



# **From fossil fuels to renewable energy**

**--who delivers prosperity and salvation  
to our planet**

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**Beijing, winter, 2014**



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Great smog, London, 1952



Los Angeles, 1943

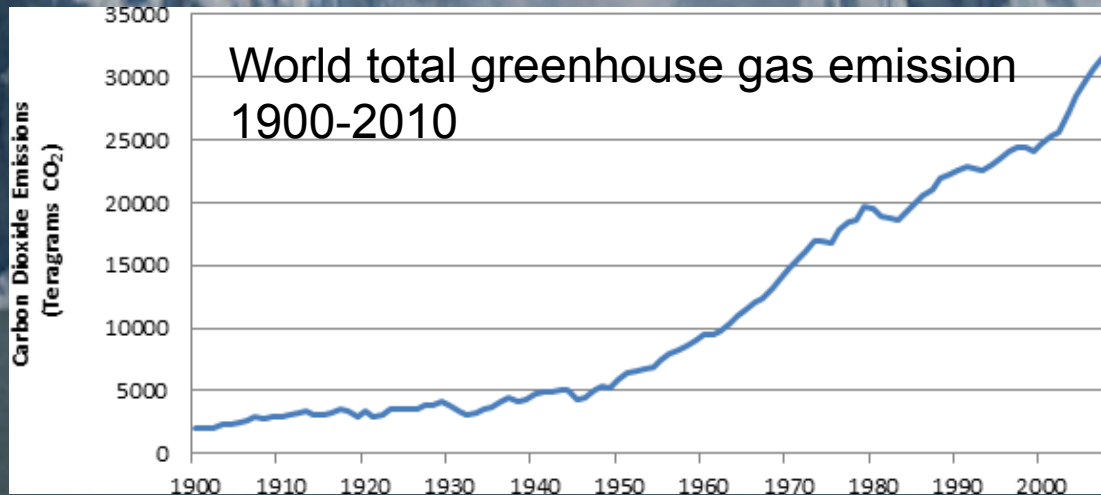
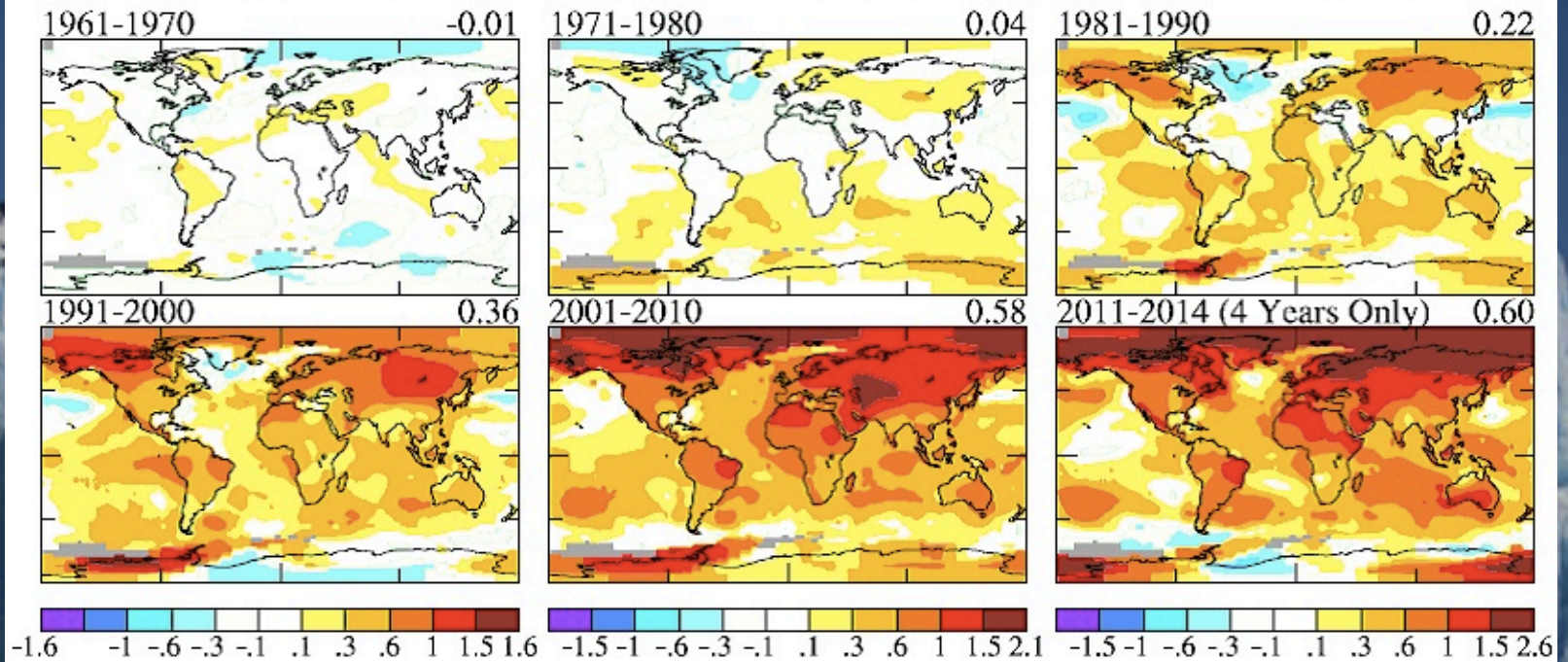


Gulf of Mexico,  
oil spill, 2010

<http://www.dailymail.co.uk>  
<http://airfactsjournal.com>  
<http://www.nature.com>



# Decadal Mean Surface Temperature Anomaly (°C): 1951-1980 Base Period





# Fossil fuel: amazing gift from God

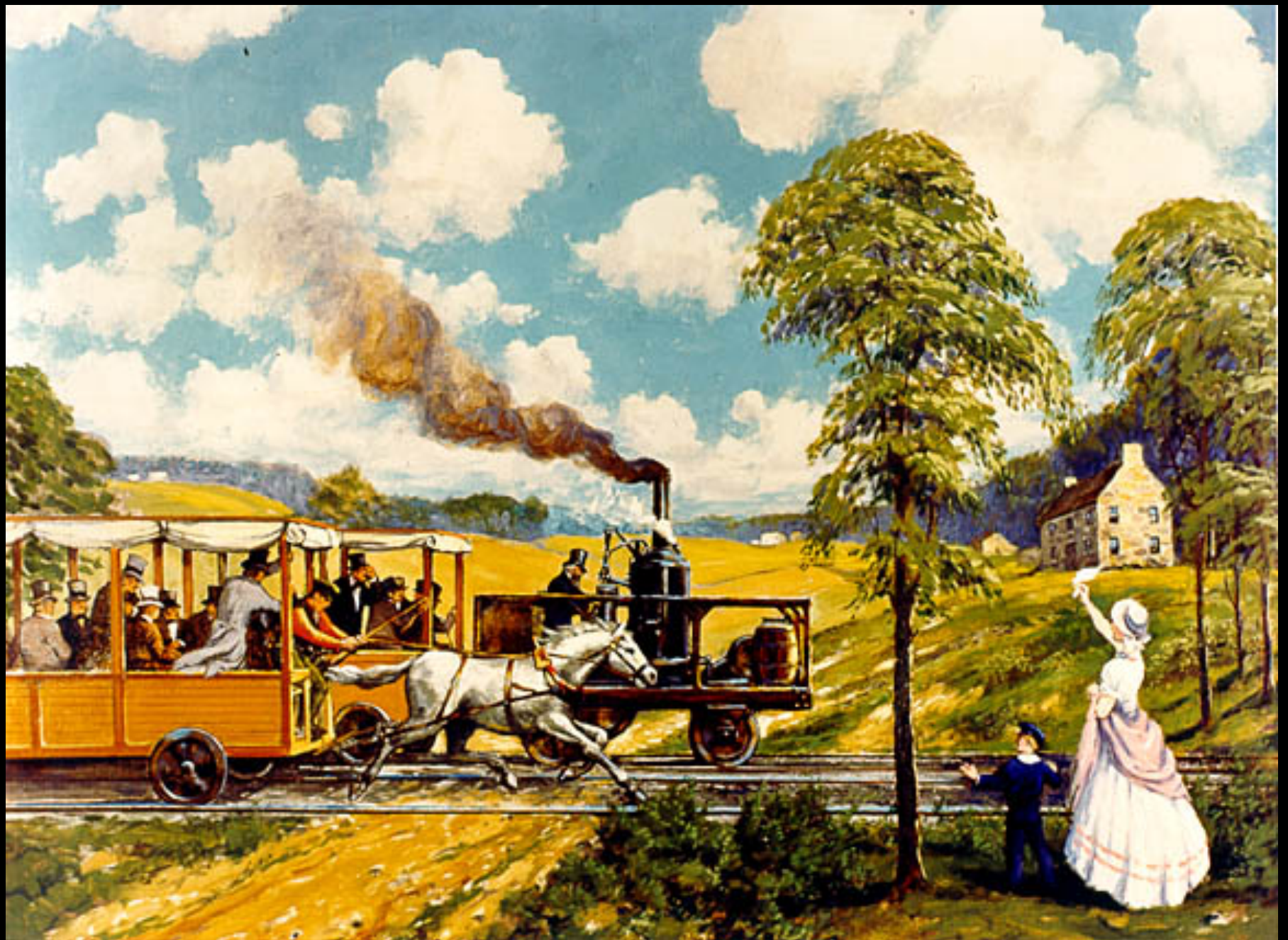
- Higher energy density and calorific value
- Easily available and abundant
- Low cost
- Stable and easy to transport
- Very well developed, easy to set up

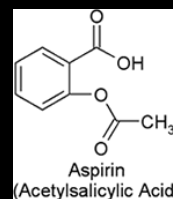
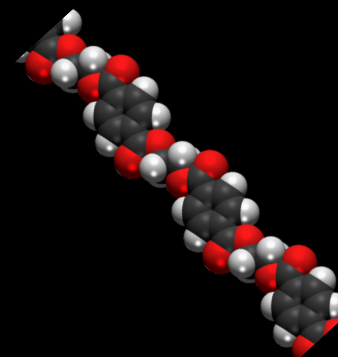
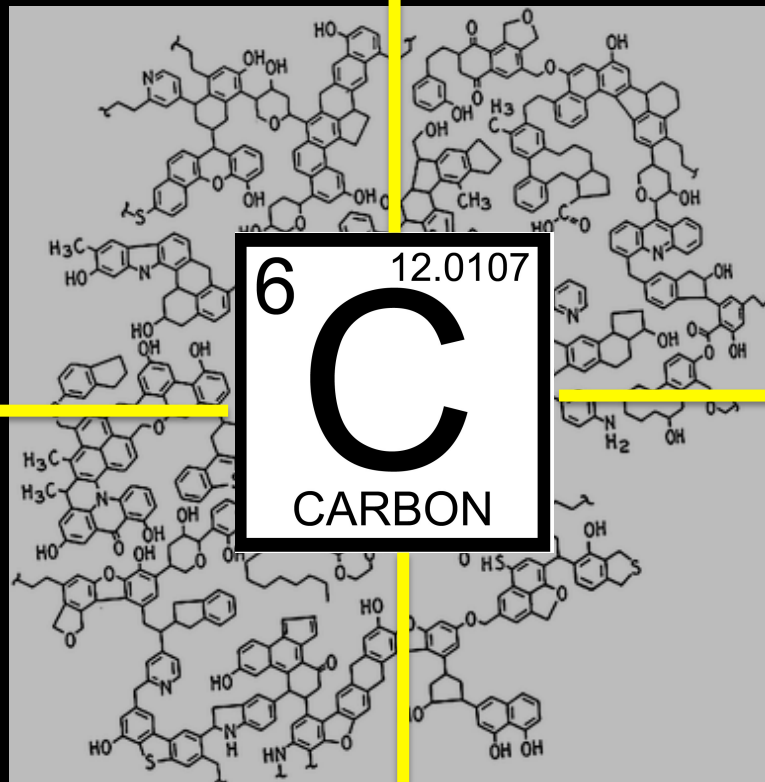


<https://gingercreekstoves.wordpress.com>

<https://commons.wikimedia.org>

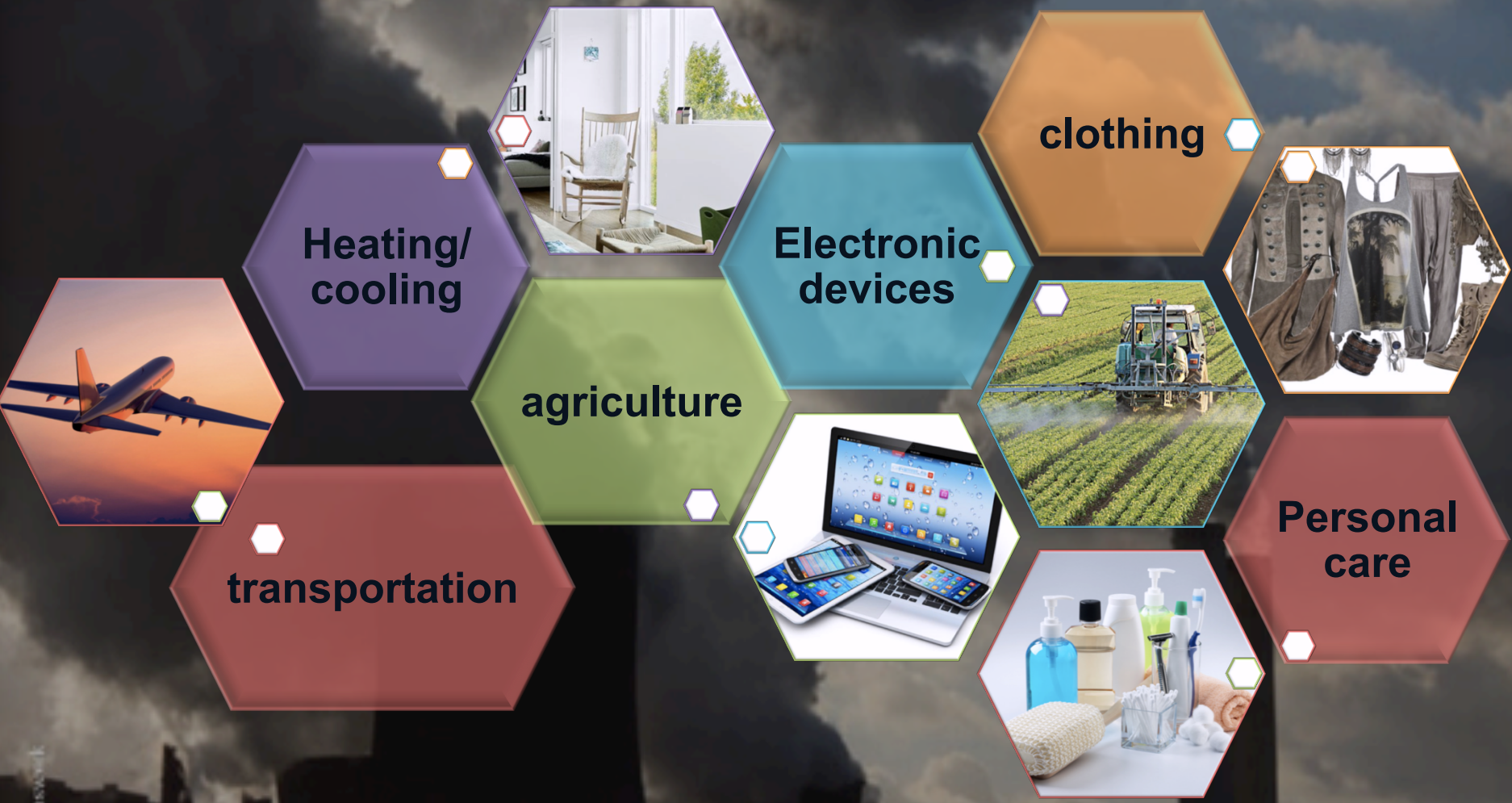








# We built modern society from fossil fuels



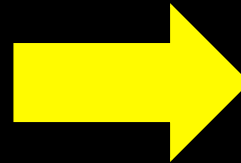
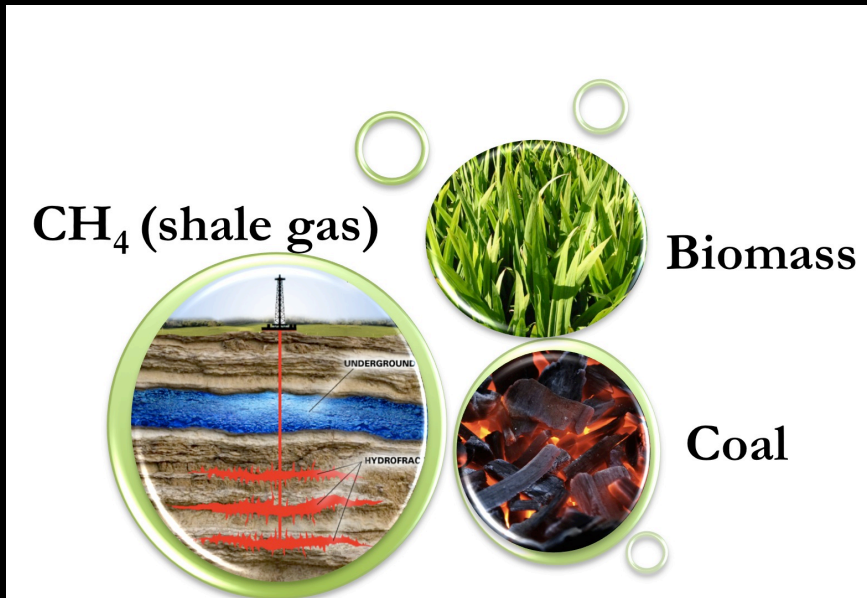
# Something we “worship”



China discovered its major oil reservoir, Sep 26<sup>th</sup> , 1959

# Fossil fuels: what we worship can harm us

- “Nonrenewable” & “unsustainable”
- Contains N,S,P, heavy metals...generate pollutants
- Emission of green house gases

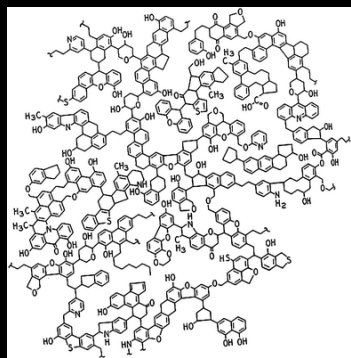
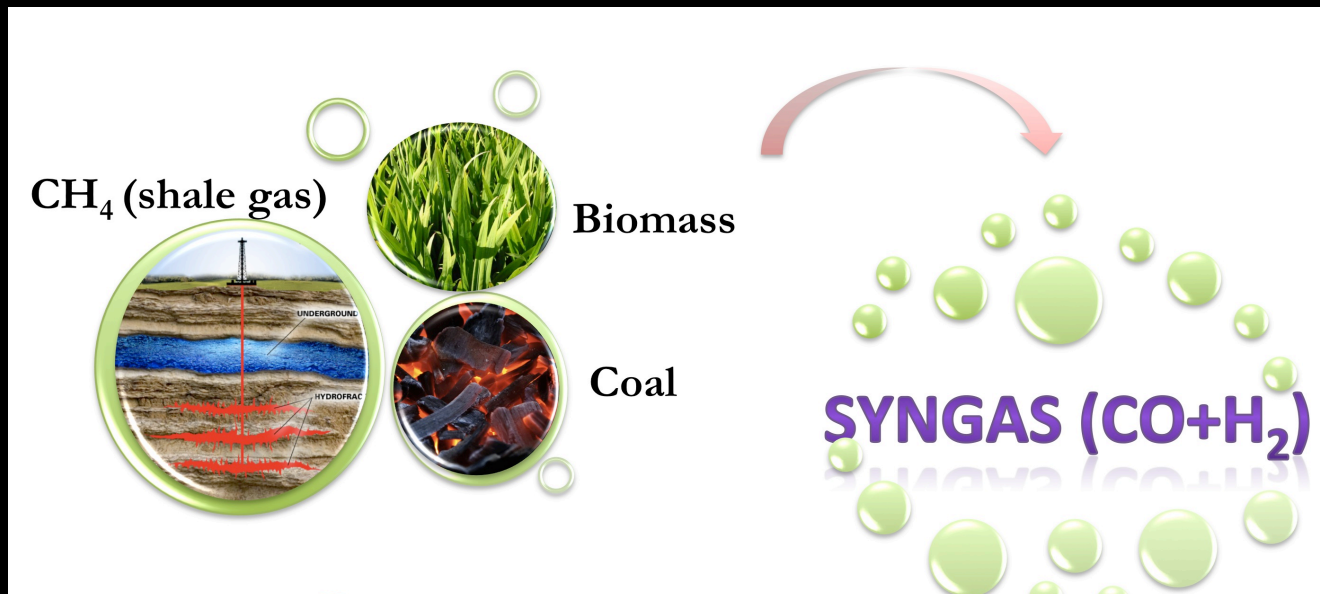




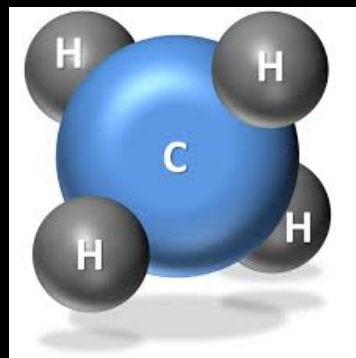
**Can we use fossil fuels in a cleaner way?**



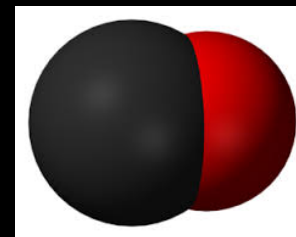
# A cleaner way to use fossil fuels



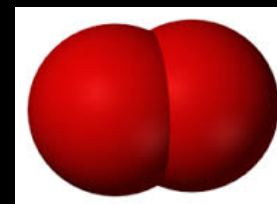
Coal



Natural gas

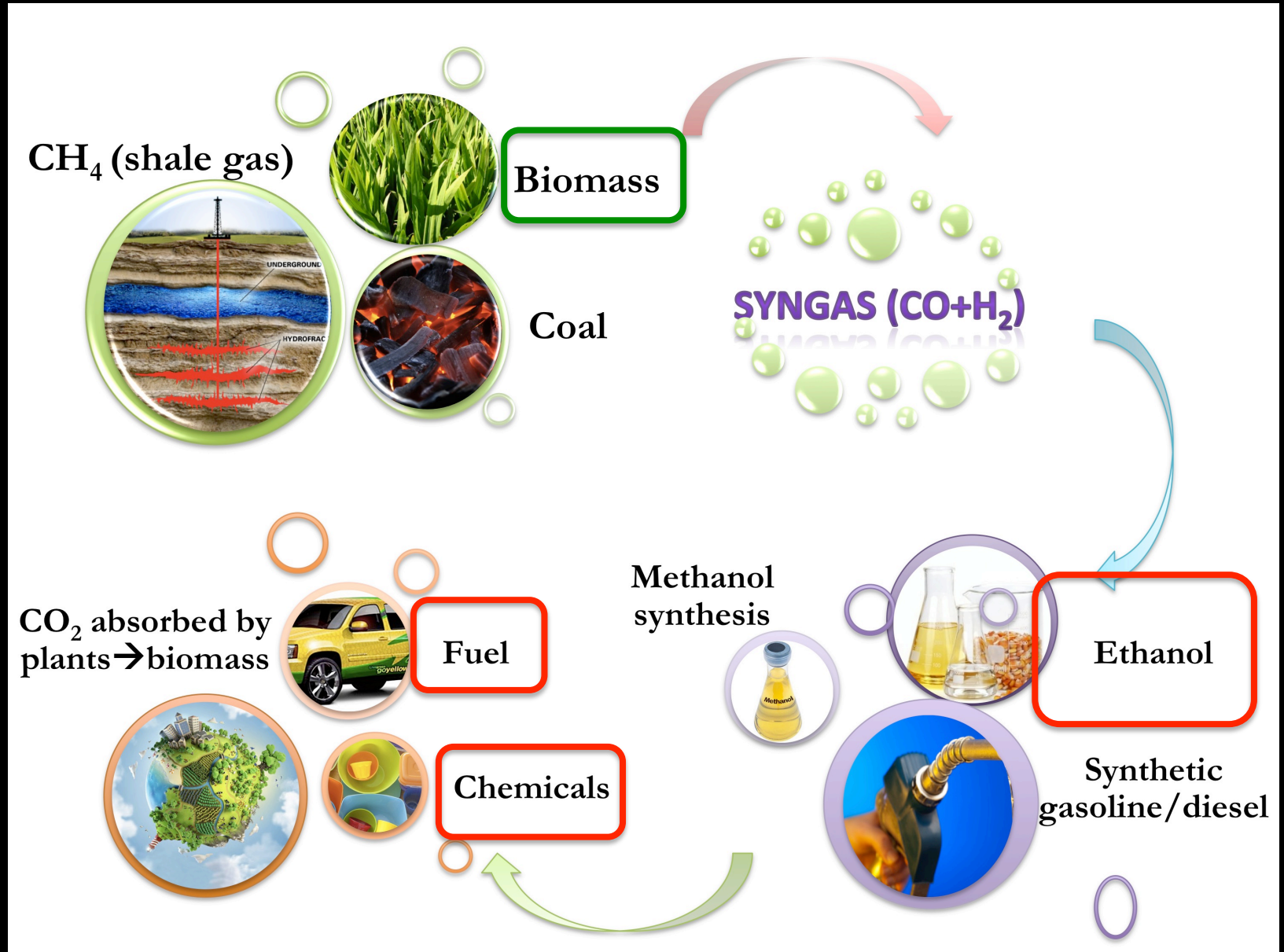


CO



H<sub>2</sub>

# A cleaner way to use fossil fuels







[www.energyandpolicy.org](http://www.energyandpolicy.org)  
<http://1sunsolar.co>

[www.cchem.berkeley.edu](http://www.cchem.berkeley.edu)  
<http://www.bentley.com>



- 
- **Every energy resource is provided by God**
  - **It is not that we are so smart, it is because God is so mercy**
  - **Unsustainable V.S. renewable**





Genesis 1:28 God blessed them and said to them, "Be fruitful and increase in number; fill the earth and subdue it. Rule over the fish in the sea and the birds in the sky and over every living creature that moves on the ground."



A satellite view of Earth showing the Americas and surrounding oceans. The text "Thank you for your attention" is overlaid in the center.

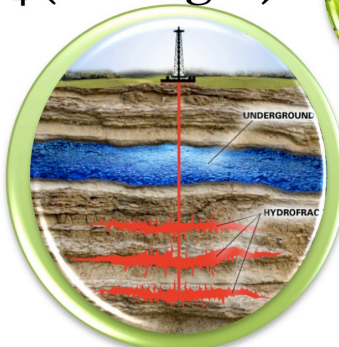
**Thank you for your attention**

Fossil fuels have not changed much,  
but they have changed us.

The resource we worship cannot satisfy our ever-  
increasing needs without harming us.

# A cleaner way to use fossil fuels

CH<sub>4</sub> (shale gas)



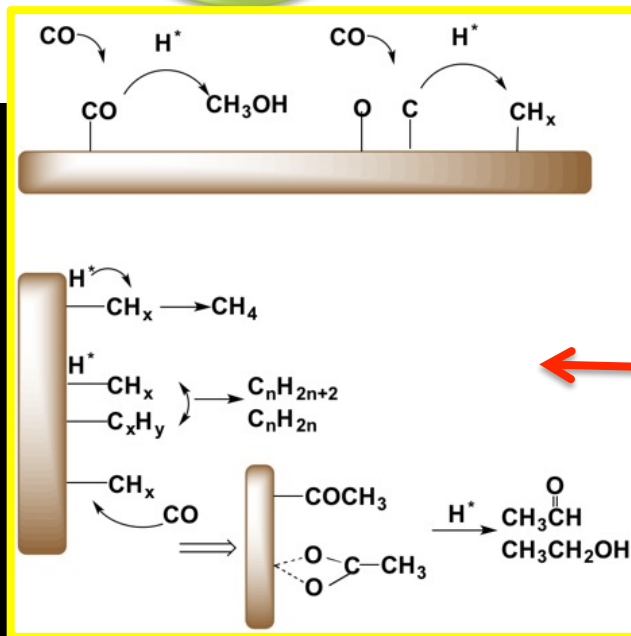
Biomass



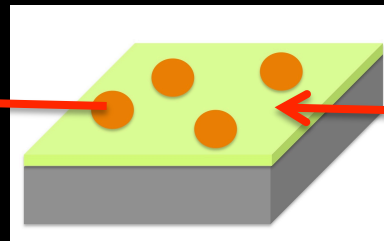
Coal



**SYNGAS (CO+H<sub>2</sub>)**



Metal nanoparticle



Oxide substrate





# Ethanol



- High energy density
- Reduce pollutant emission
- Non-toxic
- Liquid, stable
- Basic building block for other valuable chemicals

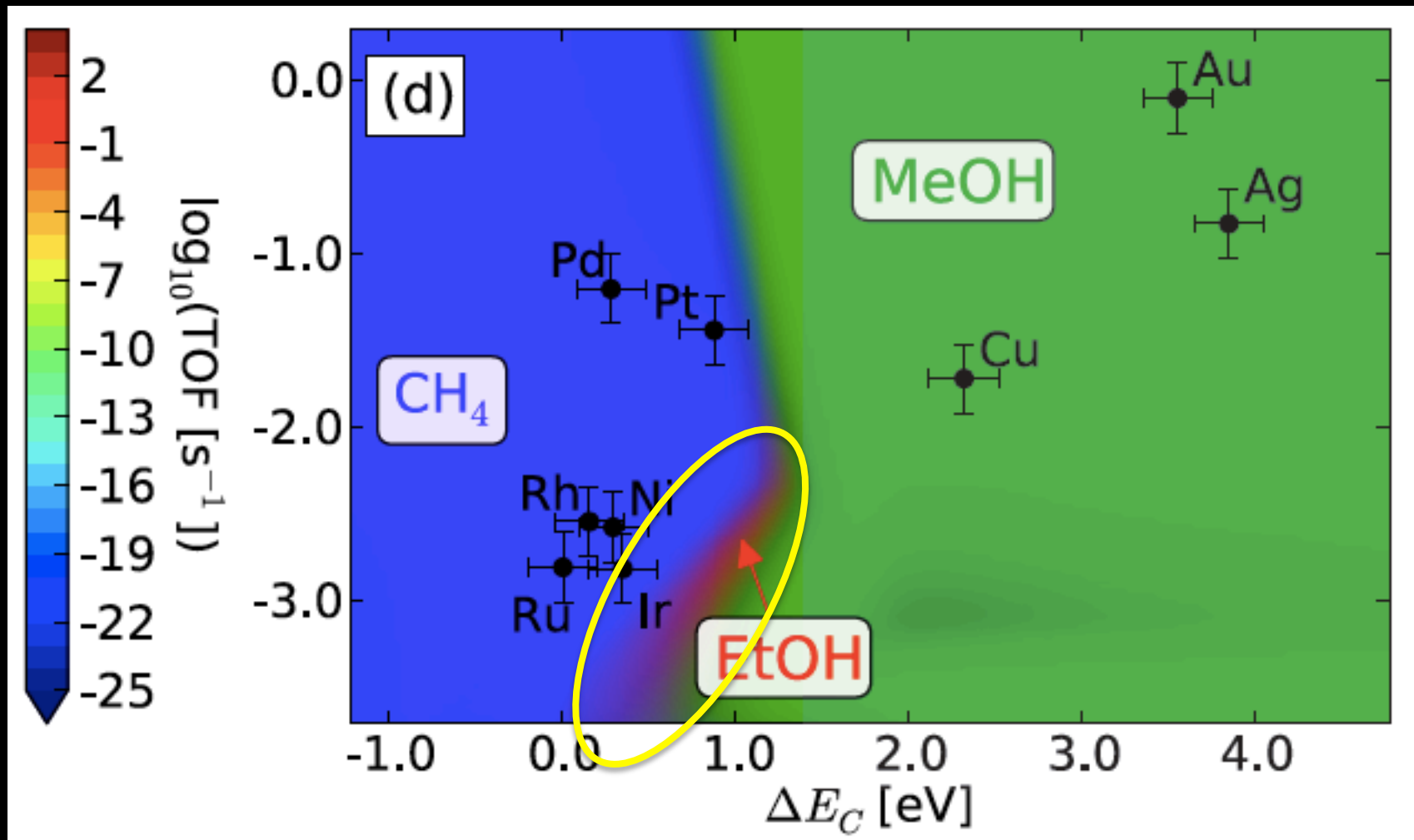
## Ethanol from syngas conversion:

- Clean coal solution
- Transform natural gas into easily transportable liquid
- Utilize biomass and organic waste; reduce net carbon emission
- Ease competition with food supply

## Scientifically challenging:

- Model system for understanding higher alcohol synthesis

# Challenge: finding the right material



# Challenge: finding the right material

## THE PERIODIC TABLE OF ELEMENTS

H <sup>1</sup> 																	He <sup>2</sup> 											
Li <sup>3</sup> 	Be <sup>4</sup> 													B <sup>5</sup> 	C <sup>6</sup> 	N <sup>7</sup> 	O <sup>8</sup> 	F <sup>9</sup> 	Ne <sup>10</sup> 									
Na <sup>11</sup> 	Mg <sup>12</sup> 													Al <sup>13</sup> 	Si <sup>14</sup> 	P <sup>15</sup> 	S <sup>16</sup> 	Cl <sup>17</sup> 	Ar <sup>18</sup> 									
K <sup>19</sup> 	Ca <sup>20</sup> 	Sc <sup>21</sup> 	Ti <sup>22</sup> 	V <sup>23</sup> 	Cr <sup>24</sup> 	Mn <sup>25</sup> 	Fe <sup>26</sup> 	Co <sup>27</sup> 	Ni <sup>28</sup> 	Cu <sup>29</sup> 	Zn <sup>30</sup> 	Ga <sup>31</sup> 	Ge <sup>32</sup> 	As <sup>33</sup> 	Se <sup>34</sup> 	Br <sup>35</sup> 	Kr <sup>36</sup> 											
Rb <sup>37</sup> 	Sr <sup>38</sup> 	Y <sup>39</sup> 	Zr <sup>40</sup> 	Nb <sup>41</sup> 	Mo <sup>42</sup> 	Tc <sup>43</sup> 	Ru <sup>44</sup> 	Rh <sup>45</sup> 	Pd <sup>46</sup> 	Ag <sup>47</sup> 	Cd <sup>48</sup> 	In <sup>49</sup> 	Sn <sup>50</sup> 	Sb <sup>51</sup> 	Te <sup>52</sup> 	I <sup>53</sup> 	Xe <sup>54</sup> 											
Cs <sup>55</sup> 	Ba <sup>56</sup> 													Hf <sup>72</sup> 	Ta <sup>73</sup> 	W <sup>74</sup> 	Re <sup>75</sup> 	Os <sup>76</sup> 	Ir <sup>77</sup> 	Pt <sup>78</sup> 	Au <sup>79</sup> 	Hg <sup>80</sup> 	Tl <sup>81</sup> 	Pb <sup>82</sup> 	Bi <sup>83</sup> 	Po <sup>84</sup> 	At <sup>85</sup> 	Rn <sup>86</sup> 
Fr <sup>87</sup> 	Ra <sup>88</sup> 	Rf <sup>104</sup> 	Db <sup>105</sup> 	Sg <sup>106</sup> 	Bh <sup>107</sup> 	Hs <sup>108</sup> 	Mt <sup>109</sup> 	Ds <sup>110</sup> 	Rg <sup>111</sup> 																			

La <sup>57</sup> 	Ce <sup>58</sup>	Pr <sup>59</sup>	Nd <sup>60</sup>	Pm <sup>61</sup>	Sm <sup>62</sup>	Eu <sup>63</sup>	Gd <sup>64</sup>	Tb <sup>65</sup>	Dy <sup>66</sup>	Ho <sup>67</sup>	Er <sup>68</sup>	Tm <sup>69</sup>	Yb <sup>70</sup>	Lu <sup>71</sup>
Ac <sup>89</sup> 	Th <sup>90</sup> 	Pa <sup>91</sup> 	U <sup>92</sup> 	Np <sup>93</sup> 	Pu <sup>94</sup> 	Am <sup>95</sup> 	Cm <sup>96</sup> 	Bk <sup>97</sup> 	Cf <sup>98</sup> 	Es <sup>99</sup> 	Fm <sup>100</sup> 	Md <sup>101</sup> 	No <sup>102</sup> 	Lr <sup>103</sup> 

by Anika Train