

ENERGY COUNTRY REVIEW

# Spain

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# Country Review Spain

Spain emerged as a unified and powerful country in the 15th century. However, its empire began to collapse in the 19th Century bringing with it economic and political turmoil which culminated in the Spanish Civil War in 1936 and fascism. Franco died in 1975 and democracy was restored in 1978. Spain joined the European Union in 1986 and the Euro zone at its inception.

## Oil and gas history

Onshore oil production began in 1964 from the Ayoluengo field in the Cantabrian Basin in north central Spain. Output is now small but attempts are being made to redevelop the fields in this area.

Offshore oil production, primarily from the Ebro Delta region in the Mediterranean Sea, began in 1973. It is also in decline although some additional small developments are planned.

Gas production is limited from both onshore and offshore regions, associated with oil, from the Guadalquivir basin in the southwest and from a now abandoned field in the Bay of Biscay. Some gas will continue to be produced and gas shales may have potential. Meanwhile imports of piped gas have been building from Algeria, to add to gas from Norway and imported LNG.

## Key facts

- 689 wells have been drilled offshore Spain since 1960 - at least 200 were in the Mediterranean
- 200,000km of seismic data has been acquired offshore Spain in the last 40 years; 100,000km of which was in the Mediterranean
- The oil and gas industry in Spain is more than 50 years old

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## Country Key Facts

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Official name:	El Reino de España (The Kingdom of Spain)
Capital:	Madrid
Population:	45 999 676 (2016)
Area:	504,645 km <sup>2</sup> (195,364 sq mi)
Form of government:	Parliamentary Monarchy
Language:	Spanish
Religion:	Roman Catholic
Currency:	Euro (€)
Calling code:	+34

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## **Production**

Crude Oil Production in Spain averaged 6.12 BBL/D/1K from 1994 until 2016, reaching an all time high of 16.57 BBL/D/1K in February of 1994 and a record low of 1.00 BBL/D/1K in September of 2012.

*Source: Trading Economics*

## **Petroleum system**

Northern Spain has a long established working petroleum system, dating back to the late 1800's. Numerous seeps and shallow, naturally occurring asphalt beds have been identified; with inchoate hydrocarbon production from mining of tar sands and from shallow wells. In the late 1950's and early 1960's, onshore Northern Spain was targeted for oil and gas exploration by many international companies. The results of this were the discovery of the Ayeluengo oil-field, producing from Jurassic and lower Cretaceous reservoirs; and the Castillo gas-field, producing from the Albian/Cenomanian Flysch deposits. The Serrablo gas-field, producing from Eocene foreland-basin deposits, and the offshore (Bay of Biscay) Gaviota gas/condensate field were also discovered in the 1970's. Although the results of these exploration efforts resulted in meager conventional reserves, these wells proved the potential of several world-class unconventional reservoirs.

Carboniferous shales, deposited during the Variscan orogeny, analogous to San Leon's Carboniferous shale play in Poland, have shown significant shale gas potential.

The Paleozoic section is often more than several thousand meters in thickness, and has shown Type II and Type III kerogen, with coal and high TOC shale within the gas generating window. Carboniferous shales and coals are known to have sourced the gas in the Gaviota field.

The Jurassic marine shales sourcing the Ayeluengo field are reportedly several 100 meters thick, with TOC's upwards of 8%, and are residing in the hydrocarbon-generating window. Asphalts linked to Jurassic shales have been actively mined in Northern Spain, and are Jurassic oil is also known to have been the reducing agent for Cantabrian lead/zinc deposits in Lower Cretaceous limestones.

The Cretaceous (Albian/Cenomanian) Valmaseda Formation has proven gas reserves in the Castillo field. The formation is a so-called flysch deposit, consisting of alternating shale/sand beds, with the shales often having over 1% TOC, over a several 100 meter thick section.

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The Valmaseda Formation proved in the 1960's to be a viable exploration target, with vertical wells capable of IP rates of several MMCFD. Decline curves were steep, however, suggesting low permeability. Modern drilling, completion and stimulation techniques promise to allow for sustained high production rates from the Valmaseda Formation, making the Albian/Cenomanian section a highly attractive unconventional target.

Eocene shales deposited in the fore-land of the Pyrenean mountains have proven to be the source rock for the Eocene Serrablo field as well as having sourced the Riudaura discovery. Eocene deposits are flysch deposits, deposited in the fore-land of the Pyrenean mountains. TOC values are 1-1.5%, and the maturity is within the hydrocarbon generating window.