Renewables introduce another particularity in utility balance sheets, namely their long investment payback period because of low load factors and despite of subsidies.

Low load factors can slow down the pace of investment recovery to between 12 and 15 years. Annual cash flows are spread thinly over the useful life of the asset, resulting in low returns on capital employed in the first years of operation.

Growing renewable activities within a traditional utility can lead to decreasing returns to the point of not covering the utility's weighted average cost of capital. Impairments in non-renewable activities help to offset lower returns from renewable activities in the initial years of operation.

Defending the dividends

European utilities have a few golden rules and one is to defend dividends to shareholders, particularly if they happen to be governments. Maintaining dividends in the face of impairments, however, can turn into excessive capital withdrawn.

The intrusion of 'green' activities in the balance sheet can also impact dividend policy. Renewable energy affiliates pay a low proportion of their earnings to shareholders, perhaps a third or even zero. Non-renewable activities are mature businesses that can afford much higher dividend pay-out ratios, due to less need of cash flow reinvestment.

As cash flow from renewables increases, the proportion of earnings distributed at group level should decrease. At end-2012, renewable activities contributed a modest 3% to RWE's operating profit but some 13% to E.ON's operating profit and 15% to Enel's - a signficant proportion.

While impairments and growing renewables would suggest a more prudent dividend policy, the reality is different. Many utilities promise shareholders a fixed proportion of net earnings excluding non-recurrent items such as impairments. RWE distributes between 50% and 60% of recurrent net income, while Enel aims to pay 40% of the net ordinary profit in dividends.

RWE reported a 28% drop in 2012 net profit but maintained its 2012 dividend. Enel announced a 79% drop in 2012 net profit but cut its 2012 dividend by only 14%. Good news for utility shareholders, but they will be aware of the fact that part of the dividend will be financed with new debt.

ITM Power: accelerating power-to-gas

A British company based in Sheffield has just won what could turn out to be a hugely significant contract. As reported in the last issue of Power in Europe, ITM Power is to supply its fast-response proton exchange membrane (PEM) electrolysis technology to Germany's Thuega Group, a conglomerate of 100 municipal energy utilities. The equipment will be at the heart of a power-to-gas energy storage demonstration plant in Frankfurt, Thuega said March 13.

Construction begins in mid-2013 with commissioning scheduled for the end of the year. The plant has input capacity of 360 kW and will generate 60 cubic meters of hydrogen an hour (1 cu m of hydrogen is equivalent to 3.54 kWh). The hydrogen will then be fed into the natural gas network, limited to a maximum concentration of 5%.

A second phase may follow in which CO_2 from an adjacent heat-only plant – Mainova's Schielestrasse plant - is reacted with the hydrogen to produce synthetic methane. This could be fed into the gas grid in unlimited quantities.

Germany will need 17 TWh of storage capacity by 2020, Thuega said. "The municipal natural gas distribution network will be the battery of the future, we are building the battery charger," said board member Michael Riechel.

Following contract announcement, Platts spoke to ITM Power's chief executive Graham Cooley. Cooley joined ITM Power in 2009 having previously been business development manager at National Power. He has spent 11 years in the power industry developing energy storage and generation technologies.

"The problem with electricity is that it is dynamically coupled from production to consumption – when you make it you use it, there is very little storage on the network," Cooley said March 18. "Intermittent generation (wind, solar) takes some of the control away from the supply side. What we need to do is shift some of the control to the demand side – units that can be turned on and off."

In the power-to-gas paradigm, you use an electrolyser to absorb surplus renewables and produce hydrogen, Cooley said. "Our proposition is putting that into the gas grid," he said. "The UK gas grid is three times the size of the power grid in terms of energy but the main difference is that it has storage – it's relatively easy to store gas. Every day we shift energy from the gas grid into the power grid via power generation. What we need now is a way of moving energy back from the electricity grid into the gas grid."

Storage potential in the German gas grid is also immense, Cooley said. "If want a full renewable gas grid you have to react the hydrogen with CO_2 to make synthetic methane – that's because the flame speed of hydrogen is different from methane. But make no mistake, all the excess wind we're ever going to produce on the power network can be stored in the gas grid."

The process is an elegant solution to the renewable heat conundrum, Cooley said: "this decarbonizes gas and two thirds of it ends up as renewable heat, which is incredibly difficult to achieve – harder to achieve, in my opinion, than decarbonizing electricity or transport."

Making it pay

In the UK, ITM Power is seeking to promote hydrogen as a substitute for biogas into the gas grid. "Today biogas gets 7.1 pence per kWh subsidy," Cooley said. "We are looking for an equivalent for hydrogen or synthetic natural gas."

The UK has two major grid payments on the demand side – Frequency Control by Demand Management (FCDM) and Short Term Operating Reserve (STOR). "To access FCDM you need to be able to respond in under two seconds," Cooley said. "Our electrolyser is the first one ever that can do that. We can access STOR payments as well."

In Germany the compensation structure is being debated at the moment. "One of the reasons Thuega wanted our rapid response unit was so they could demonstrate the capabilities of power-to-gas and show that payment structures are sensible on the demand side," Cooley said. "The UK's National Grid is quite advanced in having tariff structures on the demand side – you've got STOR and you've got FCDM."

If all the potential revenue streams can be accessed, then power-to-gas begins to represent a compelling proposition, Cooley said: "at one end you can buy electricity at between 3.5 pence and 6 pence at night, you get STOR and FCDM payments during that period because those are availability payments, and then at the other end, if you inject into the gas grid at 7.1 pence a kWh. It all makes great sense."

Germany has around seven 1-MW schemes for power-to-gas. "The difference with ours is that we can turn our PEM electrolysers on and off very quickly," Cooley said. "They can balance against renewable power, which you can't do with conventional old-fashioned alkaline electrolysers. You have to run them up slowly and leave them on – they are really only suitable for converting baseload power."

Further, ITM Power's system self-pressurizes to 80 bar, matching the high pressure gas grid. "With a conventional electrolyte you need a compressor and a buffer store. With our system you put the energy straight into the gas grid at 80 bar," Cooley said.

The company is looking at a first large deployment in the UK - a co-firing project with a to-be-named partner. Cooley was happy to talk about the principle behind this: "another thing you can do with an electrolyser is make hydrogen that goes into the mid-pressure grid, which goes straight to a gas turbine. A Siemens turbine is still within warranty if you have 10% hydrogen in your gas. In fact Siemens and GE are both designing 100% hydrogen turbines. The reason is that hydrogen is the fuel you use when you do CCS."

The company has two other UK projects - one a direct hydrogen injection project with SSE, National Grid and Shell, the other DECC's methanation project with SSE and Scotia Gas Networks, reacting renewable hydrogen with CO_2 to make synthetic methane for gas grid injection.

The electrolyser's cost structure beats other forms of energy storage, Cooley said. "When you buy a battery you buy kilowatts and kilowatt hours. For grid energy storage you buy a two-hour battery. So for a 1-MW battery you charge it for two hours, and you play it back your 2 MWhs at a later time."

With a flow cell you store the reactants externally in a tank. "If I want to increase the length of time I can deliver power or the energy I'm storing, I make the tank bigger," Cooley said. "It stores the reactant externally, while the battery stores it internally. The cost of an electrolyser is similar to that of a two-hour battery but you can use it all year, because the gas grid is your store – we already own that, and it's huge. Really for long term energy storage, months or even years, hydrogen is the only way of doing it."

Curtailment happens every day with renewables, Cooley concluded, "so you are taking something that is normally thrown away, and converting 70% of it for injection into the gas grid [ITM's electrolyser is 70% efficient]. We have one of the world's best technologies in the UK and our first major deal is in Germany - they understand it and I'm confident that we will have significant orders as a result of this project."