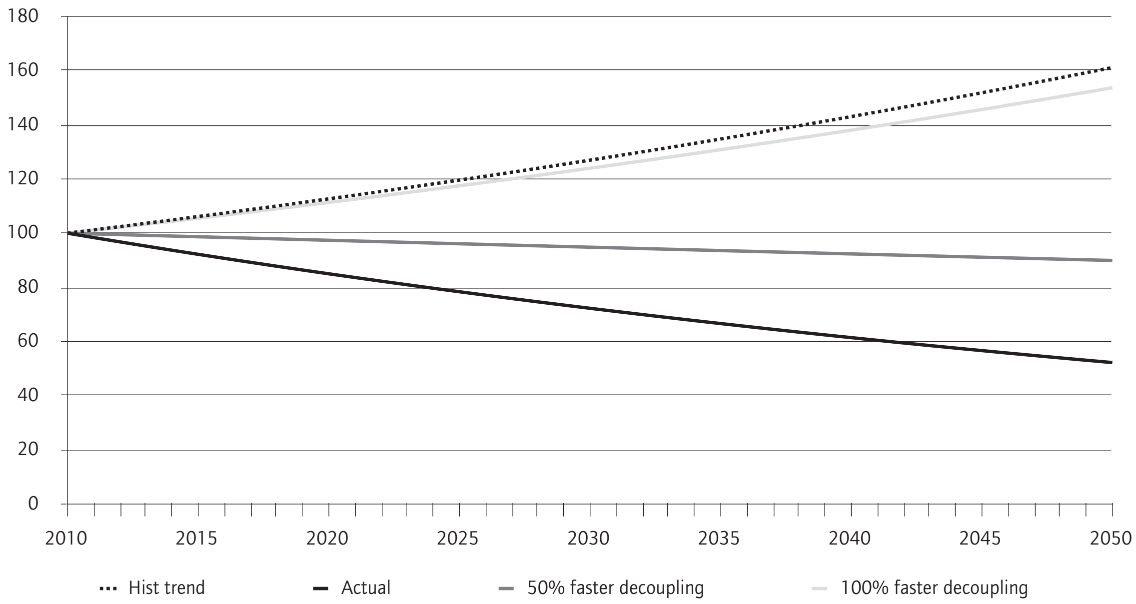
Source: Own calculations

If no progress is made at all in raising the rate of decoupling emissions from growth, very large reductions in working time would be necessary, on the above assumptions, to enable emissions targets to be met (dark line 'actual'). Europeans would be 'permitted' to work only just over 10 and Germans a little more than 11 hours per week to ensure meeting the climate goals.[12] While this can, considered solely from the 'disutility of labour' perspective, be taken to be a good thing, the impact on living standards would be brutal.

As Figures 6 and 7 show, in this scenario, if we are unwilling or unable to accelerate the decoupling process, living standards would shrink dramatically. It is useful to start with a benchmark. If we extrapolate the positive effect on material living standards of labour productivity growth as offset by the historical trend reduction in working hours (the dotted line which approximates GDP per capita), it implies that material living standards would be around 60% higher in Europe (a little less in Germany) by 2050. (Clearly this can be considered realistic only if decoupling is sufficiently rapid, given that climate models suggest massive deterioration of productive capacity if emissions continue to rise.) Nevertheless, it is worth considering this benchmark, along with current living standards, as it is an indicator of widely held expectations about 'reasonable' increases in material living standards, based on past trends, also for coming generations.

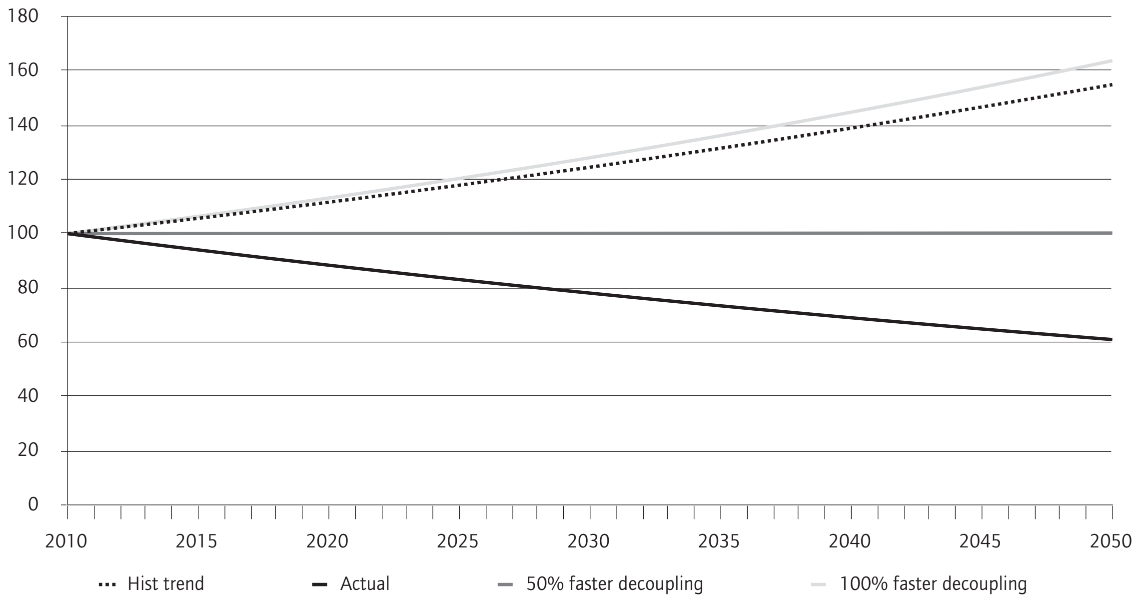
12. Of course, the working time reduction could equally take other forms, such as an equivalent reduction in annual or even lifetime hours.

Figure 6 **Scenario projections of material living standards, EU27 (2010 = 100)**



Source: Own calculations

Figure 7 **Scenario projections of material living standards, Germany (2010 = 100)**



Source: Own calculations

Taking now the case that the climate protection goals are met, but there is no improvement in the rate of decoupling and thus the above-mentioned huge cuts in working time are necessary, living standards would plunge by almost half compared with their current levels in Europe (and by around 40% in Germany). Accordingly, material living standards in Europe would be only about one third as high as in the benchmark scenario.

A second key finding revealed by all four graphs is that increasing the rate of decoupling by half would certainly help but, to use a perhaps inappropriate metaphor, would not cut much ice. Europeans would be working just less (and Germans a little more) than half their current weekly hours. As attractive as a two-and-a-half-day working week, on average, might seem, living standards would be very substantially affected: they would fall by 10% in Europe and by 6% in Germany. The crisis has shown the social impact of income declines of such orders of magnitude, and it needs to be borne in mind that these are probably perceived as temporary. In contrast, the declines sketched out here would be permanent and, indeed, ongoing beyond 2050. Moreover, they need to be seen against aspirations of continued *increases* in living standards of perhaps about one half.

On these assumptions, an increase by 50% of the rate at which emissions are decoupled from output would appear to be a just-about-conceivable way to meet climate protection goals, but woefully inadequate in social and economic terms. Unless accompanied by an unprecedented redistribution of income from top to bottom, the impact on the poor, in particular, would be huge.

It takes an acceleration of decoupling by a factor of two, an increase of the rate by 100%, (that is from 2.69% to 5.38% a year in Europe and from 2.47% to 5.94% in Germany), to arrive at results that, on these assumptions, seem vaguely commensurate with normative notions of a 'good society'. In this scenario, the rate of reduction of working hours would be broadly in line with recent historical trends. Europeans would see a continued slow decline in their working hours totalling around 15%, representing a bit more than six-and-a-half hours per week in additional leisure; the reductions in Germany are slightly lower. Assuming that productivity growth is maintained, living standards rise in this scenario broadly in line with the historical trend (slightly below it in Europe, somewhat higher in Germany) *while hitting climate protection goals*.

These scenarios suggest that a very substantial effort is needed to double the rate of decoupling of economic growth from emissions, permitting climate-protection targets – at least in terms of domestically produced emissions – to be reached while living standards continue to rise and average working hours to decline. The focus of this contribution is not *how* to improve the carbon efficiency of our economies; nor is it to discuss *how hard* this will be (see Jackson 2009; von Weizsäcker *et al.* 2009). However, it is important to emphasise that doubling a rate of change is a lot more difficult than doubling a level or stock. It means that the fall in carbon emissions has to be twice as high as the recent trend, and that needs to be maintained every single year. While there is arguably plenty of 'low-hanging fruit' that would enable a swift increase in the decoupling rate (and probably more in low-income countries in Europe than in developed ones like Germany), it becomes harder to maintain the higher decoupling rate as time goes on; not only, in other words, do decarbonisation efforts have to be intensified, but this intensification will need to be exponential over time in order to keep the decoupling rate on a higher trajectory.

6. Producing versus consuming carbon: how big a difference would consumption-based accounting make?

It has been mentioned several times that the above calculations are based on the carbon emitted from the *territory* of Europe and Germany; this is implicit in the idea of gross domestic product. Yet this ignores the fact that emissions of the respective *populations* on the basis of their consumption will be higher (lower) if the carbon content of imported goods is higher (lower) than that of exports.[13] Given that Europe is increasingly specialised in services and high-tech-manufacturing, while importing inputs (including energy) and less sophisticated manufactured goods from lower-cost economies such as China, this is likely to be an important factor. It affects not only the estimate of the current level of emissions but also that of the rate of decoupling between growth and emissions, influencing the very definition of a successful climate change policy. For instance, a policy to ban aluminium smelting in Europe would decrease the carbon intensity of production in Europe; but if aluminium consumption stays the same, the gap being made up by increased imports, then this will be offset by an increase in emissions in the rest of the world.[14] This is often termed carbon leakage. In short, allowing for this effect increases the extent of the reduction needed and reduces the extent of decoupling, making the challenges analysed in the previous section even more daunting. But by how much?

The science of estimating emissions on a consumption basis is in its infancy. I cannot reproduce the above calculations on a consumption basis with a high degree of confidence. However, some back-of-the-envelope calculations will serve to show its potential importance.

According to Davis/Caldeira (2010), one of the few studies to attempt to estimate the magnitude of this phenomenon, “in 2004, 23% of global CO2 emissions (…) were traded internationally, primarily as exports from China and other emerging markets to consumers in developed countries” (Davis/Caldeira 2010: 1). The authors examine only selected countries in 2004 and so their findings cannot be directly applied within the framework used here. But they conclude that “(i)n the large economies of Western Europe net imported emissions are 20-50% of consumption emissions” (Davis/Caldeira 2010: 4). I propose, by way of illustration, to take a 25% higher initial stock of emissions as a first approximation in calculating the impact of using consumption rather

13. This also assumes a balanced trade position, which is broadly the case for Europe, although Germany famously runs a substantial trade surplus. We abstract from this consideration here.

14. Indeed, if production abroad is technologically less efficient, the net impact on emissions would be positive (in the quantitative not political sense).

than production as a basis. This is probably a conservative figure for Europe as a whole, given the range of the authors' estimates, but takes into account the fact that the countries not considered in that analysis tend to have lower incomes than those that are.

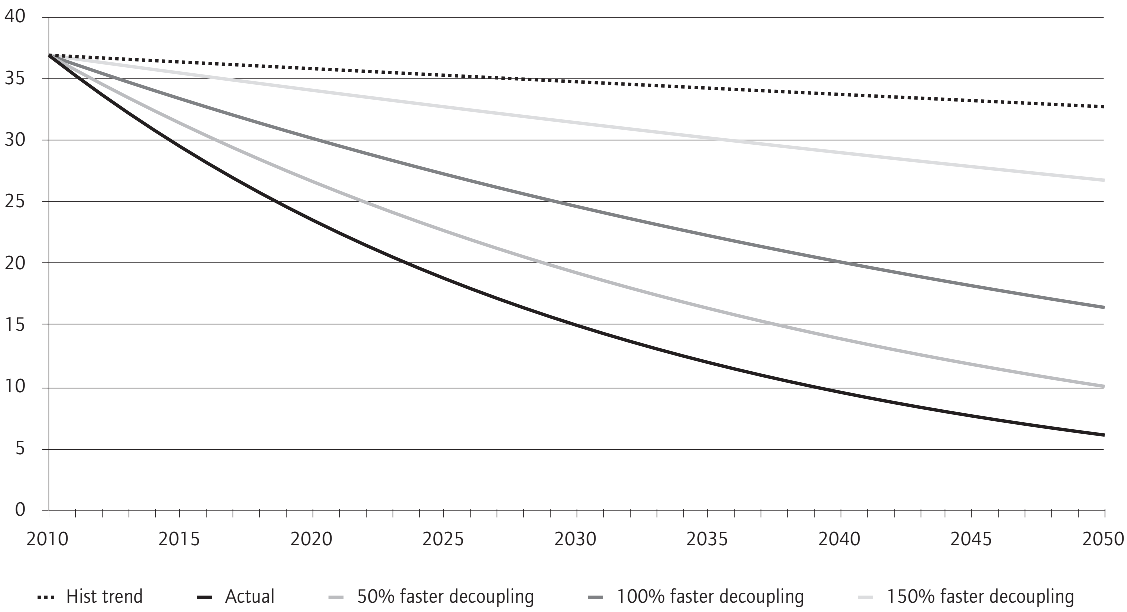
Starting from a level of 125 rather than 100, while still reducing emissions to 20% of the 2010 figure based on production, means cutting emissions from 125 to 16; this requires an annual fall in emissions of about 5% instead of 4%. In line with the analysis above, there must be a faster decline in carbon intensity or in working time totalling 1pp. a year.

But that is not all. To some extent the rate of decoupling used as a basis in the above calculations has been 'exaggerated' by being partially based on carbon leakage. The Davis/Caldeira analysis gives figures for a single year (2004) alone, and so cannot be used to estimate the importance of this effect. Given that net imports account for a quarter of domestic emissions and what we know about the ongoing process of globalisation and sectoral structural change, it does not seem implausible to reduce the underlying rate at which carbon intensity is declining in the EU by 10%. This figure has the status of no more than a 'guesstimate', however.

Figures 8 and 9 summarise the effects of making these very probably conservative changes (i.e. a 25% higher initial level of emissions and a 10% lower decoupling rate) to the earlier analysis for the EU27.

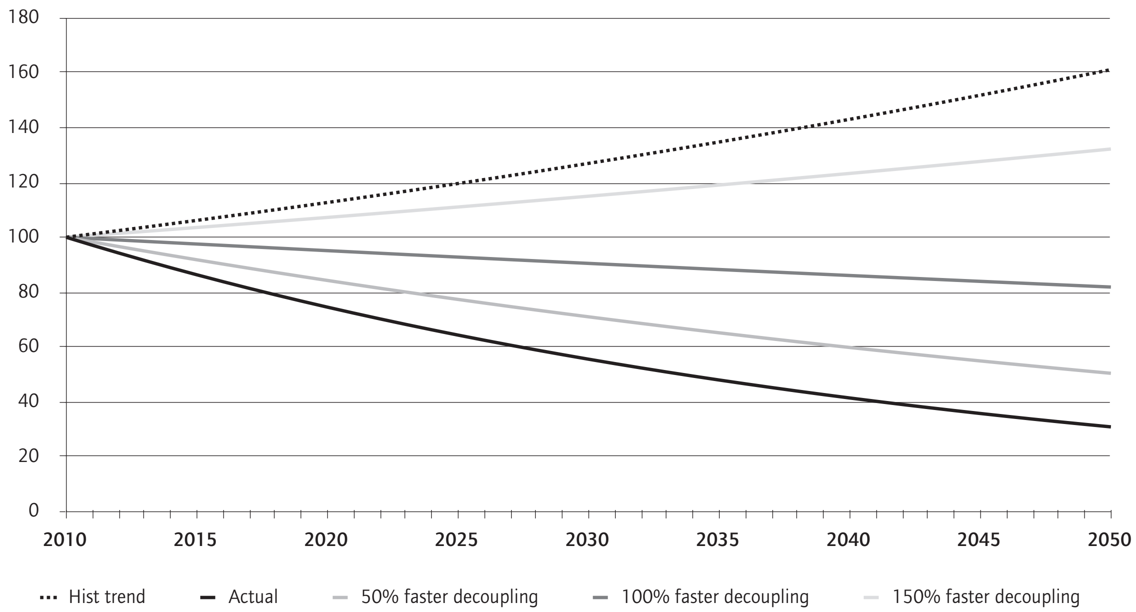
The effect is quite dramatic.

Figure 8 **Scenario projections of weekly working hours, consumption-based approach, EU27**



Source: Own calculations and assumptions derived from Davis/Caldeira 2010.

Figure 9 **Scenario projections of material living standards, consumption-based approach, EU27**



Source: Own calculations and assumptions derived from Davis/Caldeira 2010.

On these assumptions, if the decoupling rate were held constant, and even if it were increased by half, it would imply the more or less total collapse of the European economy. Working hours would have to be forced down to 6 and 10 hours per week respectively. Living standards would fall on average by more than two-thirds or by half respectively. The implied changes are so dramatic as to be virtually inconceivable.

If the rate of improvement of carbon efficiency can be doubled – which was roughly sufficient in the previous analysis for a balanced social, economic and ecological development – working time would fall to less than half its current levels (some 16 hours per week) and living standards would be cut by almost 20% on current (never mind expected future) levels.

It is evident from the charts that, when making (probably conservative) allowance for the impact of trade on emissions, it takes an increase in the rate of improvement of carbon efficiency by a factor of at least 2.5 (a 150% increase) to arrive at plausible trajectories. At that rate, average working time would fall by ten hours a week to a little under 27 hours per week. This is about six hours per week below what would be expected on current trends. Given that this average also includes part-timers, one might expect a full-time position to imply a four-day working week, with a somewhat shorter working day (or longer holidays). That would seem to be a manageable and indeed attractive transition in working hours. Living standards would continue to increase under such a regime, albeit considerably more slowly. By 2050 the average European would be better off in terms of material living standards by approximately one third rather than one half. Yet this would require a massive and sustained increase in the rate of decoupling.

Summing up, if we assess prospects based on the (superior) consumption basis, at least as far as data uncertainties allow, even on conservative assumptions the challenge of meeting climate protection goals is very considerably more difficult. It seems likely that a combination of an even greater attempt to decouple growth and emissions will need to be combined with policies that encourage and manage an accelerated path of working time reduction.

7. Conclusions, questions and avenues for further work

The key findings from these scenarios are that, on the basis of recent trends, unless there is a qualitative leap in the resource efficiency of our economies, reaching Europe's climate change targets would require a very substantial reduction in economic output and living standards. If employment rates are to be maintained, this, in turn, presupposes a substantial reduction in average working hours. The acceleration of decoupling required to permit living standards to continue to rise and working time reduction to be limited is very substantial. This is particularly the case if allowance is made for the fact that Europe's carbon emissions are higher and its rate of decoupling lower on a consumption rather than production basis (carbon leakage). The only strategy that appears commensurate with the normative views set out in the paper would seem to be a combination of radical efforts to accelerate the decoupling of emissions from economic growth and considerably faster reductions in average working hours than have been the norm in recent decades.

In policy terms there is clearly an overriding need to focus on ways to increase resource efficiency. This is not the main focus of this contribution. (A wealth of evidence is in von Weizsäcker *et al.* 2009.) It is widely agreed that the overriding goal is to substantially and predictably raise the price of carbon to reflect its huge externalities.[15]

But alongside resource efficiency, much more thought and policy work needs to be devoted to the question of working time and the conditions under which its trend rate of decline could be accelerated. Important issues include questions of individual versus collective choices and distributional concerns (see below). This paper started by referring to President Sarkozy, and it would be appropriate to suggest a re-examination of the French 35-hour-week policy, on which the verdict in economic and political circles has been largely negative, as being a good starting point (Logeay/Schreiber 2006; Watt 2012).

These conclusions seem ineluctable unless one or more of the conditions that are assumed to hold in this analysis are *not* met. This could mean that the target rate of emissions reduction is not achieved; but this would need a major downward change of our assessment of the amount of carbon emissions that

15. Watt 2011 discusses changing incentives through taxation and emissions trading; see also Cottrell *et al.* 2010. This cannot be the only approach, however. Successful decoupling is, in itself, as much a social as a technical issue, as the change processes need to be effectively managed; see for instance Galgóczi (2010).

is compatible with maintaining the planet in a condition on which life can continue to exist. Or life will not continue to exist. Or the level of employment is not maintained. This, in turn, implies either the existence of mass unemployment (or, possibly, some more socially acceptable 'functional equivalents' to unemployment) or that Europe's population shrinks appreciably and this is not offset by inward immigration. Finally, the rate of labour productivity growth could fall appreciably below its recent trend. I have already indicated why I am sceptical about such a development, but clearly it cannot be ruled out (see also below).

Beyond the obvious uncertainties involved in extrapolating trends for many years into the future, three main limitations of the approach adopted here should be pointed out. The first such limitation is that all the figures used take European or German *averages* as the basis. Distributional issues (with respect to income, emissions, working time) are not addressed. They are likely to be crucial, however. Inequality is almost certainly a driver of excessive working hours, as in the US (Bell/Freeman 2001; Bowles/Park 2005). For instance, it is inconceivable that lower income groups will be able to accept income losses proportional to any non-trivial fall in working hours. An income redistribution strategy of one form or another is likely to be a necessary corollary to any policy of collectively reduced working hours. Also within Europe it would be perfectly possible, and desirable, for changes in variables such as emissions and living standards to vary across countries. As with labour productivity, there may well be a catch-up effect in terms of resource productivity, with low-income countries finding it initially easier to raise their decoupling rates.

The second limitation is that the analysis here creates the impression that changes in the four variables determining the level of emissions (resource intensity, labour productivity, employment and average working time) are independent of one another. This is unlikely to be the case in practice. It may be that the interdependence is beneficial, in the sense that it reduces the extent of the trade-offs implied by the above analysis. For instance, if energy is made more expensive while the cost of labour is reduced by introducing revenue-neutral ecological tax reform (Cottrell *et al.* 2010) this will, among other things, cause firms to invest more in resource-saving and less in labour-saving technology. In terms of this analysis this would have a double-positive effect on emissions, increasing the rate of decoupling while depressing labour productivity growth (and the increase in material living standards). Much detailed work has been done on such double-dividend tax reforms, which also lend themselves to straitened fiscal times (e.g. Bach *et al.* 2001).

However, there may also be cases where improving the performance of one variable tends to worsen that of another. For example reduced working hours may well encourage at-home production of some commodities; these would no longer form part of GDP but emissions would still be generated (they may even be higher if cottage-industry production is technically less efficient) and thus the carbon intensity of GDP will increase. This is a sort of carbon leakage, but out of measured and into unmeasured output, rather than across borders.

Thirdly, the analysis has been limited to GHG emissions. In principle similar calculations could be made for any pollutant for which we have data on its incidence and some basis for a target for its reduction. And to the extent that decarbonisation comes through a dematerialisation of GDP, there is likely to be a strong correlation between reducing carbon and other pollutants.

Despite these limitations and the uncertainty inevitably involved in any extrapolation of past trends over long periods, this simple analysis serves to indicate the scale of the challenge facing policymakers in meeting climate protection goals without losing sight of widely accepted goals such as decent living standards and job opportunities. Incremental changes in business models and individual, corporate and government behaviour will be woefully inadequate. Quantum leaps are required and economic, social and technological policies will have to be aligned to this overarching policy goal. But this analysis also permits what might be called a ‘conditionally optimistic’ conclusion to be drawn. *If* the required decoupling acceleration can be achieved, our children and grandchildren can enjoy decent living standards and high levels of employment, along with considerably greater free time, while dramatically reducing Europe’s carbon emissions.

Europe is a small part of the world, and the challenges in limiting and reversing emissions growth in faster-growing countries with large and expanding populations and low income levels are greater still. Reduced inequality is vital at the global level (Dauderstädt 2011). But Europe and other rich countries, which have contributed most to the historical upward trend in GHG emissions, must take the lead.

Bibliography

Bach, S. *et al.* (2001) *Die ökologische Steuerreform in Deutschland. Eine modell - gestützte Analyse ihrer Wirkungen auf Wirtschaft und Umwelt*, Heidelberg: Physica-Verlag.

Bell, L. and R. Freeman (2001) 'The incentive for working hard: explaining hours worked differences in the US and Germany', *Labour Economics* 8 2001: 181–202.

Bowles, S. and Y. Park (2005) 'Emulation, inequality and work hours: Was Thorsten Veblen right?', *The Economic Journal*, 115 (November): 397-412.

Cottrell, J., R. Mander, S. Schmidt and K. Schlegelmilch (2010) 'Environmental fiscal reform in Europe: research, experience and best practice', *ETUI Policy Brief* 5/2010. http://www.etui.org/Publications2/Policy-Briefs/European-Economic-and-Employment-Policy/Environmental-fiscal-reform-in-Europe-research-experience-and-best-practice

Coutrot, T. and J. Gadrey (2012) ''Green growth' is called into question', *ETUI Policy Brief* 3/2012. http://www.etui.org/Publications2/Policy-Briefs/European-Economic-Employment-and-Social-Policy/Green-growth-is-called-into-question/

Dauderstädt, M. (2011) 'Globales Wachstum zwischen Klima, Gleichheit und Demographie', WISO direkt, January 2011. FES http://library.fes.de/pdf-files/wiso/07760.pdf

Galgóczi, B. (2010) 'The harsher employment effects of a necessary paradigm shift in climate policy will need active transition management', *ETUI Policy Brief*, 7/2010. http://www.etui.org/Publications2/Policy-Briefs/European-Economic-and-Employment-Policy/The-harsher-employment-effects-of-a-necessary-paradigm-shift-in-climate-policy-will-need-active-transition-management

Jackson, T. (2009) *Prosperity without growth? The transition to a sustainable economy*, Sustainable Development Commission. http://www.sd-commission.org.uk/data/files/publications/prosperity_without_ growth_report.pdf/

Logeay, C. and S. Schreiber (2006): 'Testing the Effectiveness of the French Work-Sharing Reform: A Forecasting Approach', *Applied Economics*, Vol. 38, 2053-2068.

Stern, N. (2006) Stern Review on the Economics of Climate Change, HM Government, UK. http://webarchive.nationalarchives.gov.uk/+/http://www.hm-treasury.gov.uk/stern_review_report.htm

Von Weizsäcker, E. *et al.* (2009) 'Factor Five Transforming the Global Economy through 80% Improvements in Resource Productivity', Earthscan.

Watt, A. (2011) 'Signal change: environmentally sustainable corporate behaviour requires a change in incentives', in S. Vitols and N. Kluge (eds.) *The Sustainable Company: a new approach to corporate governance*, Brussels: ETUI.

Watt, A. (2012) 'Working time reduction: win-win and possibly win-win-win, *Social Europe Journal*. http://www.social-europe.eu/2012/01/working-time-reduction-win-win-and-possibly-win-win-win/

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